2000 New Jersey Water Quality Inventory Report

New Jersey Department of Environmental Protection
May, 2001

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This report was prepared pursuant to the New Jersey Water Quality Planning Act
and Section 305(b) of the Federal Clean Water Act

State of New Jersey
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The mission of the New Jersey Department of Environmental Protection is to assist the residents of New Jersey in preserving, sustaining, protecting and enhancing the environment to ensure the integration of high environmental quality, public health and economic vitality

Acknowledgements

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LIST OF ACRONYMS

AGWQN:	Ambient Ground Water Quality Monitoring Network
AMNET:	Ambient Biological Network
ASMN:	Ambient Stream Monitoring Network
BFF:	Bureau of Freshwater Fisheries
BIOS:	Biological System, a component of STORET (see STORET)
BOD:	Biological Oxygen Demand
BWA:	Bureau of Water Allocation
CALM:	Comprehensive Assessment and Listing Methods
CCMP:	Cooperative Coastal Monitoring Program
CEA:	Classification Exception Area
CEHA:	County Environmental Health Act
CSO:	combined sewer overflow
DO:	Dissolved Oxygen
DOT:	Department of Transportation
DRBC:	Delaware River Basin Commission
DSRT:	Division of Science, Research and Technology
DWQS:	Drinking Water Quality Standards
ENDEX:	Environmental Data Exchange
EWQ	Existing Water Quality (network)
FC:	Fecal Coliform (bacteria)
FWWPA:	Freshwater Wetlands Protection Act
GIS:	Geographic Information System
GW:	Groundwater
GWIA:	Groundwater Impact Areas
HEP:	Harbor Estuary Program
HMDC:	Hackensack Meadowlands Development Commission
HUC:	Hydrologic Unit Code
IBI:	Index of Biotic Integrity
IEC:	Interstate Environmental Commission (formerly Interstate Sanitation Commission)
KCSL:	Known Contaminated Site List
LA:	Load Allocation
MCL:	Maximum Contaminant Level
MOA:	Memorandum of Agreement
MOS:	Margin of Safety
MPN:	Most Probable Number (of Fecal Coliform bacteria)
MTBE:	methyl tert butyl ether
NAWQA:	National Ambient Water Quality Assessment
NEPPS:	National Environmental Performance Partnership System
NJ:	New Jersey
N.J.A.C.:	New Jersey Administrative Code
NJADN:	New Jersey Air Deposition Network
NJDEP:	New Jersey Department of Environmental Protection
NJDHSS:	New Jersey Department of Health and Senior Services

NJIS:	New Jersey Impairment Score
N.J.S.A.:	New Jersey Statutes Annotated
NO_3:	Nitrate
NRCS:	National Resource Conservation Service
NSSP:	National Shellfish Sanitation Program
NY:	New York
ODES:	Ocean Data Evaluation System
PAH:	polycyclic aromatic hydrocarbon
PCB:	polychlorinated biphenyl
P.L.:	Public Law (federal)
PPA:	Performance Partnership Agreement
PPM:	parts per million
PPB:	parts per billion
RF3:	River Reach File 3
RPB:	Rapid Bioassessment Protocol
SIIA:	Sewage Infrastructure Improvement Act
SRP:	Site Remediation Program
STORET:	Store and Retrieval, USEPA's water quality database
STP:	Sewage Treatment Plant
SWAP:	Source Water Assessment Program
SWQS:	Surface Water Quality Standards
TCE:	tetrachloroethlylene
TIBC:	(Interagency) Toxics in Biota Committee
TMDL:	total maximum daily load
USEPA:	United States Environmental Protection Agency
USGS:	United States Geological Survey
WATSTORE:	Water Data Storage and Retrieval System, USGS water quality database
WCE:	Water Compliance and Enforcement
WLA:	Waste Load Allocation
WRA:	Well Restriction Area
WMA:	Watershed Management Area
VOC:	volatile organic compound
305b Report:	Water Quality Inventory Report
303d List:	Impaired Waterbodies List

1. Major Findings

The 2000 Water Quality Inventory Report for New Jersey provides detailed information on the following: surface water quality status and trends, the attainment of designated uses specified in New Jersey's Surface Water Quality Standards, Special State Water Quality Concerns and Recommendations. An overview of the state's ground water quality is also included. This report was prepared pursuant to Section 305(b) of the Federal Clean Water Act and the State Water Quality Planning Act.

The New Jersey Department of Environmental Protection (NJDEP) has made significant progress in implementing environmental Results Based Management (RBM). The NJDEP Strategic Plan for New Jersey and New Jersey's National Environmental Performance Partnership System (NEPPS) agreement include environmental goals, milestones and objectives that were developed in public forums. Program strategies and activities are oriented toward meeting these goals and environmental indicators are used to measure progress.

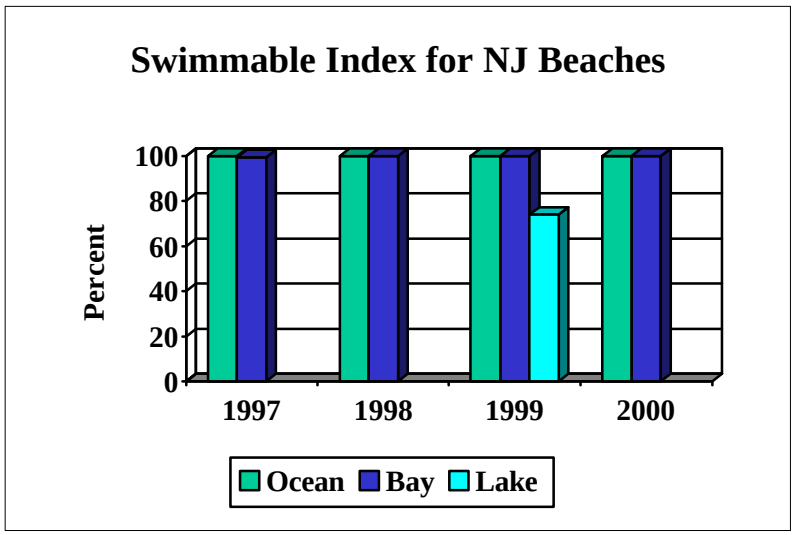
This report addresses basic water quality questions such as: What is the overall quality of New Jersey's waters? Are New Jersey's waters swimmable? Are New Jersey's waters fishable? Answers to these latter two questions are complex and should consider how "swimmable" and "fishable" are defined, how monitoring data are collected and assessed to measure these uses, as well as the specific characteristics of the waterbody and seasonal considerations.

"Swimmable" means that the waterbody can be safely used for swimming and other recreation that includes contact with water. "Fishable" means that there is a healthy population of fish and/ or shellfish in the waterbody that are safe to consume or harvest. Over time, the federal Clean Water Act definition of "fishable" has been broadened to include a healthy aquatic ecosystem. Brief responses to these questions are provided here, with additional detail in the remainder of the report.

Are New Jersey's waters "swimmable"?

Designated recreational swimming areas in oceans, bays and lakes

In the majority of cases, yes. New Jersey's 179 ocean beaches and 138 bay bathing beaches have excellent water quality. Recreational ocean and bay beaches are closely monitored in New Jersey, with 5,000 to 6,000 samples collected each summer. For ocean beaches in 1999, there were only 8 closures due to exceedences of fecal coliform standards for bathing beaches and only 6 precautionary closures due to suspected pollution events. For bay beaches in 1999, there were only 21 closures because fecal coliform standards were not met. NJDEP has developed a coastal beach milestone: By *2005, 100% of New Jersey's coastal recreational waters will be safe for swimming.* Because each beach was open more than 90% of the time in the 100-day summer beach season, 100% of 179 ocean beaches and 100% of 138 bay beaches are considered to meet this milestone.



Statewide information for lake bathing beaches is available for the first time in this report. Based on monitoring, typically conducted weekly, many of New Jersey's 376 lake bathing beaches have excellent quality and few closures: 277 of 376 lakes (74%) met bathing beach standards at least 90% of the 1998 summer. There were 50 lake beaches that were classified as partially meeting lake recreational uses because the bathing beach standards were met between 89% and 75% of the time. There were 27 lake beaches that met bathing beach standards less than 75% of the time and were thus classified as not meeting lake recreational uses. Data were not available on the remaining 22 recreational lake beaches. NJDEP has developed a lake beach milestone: *By 2000, lake recreational bathing beach waters will have been assessed and water quality improvement projects will have been prioritized.* For the first time, this statewide assessment is nearly completed and the results provided can now be used to prioritize pollution prevention and water quality improvement projects at recreational lake bathing beaches.

NJDEP is implementing a beach action plan for coastal beaches by working cooperatively with local beach communities and wastewater treatment plant operators to prevent the few remaining pollution incidents at coastal beaches. Watershed management will target water quality improvement and pollution prevention projects in lakes with water quality issues at recreational beaches.

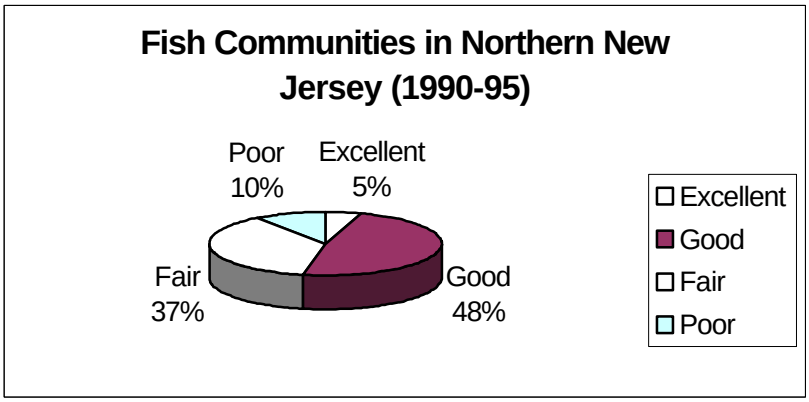
Rivers

The current river monitoring program does not target locations that are used for swimming. NJDEP and watershed partners plan to explore focused monitoring of river reaches actually used for swimming. This monitoring approach will provide data to better evaluate human health risks of swimming in rivers.

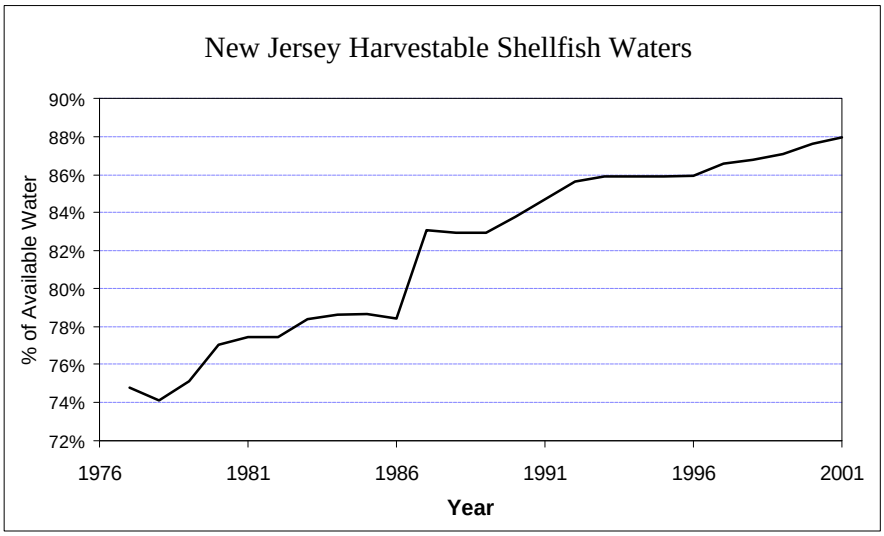
Pinelands rivers monitoring stations, including those on the Rancocas, Bass, Oswego, Great Egg Harbor and Mullica met or had better water quality than required by sanitary Surface Water Quality Standards between 1995 and 1997. Primarily because of nonpoint sources such as geese, storm drains and overland runoff, the sanitary quality of many other river monitoring locations in more urbanized areas of the state did not meet standards. Compliance with permit limits for sanitary quality of effluent at wastewater treatment plants is very high. Localized issues arise due to combined sewer overflows, failing wastewater and septic infrastructure and occasional wastewater treatment plant malfunctions. The role of livestock is also being explored. Several programs are in place to improve management of livestock waste, statewide with a special emphasis on agricultural areas in southern New Jersey.

Are New Jersey's waters fishable?

In the majority of cases, yes. In 1995, over 173 million pounds of finfish valued at more than $95 million were commercially harvested. Major species include bluefish, mackerel, whiting, red hake, tilefish, flounder ,and swordfish. New Jersey also has many high quality warm water (non-trout) fisheries including small and largemouth bass, chain pickerel, pike, walleye, perch and catfish in most waterbodies of the States.



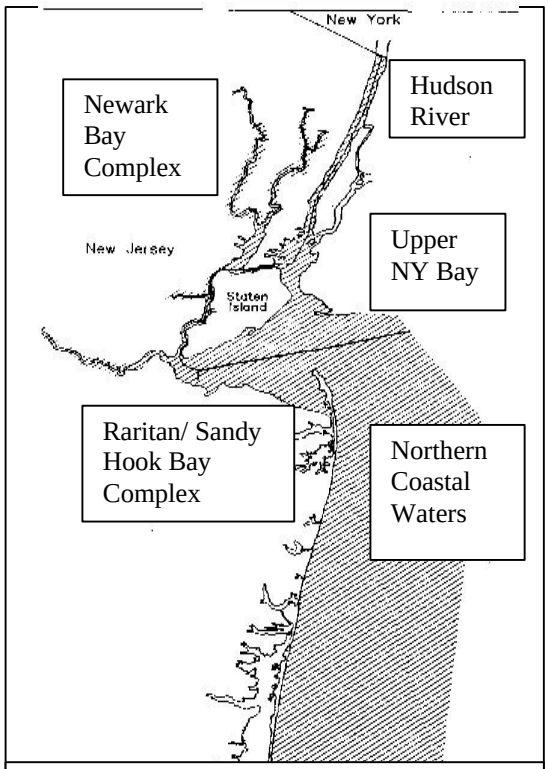
New Jersey has streams where trout naturally reproduce and streams that support trout and trout associated species. These streams are located primarily in the hilly northern portion of the state. Due primarily to improvements in water quality as wastewater treatment plants were upgraded and regionalized, fish communities in the Raritan and Delaware river basins improved from fair to good and in the Passaic river basin, fish communities improved from poor to fair. In addition, stream classifications were upgraded to trout maintenance or trout production in 16 stream segments over the last several years. Round Valley Reservoir continues to be one of the premier lake trout fisheries in the United States.



Shellfish beds available for harvest provide a good indicator of sanitary water quality. Based on 1990 data, New Jersey was one of the largest shellfish producing states in the country with estimated landings of 75 million pounds valued at over $60 million. New Jersey has been a national leader in opening shellfish beds with 88% of shellfish beds available for harvest. NJDEP is implementing a Shellfish Action Plan to increase this to 90% by 2005 and achieve the NEPPS milestone. New Jersey has increased shellfish waters available for harvest each year for the past 12 years and for 24 of the past 25 years.

Can fish caught in New Jersey be eaten?

Generally, yes. Important commercial and recreational species can be safely eaten by anyone, including summer and winter flounder, weakfish, smallmouth bass, perch, carp, etc. For other species, New Jersey and many other states have developed fish consumption advisories that apply to specific species, generally in specific areas. Fish consumption advisories generally limit frequency of consumption.



Current Fish Consumption Advisories in Coastal Waters

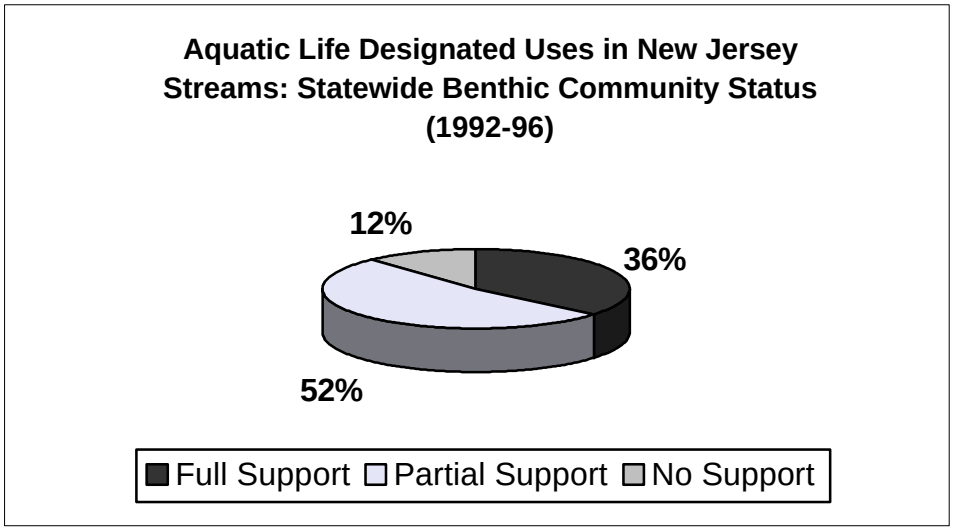
New Jersey is one of 33 states to enact advisories to limit fish consumption due to mercury contamination. The advisory applies statewide to two freshwater species, chain pickerel and largemouth bass. Mercury sources include local and regional air emissions from coal-fired power plants and municipal waste incinerators. Through air deposition and bioaccumulation processes, it accumulates in fish. In 1994, the federal Food and Drug Administration issued advice to limit consumption of shark and swordfish due to mercury contamination.

New Jersey's Mercury Task Force has conducted an inventory of mercury sources and is identifying regional and national mercury reduction strategies to reduce mercury from out-of-state sources. Within New Jersey, emissions from municipal waste incinerators, once a significant source of mercury, have been reduced 10 fold between 1993 and 2000.

In the early and mid-1980's, New Jersey issued advisories to limit consumption and sale of several species from northern New Jersey coastal waters and the lower Delaware River and Bay due to chlorinated organics contamination in fish tissue. These chemicals are now primarily released from contaminated sites and nonpoint sources. In addition, fish are mobile animals and may have become contaminated in New Jersey or elsewhere. Although regularly scheduled monitoring data and assessments for levels of toxics in fish tissue are not available, several studies are underway to collect new data on chemical levels in fish. Limited data from the late 1990's indicate that levels of chlorinated organics in fish tissue may be decreasing in some areas, warranting a re-evaluation of these advisories. In addition, several studies are ongoing to track down emissions of chlorinated organics and eliminate or control identified sources.

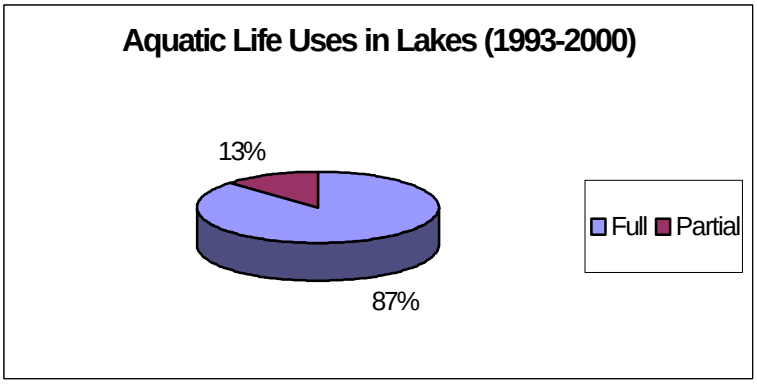
Are other forms of aquatic life healthy?

Generally, yes. Aquatic ecosystems consist of the plants, fish, amphibians, insects and other creatures that inhabit a waterbody. These organisms respond to natural and human induced disturbances to the environment in complex ways. It is not possible to monitor all components of the aquatic ecosystem. However, NJDEP operates an extensive program to monitor populations of bottom dwelling (benthic) insect larvae and other small aquatic organisms that indicate the health of riverine aquatic ecosystems.



Based on benthic data collected in rivers in the 1990's, about 35% of monitoring locations are not impaired, 52% are moderately impaired and 12% are severely impaired. These results appear different from the fish population data discussed above, but probably reflect different responses of fish and benthic organisms to environmental disturbance. Benthic communities are very sensitive to natural and human-induced disturbances to physical habitat. Natural disturbances include drought and floods; human induced disturbances include changes stream flow, erosion, and water and sediment chemistry.

NJDEP has efforts underway to identify the factors that contribute to benthic impairment and to focus watershed restoration projects to reduce impairment. Research has shown that protection of headwaters, riparian forests and wetlands, management of stormwater, and nonpoint sources of pollution as well as continued diligent management of point sources are essential to protecting and restoring aquatic ecosystems.



Aquatic life uses were assessed in lakes for the first time using fish population assessments. Results indicate that 87% of the 9,875 lake acres assessed fully support uses. Of these acres, approximately a third are threatened. Of the remaining lake acreages assessed; 1,290 acres (13%) partially supported aquatic life and 0 acres did not support aquatic life.

Based on available lake trophic status data, many of the assessed New Jersey lakes are eutrophic. Eutrophication is a natural process whereby lakes fill in with sediment and become wetlands. Eutrophic lakes are characterized by significant growth of aquatic plants and can experience depleted dissolved oxygen. Eutrophication is accelerated in many of New Jersey's lakes because they are shallow man-made impoundments and are highly prone to accelerated inputs of nutrients and sediment. The excessive growth of algae and macrophytes can impair the lakes use for swimming and boating. In addition, aquatic life in these lakes may be negatively affected by the episodes of depleted dissolved oxygen and temperature fluctuations which can occur as result of eutrophication.

Projects are being conducted at a number of New Jersey lakes to address lake eutrophication, including dredging, sedimentation reduction, and nutrient management. Over the next several years, additional fish population and benthic data will be collected and assessed to update and improve aquatic life characterizations in lakes.

Dissolved oxygen in water is necessary for almost all aquatic life. Dissolved oxygen (DO) concentration data collected in bays and the ocean were used as an indirect indicator of the health of aquatic ecosystems. In estuaries, 203 of 264 square statute miles (75%) met DO standards in 90% or more of samples and were classified as meeting aquatic life uses; 61 of 264 square statute miles (23%) partially met DO standards and were classified as partially meeting aquatic life uses.

In the ocean, 94 of 446 square statute miles (21%) met DO standards in 90% or more of samples and were classified as fully meeting aquatic life uses. In 354 of 446 square statute miles (79%) met DO standards but transient low DO cells formed in the summer. Low dissolved oxygen can occur naturally due to the actions of wind and temperature, and these natural conditions can be aggravated by nutrient inputs from land and air. Atmospheric nutrient inputs to ocean and estuarine waters are being measured through the Air Deposition Monitoring Network. A nutrient TMDL is being developed for the New York-New Jersey Harbor to manage point and nonpoint source inputs of nutrients.

Part II: Background

Part II includes an Executive Summary of the New Jersey 2000 Water Quality Inventory Report, an overview of New Jersey's water resources, water pollution control programs, costs and benefits and special state concerns and recommendations.

Chapter 1 Executive Summary

1.1. Introduction

The New Jersey 2000 Water Quality Inventory Report, commonly referred to as the 305(b) report, is the fourteenth in a series of Water Quality Inventory Reports that have been prepared by the New Jersey Department of Environmental Protection (NJDEP) since 1975. The Water Quality Inventory Report is prepared every two years, pursuant to Section 305(b) of the federal Clean Water Act (P.L. 95-217).

This New Jersey 2000 Water Quality Inventory Report was prepared using USEPA Guidelines for the Preparation of Comprehensive State Water Quality Assessments (305(b)) Reports and Electronic Updates (EPA-841-B-97-002B. Sept. 1997). This report adheres to the outline and terminology provided by USEPA Guidance to the extent possible.

Designated uses of waterbodies are specified in New Jersey's Surface Water Quality Standards (SWQS) at N.J.A.C. 7:9B-1.12 and are evaluated periodically. The designated uses in *freshwaters* are: primary and secondary contact recreation (i.e., swimmable); maintenance, migration and propagation of the natural and established biota, fish consumption (i.e., fishable/ aquatic life); industrial and agricultural water supply and public potable water supply, after conventional treatment (i.e., potable).

Designated uses in *estuarine and ocean* waters include primary and secondary contact recreation (i.e., swimmable); fish consumption, shellfish harvesting and maintenance, migration and propagation of the natural and established biota (i.e., fishable/ aquatic life).

Designated uses were established based on physical, chemical, biological, and hydrological characteristics of the waters and the economic considerations related to attaining various uses. Additional information on New Jersey's SWQS is provided in Part III-Surface Water Assessment, Chapter 3- Rivers and Streams.

Designated use assessments are performed by comparing appropriate datasets to applicable narrative and numerical criteria in the SWQS. Using *Guidance for the Preparation of Water Quality Inventory Reports provided by the Environmental Protection Agency* (USEPA, 1997), results are grouped into designated use attainment categories (i.e., full support, full support but threatened, partial support and not supporting).

This report uses the "full support but threatened" category to identify waters that currently meet designated uses, but are not expected to meet uses by the next reporting cycle (i.e., two years) due to statistically significant adverse trends. As discussed in the report, many trends indicate improving water quality. The "full support but threatened" category was also used to identify

waters for which additional data are needed to accurately characterize use support status. This approach was used because USEPA designated use support reporting requirements currently do not provide an opportunity to identify additional data needs. The applicable definition of the "full support but threatened" category is provided for each designated use support assessment.

Use of Indirect Indicators of Designated Use Attainment: In some cases, direct measurement of designated use attainment is not currently possible and one or more indirect indicators are used to estimate designated use attainment. For example, aquatic life/fishable use attainment assessments in coastal waters are currently based on water column dissolved oxygen levels and not upon direct measures of marine or estuarine biota. In the future, direct assessments of marine/estuarine biological population data will provide a more comprehensive assessment of aquatic life designated use attainment.

Spatial Extent of Assessment: For this report, the representativeness of each dataset was used to estimate the spatial extent of each assessment. For rivers and streams, the length of the stream segment which has a monitoring station was used to estimate the river miles assessed. USEPA defines stream segments in Reach File 3 as the length of stream between tributaries.

Rivers and Streams: The Ambient Stream Monitoring Network is used to collect chemical and sanitary water quality data in New Jersey's freshwater streams. Because the 79 station network as operated prior to 1997 was biased toward downstream portions of watersheds, it was not possible to extrapolate these assessments beyond the stream reach in which the monitoring station was located. Thus, 176 of 6,500 non-tidal stream miles (3%) were assessed using this monitoring program. For the next Water Quality Inventory Report, data collected under New Jersey's redesigned Ambient Stream Monitoring Network will be reported. This network design was redesigned to provide representative sampling in each of the state's 20 Watershed Management Areas and is now statistically based to allow estimations of water quality in streams that are not monitored. A higher percentage of non-tidal stream miles will be assessed using the redesigned Ambient Stream Monitoring Network.

The 820 station Ambient Biological Monitoring Network is used to collect benthic macroinvertebrate data in freshwater streams. New data collected at 139 stations, representing 330 stream miles in the northwest part of New Jersey are summarized for this report. As described above, USEPA's Reach File 3 (RF3) was used to determine the spatial extent of this assessment.

Lakes: Assessments were applied to the entire lake that was monitored.

Estuaries and Oceans: The Coastal and Estuarine Monitoring Program, Shellfish Sanitation Program and Cooperative Coastal Monitoring Program are representative of estuaries, oceans, beaches and shellfish beds. Thus, 100% of these waterbodies were assessed.

Designated use attainment status was reported by assessed river miles, lake acres, and square miles of ocean and estuary attaining each use. The designated use attainment results summarized below are also provided in tables in Appendix I to this Executive Summary.

Management Strategies: Management strategies that are being implemented or planned are identified to address data assessment needs and to maintain and improve designated use attainment.

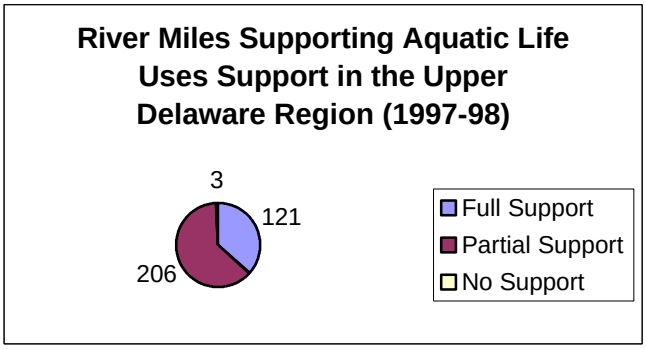
1.2 Designated Use Support By Waterbody Type

Designated use support summary tables are provided in Appendix A1.2-1. A map of New Jersey's 20 Watershed Management Areas is provided in Part II- Chapter 2: New Jersey's Water Resources, Figure II-1.

Rivers and Streams

There are 6,500 miles of non-tidal rivers and stream in New Jersey. Aquatic life designated use was assessed in 330 stream miles in northwestern New Jersey, within Watershed Management Areas (WMA's) 1, 2, 11. Published results are available for these WMA's which were sampled in 1997 and 1998. (NJDEP, 1999).

Aquatic Life Designated Uses in Rivers: Benthic macroinvertebrate data collected in 1997 and 1998 in WMA's 1, 2 and 11 through the AMNET program were used to identify stream reaches which were not impaired (fully supporting); partially supporting (moderately impaired) and severely impaired (not supporting). Results indicate that aquatic life designated uses were fully supported in 121 miles (37% of assessed stream miles), partially supported in 206 miles (62.4% of assessed stream miles) and not supported in 3 miles (1% of assessed stream miles). A review of fish population data from the 1970's and 1990's showed significant improvement in fish populations in the Delaware, Raritan and Passaic River Basins. Integration of fisheries data into future aquatic life designated use assessments will provide a more comprehensive assessment of aquatic life status. Over the past several years New Jersey has adopted upgrades to the Trout Water Classification of 16 river segments to Trout Production or Trout Maintenance status.

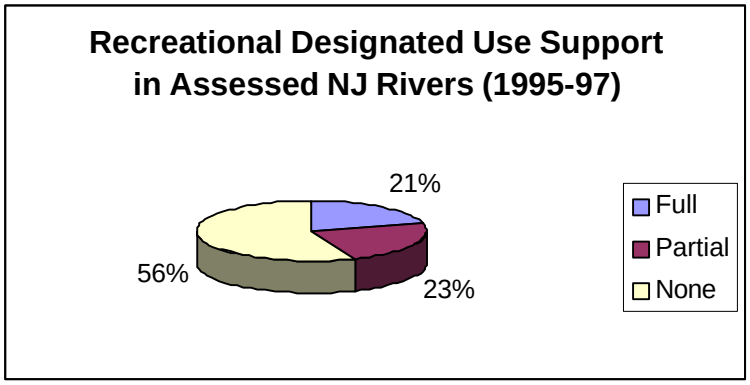


Maintaining and Improving Aquatic Life Uses in Rivers: Major strategies to maintain and improve aquatic life designated use attainment include:

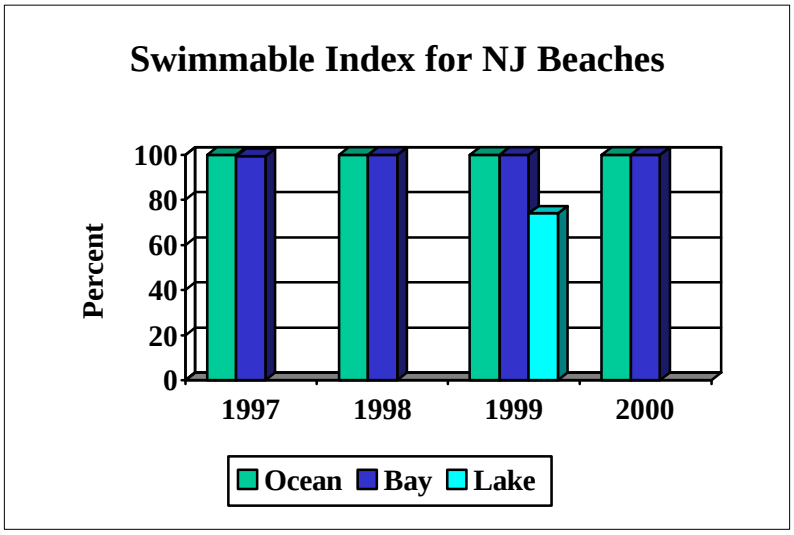
- Development of TMDLs as appropriate where water quality degradation significantly contributes to aquatic life use impairment
- Integration of various biological datasets and development of a "fishable index" to improve the technical basis for aquatic life designated use assessments
- Identification of factors that contribute to benthic impairment through research studies, field assessments, evaluations of locations where impairment ratings changed over time

- Targeting nonpoint source management projects and in the future, implementation of the watershed management rules and implementation of the municipal stormwater planning management programs.

Recreational Designated Uses in Rivers: Recreational designated use (i.e., swimming) was assessed in 176 stream miles statewide by comparing fecal coliform data collected between 1995 and 1997 in the Ambient Stream Monitoring Network to NJSWQS. Results indicate that recreational uses were fully met in 30 miles (22% of assessed stream miles), partially met in 28 stream miles (23% of assessed stream miles) and not met in 118 stream miles (56% of assessed stream miles). As discussed previously, the monitoring design used to collect these data does not support extrapolating results to streams that are not monitored. However, streams that appeared to have the greatest impact were prioritized.



New Jersey's recreational lake, ocean and bay bathing beaches, where the vast majority of swimming takes place, are thoroughly monitored and generally very safe for swimming. Recreational bathing beach assessments for lakes are summarized below; assessments for ocean and bay beaches are provided in Part III, Chapter 5 of this report.



It is important to note that stream monitoring stations were not located at places in rivers where swimming occurs. Thus, this assessment is not an appropriate measure of potential human health risk from swimming in New Jersey rivers. Through Watershed Management, swimming and canoeing areas in rivers and streams will be identified and targeted monitoring will be explored. In addition, New Jersey's rivers are affected primarily by nonpoint sources of pollution such as geese, storm drains and overland runoff. Compliance with sanitary effluent requirements at wastewater treatment plants is very high.

Improving Sanitary Quality in Rivers: Major strategies include:

- Targeting collection of data to river locations where swimming or boating occurs to evaluate human health risk.
- TMDL development and implementation based on the schedule in the TMDL Memorandum Of Agreement between USEPA Region II and NJDEP.
- Source identification, including evaluations of sanitary storm sewers, failing and inappropriately placed septic systems, livestock, wildlife and pets.
- Management of sources through municipal stormwater management and permitting, BMP implementation, pet waste ordinances, septic system management on a watershed specific basis. Projects can be funded through the Nonpoint Source Management (319h) grants and New Jersey Environmental Infrastructure Trust, among other sources.

Drinking Water Designated Use in Rivers: Drinking water designated use was systematically assessed for the first time in this report. This designated use assessment indicates whether surface waters are of adequate quality to be used as drinking water supplies. Finished drinking water is of very high quality: in 1998, 97% of systems met all microbiological standards and 93% met all chemical standards. Levels of nitrate in finished drinking water remain consistently below the Maximum Contaminant Level allowed under the Drinking Water Quality Standards, however, rising levels of nitrate were identified as an emerging issue for some surface water supplies, particularly under record low stream flow conditions that were experienced during the summer of 1999. In the Passaic Basin, several wastewater treatment plants reduced levels of nitrate in effluent during the drought of 1999 to successfully protect water supplies during this critical period.

Maintaining and Improving Drinking Water Designated Use in Rivers

- Additional information regarding quality of drinking water sources will be compiled and assessed through the Source Water Assessment Program.

- The pilot project to reduce nitrate concentrations in effluent in the Passaic Basin is continuing during the summer of 2000.

Agricultural Supply Designated Use in Rivers: Agricultural designated use was assessed for the first time in this report. This designated use assessment indicates whether surface waters are of adequate quality to be used for irrigation and livestock. Data from the Ambient Stream Monitoring Network collected between 1995 and 1997 were compared to standards based on the Soil Conservation Service guidelines. Of 176 miles assessed, 100% met the guidelines, indicating that agricultural designated use was fully met. Programs focusing on maintaining or improving water quality in agricultural areas include the $1.3 million best management practices (BMP) program initiated in 1998 to minimize impacts to water quality by agriculture throughout the state.

Industrial Supply Designated Use in Rivers: Industrial designated use was assessed for the first time in this report. This pilot designated use assessment was based on attainment of NJSWQS for pH and total suspended solids (TSS). These constituents were selected to indicate whether

surface waters are of adequate quality to be used for industrial purposes. However, additional input from industrial water users is needed to further evaluate this assessment method.

The preliminary assessment was based on pH and TSS data from the Ambient Stream Monitoring Network collected between 1995 and 1997. Of 176 miles assessed, 114 stream miles (65% of assessed stream miles) fully meet industrial uses, and 64 stream miles (35% of assessed stream miles) partially meet industrial designated uses.

Maintaining and Improving Industrial Supply Designated Use in Rivers: Major strategies include:

- Development and implementation of TMDLs for locations with exceedences of SWQS criteria for pH
- Clarify needed water quality by industrial users.

Fish Consumption Designated Use in Rivers: Fish consumption designated use was assessed using existing consumption advisories in New Jersey waters. Any current advisory to reduce or eliminate the consumption of one or more species was included. The spatial extent of fish advisories was estimated for the first time in this report. Of 124 stream miles assessed, 30 miles (24% of assessed stream miles) fully support fish consumption but uses are considered to be threatened. This USEPA classification was employed for any waters where the advisory is more than 10 years old and where preliminary data indicate that contaminant levels may be decreasing, warranting re-evaluation of the advisories. There were 94 stream miles (76% of assessed stream miles) that partially support fish consumption designated uses due to advisories to limit consumption of 2 species, largemouth bass and chain pickerel, due to mercury contamination.

Maintaining and Improving Fish Consumption Designated Use in Rivers: Major strategies include:

- Improve the basis for fish consumption advisories through assessment of new data and amendments to advisories as needed.
- Development of a fishable index that considers fish populations and consumption issues
- Continue to monitor for sources especially air deposition of toxics
- Develop a stable source of funding for routine monitoring of fish tissue

Lakes

There are 3,600 lakes larger than 2 acres, including 380 public lakes in New Jersey covering 72,590 acres and 24,000 public lake acres. Aquatic life use support was assessed for the first time using fisheries data collected at public and private lakes by the NJDEP's Bureau of Freshwater Fisheries. Of 9,875 lake acres assessed, 5,950 acres (60% of assessed lake acres) fully support aquatic life uses. Another 2,635 acres (27%) fully support but are threatened. The remaining 1,290 acres (13% of assessed lake acres) partially meet aquatic life uses.

Maintaining and Improving Aquatic Life Designated Uses In Lakes: Major strategies include:

- Developing more direct measures of aquatic life designated uses in lakes by expanding use of fisheries data and developing benthic macroinvertebrate protocols for lakes
- Implementing warmwater fisheries management strategies in lakes

Recreational Designated Uses: Primary contact recreation at New Jersey's 376 recreational lake bathing beaches was assessed for the first time in this report. Data collected by county health departments and local lake managers at public and private lakes were compiled and compared to New Jersey Department of Health and Senior Services Standards for primary contact. Of 376 lake beaches, 277 (74%) fully support recreational designated uses, 50 lakes (13%) partially support recreational designated uses, 27 lakes (7%) do not support recreational designated uses and 22 lakes (6%) could not be assessed due to lack of data. To date, 167 of 376 lake beaches have now been located on NJDEP's GIS system. GPS locations for the remaining lakes are being collected and will be included in a future report.

Based on available lake trophic status data, many New Jersey lakes are threatened by eutrophication. Eutrophication is a natural process: lakes fill in with sediment and become wetlands. Eutrophic lakes are characterized by significant growth of aquatic plants and can experience depleted dissolved oxygen. Eutrophication is accelerated in many of New Jersey's lakes because they are shallow man-made impoundments, which are highly prone to accelerated inputs of nutrients and sediment. Aquatic life may at times be negatively affected by depleted dissolved oxygen and temperature fluctuations that can occur in eutrophic lakes and the abundant algae and/or macrophytes can impair swimming and boating.

Through the development of Total Maximum Daily Loads for eutrophic lakes, the sources of nutrient and sediment inputs will be characterized. Nonpoint sources of nutrients and sediment include erosion, runoff and stormwater. Point sources above impoundments may contribute nutrients to lakes.

Maintaining and Improving Recreational Designated Uses in Lakes: Major strategies include:

- Improving the spatial assessment by locating remaining lakes on GIS
- Continuing and expanding cooperative assessments and data exchange with Department of Health and Senior Services
- Improve the lake beach component of the "Swimmable Index" to include beach closures at all New Jersey lake beaches
- Identifying and prioritizing improvement projects at lakes with recreational use impairments
- Developing TMDLs for impaired lakes
- Implementing TMDLs and improvement projects in impaired lakes

Fish Consumption Designated Use in Lakes: Fish consumption designated use was assessed if an advisory to reduce or eliminate consumption of one or more species was in effect. The spatial extent of fish advisories was estimated for the first time in this report. Of 14,357 lake acres assessed, 14,131 acres (98% of assessed lake acres) partially support fish consumption designated use due to advisories to limit consumption of 2 species, largemouth bass and chain pickerel. These advisories are based on data that are less than 10 years old. The remaining 114 acres (2% of assessed lakes) were classified as threatened; advisories on these Camden area lakes are based on chlordane data more than 10 years old.

Maintaining and Improving Fish Consumption Designated Use in Lakes: See major strategies for Rivers.

Coastal Waters

There are 725 square statute miles (1 statute mile = 5,280 feet) of estuary and 446 square statute miles of ocean within New Jersey jurisdiction. Assessments of estuarine waters are conducted by NJDEP, the Delaware River Basin Commission (DRBC) and Interstate Environmental Commission (IEC). DRBC assesses the Delaware River and estuary; IEC assesses the New York-New Jersey Harbor in their Water Quality Inventory Reports. Estuary assessments in this report focused on the 269 square statute miles that are not part of interstate waterbodies. Ocean assessments in this report include all 446 square statute miles of ocean within New Jersey jurisdiction.

Aquatic Life Uses in Coastal Waters: Aquatic life designated uses in New Jersey estuaries and ocean waters were assessed for the first time in this report. The assessment relied on dissolved oxygen data collected by NJDEP (estuaries) and USEPA (ocean). Of 710 square statute miles of ocean and estuary assessed, 649 (92%) fully support the use while the remaining 61 square statute miles (8%) partially supported aquatic life. Within this subcategory of 649 square miles fully supporting, 297 square miles (42% of total assessed area) fully supported aquatic life while 352 square statute miles (50%) fully supported the use but are threatened The data used for this assessment were collected during the summers of 1997 and 1998. USEPA's classification of threatened was employed because additional data are needed to characterize aquatic life use support in these waters.

During the summer, DO naturally declines as waters warm; these natural conditions may be extended by inputs of nutrients from coastal lands. These low DO conditions do not occur during other times of the year as waters are cooler and storms contribute to a well mixed water column. As discussed previously, DO is an indirect indicator of aquatic life uses; fish and shellfish are generally tolerant of some low DO conditions. Additional data are needed to more directly characterize effects on aquatic life. Thus, waters where DO did not meet SWQS for portions of the summer were classified as "threatened". As additional data and assessments are completed, aquatic life designated use assessments for coastal waters will be refined.

Maintaining and Improving Aquatic Life Designated Use in Coastal Waters: Major strategies include:

- Improve the scientific basis for aquatic life use assessments in coastal waters through integration of fisheries population data, ocean discharger biological monitoring and other biological datasets
- Develop a "fishable index" that considers fish population and consumption issues
- Continue to monitor and assess air deposition of nutrients to coastal waters
- Manage nutrient loads to coastal waters through available programs and TMDL development (e.g., New York-New Jersey Harbor nutrient TMDL)

Recreational Uses in Coastal Waters: Recreational designated uses in New Jersey estuaries and ocean waters were assessed using fecal coliform data collected in estuaries by NJDEP's Coastal and Estuarine Water Quality Monitoring Program, and in the ocean by NJDEP's and USEPA's Helicopter Monitoring Program. The NJDEP's aerial surveillance consisting of six flights per week, provides for routine evaluation of coastal water quality and the assessment of the nature

and extent of ocean pollution in Raritan Bay, the Lower New York Bay, and the Atlantic coast from Sandy Hook to Cape May Point.

The spatial extent of this assessment is provided for the first time in this report. Bathing beaches represent a very small portion of estuarine and ocean waters but they are summarized using data from the Cooperative Coastal Monitoring Program because of the broad interest in recreational bathing beaches. Bathing beach data are also most relevant to potential human health risks from swimming. Of 715 square statute miles of ocean and estuary assessed, 710 (99.3%) fully supported recreational designated uses and 5 square miles (0.7%) partially supports recreational designated uses.

Maintaining and Improving Recreational Use in Coastal Waters: Major strategies include:

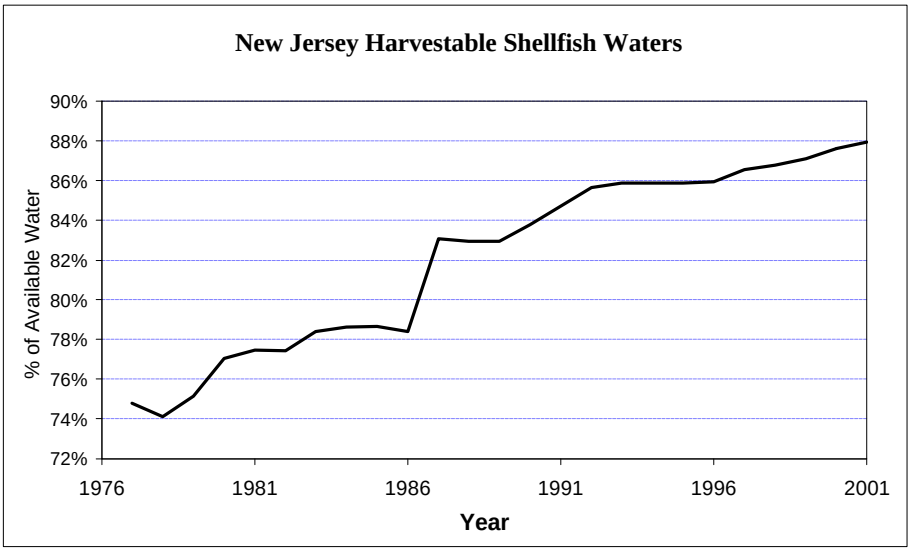
- Implement NJDEP's Beach Action Plan
- Expand inspections of coastal wastewater facilities to include sewage collection systems
- Through development and implementation of TMDLs and the municipal stormwater planning and permitting program, manage sources of FC from freshwater systems and coastal stormwater systems

Fish Consumption Use in Coastal Waters: Fish consumption designated use was assessed for waters affected by fish consumption advisories or bans for one or more species. The spatial extent of this assessment is provided for the first time in this report. The assessment was limited to 215 square statute miles of ocean waters because fish consumption designated uses are assessed in interstate waters by DRBC and ISC. Of 215 square miles assessed, 100% fully meet fish consumption designated uses but were threatened because of consumption advisories and bans. This assessment is based on fish advisories for chlorinated organics that are more than 10 years old. Because preliminary data indicate that contaminant levels may be decreasing, warranting re-evaluation of the advisories, these waters were classified as threatened. It is important to consider that fish are mobile animals and may have become contaminated in New Jersey's waters or elsewhere. Clearly, new data are needed to evaluate fish tissue contamination and adjust advisories as needed.

Maintaining and Improving Fish Consumption Designated Use in Coastal Waters: See major strategies for rivers

Shellfish Consumption Designated Use in Coastal Waters: Shellfish consumption designated uses were assessed using total coliform data collected in the National Shellfish Sanitation Program. These data are used to classify waters for shellfish harvest as unrestricted harvest (fully supporting), special restricted or seasonal harvest (partially supporting) and closed (not supporting). Of 1,053 square miles assessed, 808 square miles (77%) fully support shellfish consumption designated uses, 115 square miles (10.9%) are classified for seasonal or special restricted harvest and thus partially support shellfish consumption designated uses and 130 square miles (12.3%) do not support shellfish consumption. Note that 923 square miles (87.7%) available for unrestricted, special restricted or seasonal harvest are considered "harvestable waters" by the National Shellfish Sanitation Program because harvesting is allowed under specific conditions, such as seasonally or after relay or depuration processes. The shellfish

waters that support harvesting have increased from 75% in 1977 to 86% in 1996, to 87% in 1998 and 88% in 2000.



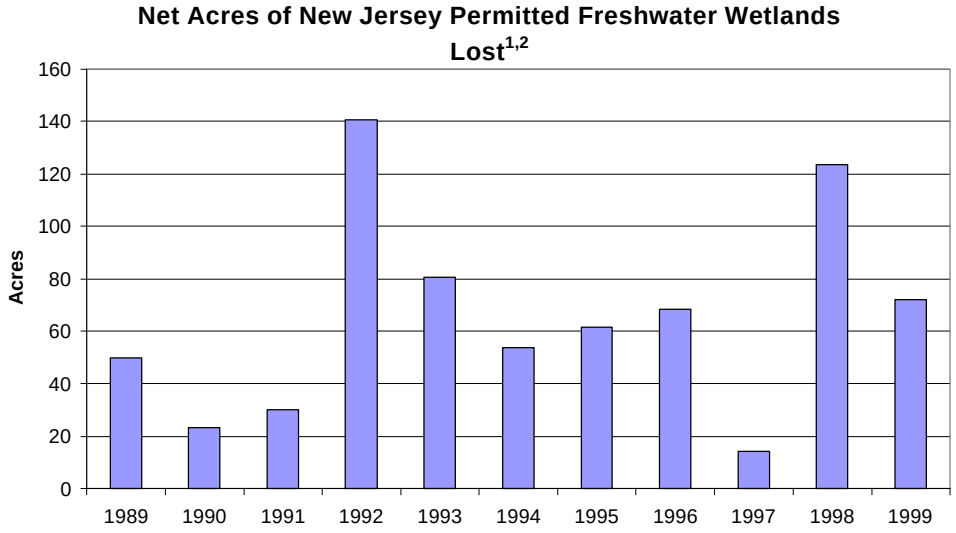
Maintaining and Improving Shellfish Consumption Designated Use in Coastal Waters: Major strategies include:

- Implement the shellfish action plan to attain 90% harvestable by 2005
- Address sources of coliform bacteria to Seaside Heights shellfish harvesting areas
- Continue to implement the nonpoint source monitoring strategy as appropriate in additional locations.

1.3 Wetlands Resources

New Jersey has an estimated 948,429 acres of wetlands or approximately 19% of New Jersey's land base: 739,160 acres are freshwater wetlands and 209,269 acres are tidal wetlands. Following the stressor-condition-response model of indicators established in NJDEP's Performance Partnership Agreement with USEPA, the 305B Report, for the first time, has included both stressor and condition indicators for wetlands, as well as descriptive response measures. Permitted wetlands losses in relation to required mitigation acreage, show that from July 1, 1988 through June 30, 1999 there was an estimated permitted net loss of 718 acres of freshwater wetlands. From 1992 through 1998, there was an estimated permitted disturbance to 204.18 acres of New Jersey coastal wetlands with 17.5 acres of compensatory mitigation through wetlands creation and enhancement of 8,849 acres of coastal wetlands through ongoing enhancement and restoration projects. Permitted wetland disturbances are indirect measures of wetlands loss, as all permitted activities would need to be field verified to ascertain if they occurred. In some limited cases, permitted activities are temporary disturbances with no net loss of wetlands. For example, General Permit #2 allows for installation of underground utility lines, but requires the disturbed area to be restored once construction is complete. Therefore, these sorts of activities are not losses, but permitted disturbances.

Maintaining and Improving Wetlands Resources: In addition to the stressor and condition indicator data for wetlands, NJDEP recognizes the need to track wetland acreage (conditions) and wetlands conversion (stressor) over time. Therefore, NJDEP included DRAFT data for 12/20 New Jersey Watersheds (data for the entire State were not available) to show the change in wetlands acreage based upon aerial photography for two time periods, 1986 and 1995, by Anderson level classification. NJDEP has publicly released these data, via the Internet, to assist in scientific analyses and environmental planning efforts by governmental and non-governmental organizations.



Notes
1 Acres lost equals sum of acres disturbed pursuant to both individual and general permits minus acreage of compensatory mitigation required
2 Data include repeat disturbances/impacts for certain activities and/or temporary disturbances which do not necessarily constitute new or additional wetlands losses.

In addition to establishing new data on wetland resources for New Jersey, NJDEP is currently conducting over a dozen studies in concert with university scientists and wetlands professionals to map and monitor New Jersey wetlands, as well as develop methods to assess wetlands quality and function.

Wetlands protection activities include preservation, compensatory mitigation, and one of the strictest regulatory programs in the United States. Wetlands open space acquisition and tax exemption programs have been further secured through the Garden State Preservation Trust Act of 1999 dedicating $98 million of annual funds over ten years and $1 billion in bond financing to support open space preservation. NJDEP and the New Jersey Department of Agriculture are anticipating a cooperative Conservation Resource Enhancement Program (CREP) with the federal government to purchase easements or rental contracts on up to 30,000 acres of riparian

buffers of agricultural land (including wetlands). Newly proposed NJDEP freshwater wetlands rules include vernal pool protection and additional buffers adjacent to wetlands transitional areas. In addition, newly proposed NJDEP watershed rules provide increase protection for wetlands as environmentally sensitive areas, through stormwater nonpoint source requirements, and maintenance of base flows to streams.

1.4 Status and Trends in Water Quality

Rivers and Streams

The status of rivers and streams water quality was characterized by comparing 1995 to 1997 data collected from 79 stations sampled in the Ambient Stream Monitoring Network (ASMN) to applicable SWQS criteria. See Part III, Chapter 3.1 for a description of New Jersey's SWQS.

USEPA Guidance for the Preparation of Water Quality Inventory Reports recommends that SWQS for non-toxic parameters are met if 0-10% of samples from a monitoring location exceed applicable criteria; SWQS are partially met if 11-25% of samples from a monitoring location exceed applicable criteria and SWQS are not met if more than 25% of samples from a monitoring location exceed applicable criteria.

The ASMN was redesigned beginning in October 1997. Sufficient data for comparison to SWQS will be available from the redesigned ASMN for the 2002 Water Quality Inventory Report. Trends between 1986 and 1995 were assessed by the United States Geological Survey (USGS) under contract to NJDEP. (USGS, 1999).

Of 1,259 **dissolved oxygen** (DO) measurements collected at 76 stations in the Ambient Stream Monitoring Network between 1995 and 1997, 98.8% of samples met applicable SWQS criteria. The average DO for all monitoring stations was 9.8 parts per million. Thus, 173 of 176 monitored stream miles (98.3%) met applicable DO criteria.

Of 1,265 **total phosphorus** (TP) measurements collected between 1995 and 1997 in the Ambient Stream Monitoring Network, applicable SWQS criteria for TP were met at 29 of 79 stations, representing 67 assessed stream miles and 858 (68% of samples) met applicable SWQS criteria. Of 79 stations, 40 (50% of stations) had statistically significant decreasing trends (i.e., improving water quality) between 1985 and 1995; a statistically significant increasing trend was found at only 1 station. Through TMDL planning and development, additional data collection and assessments will be conducted to evaluate whether excessive primary production is occurring at or downstream of monitoring stations with elevated TP.

Of 1,183 **un-ionized ammonia** measurements collected at 76 stations in the Ambient Stream Monitoring Network between 1995 and 1997, only 1 exceedance of applicable SWQS criteria was found. Thus, 100% of 176 monitored stream miles met un-ionized ammonia criteria.

Of 1,216 **pH** measurements collected between 1995 and 1997 in the Ambient Stream Monitoring Network, 1013 (83.3% of samples) met applicable SWQS. Based on these data, pH criteria were met at 54 of 76 stations (71%) representing 114 of 176 monitored stream miles (65%). It is important to note that naturally low pH occurred in some streams outside the Pinelands area,

reducing overall compliance with pH criteria. Additional pH characterizations will be conducted in these areas as TMDLs are planned and developed. These results can be used as appropriate to evaluate SWQS criteria for pH.

Of 1,254 **nitrate** samples collected between 1995 and 1997 in the Ambient Stream Monitoring Network, 1,252 (99.9%) met applicable SWQS criteria, and only 1 exceeded the Drinking Water Maximum Contaminant Level of 10 ppm. However, nitrate in surface water was identified as an emerging issue. Rising trends (i.e., declining water quality) were found at 24 locations and 9 of 81 stations (11% of stations) had maximum nitrate concentrations over 5 ppm. This concentration was chosen to evaluate nitrate in streams because drinking water purveyors are required to monitor quarterly if finished drinking water exceeds 5 ppm (half of the 10 ppm Maximum Contaminant Level).

Table II-1.1: Water Quality Status Summary (1995-1997) in 176 Stream Miles Assessed

Parameter	**SWQS Fully Met**	**SWQS Fully Met but Threatened (1)**	**SWQS Partially Met**	**SWQS Not Met**
Dissolved Oxygen	173	0	3	0
Total Phosphorus	67	0	25	84
Un-ionized Ammonia	176	0	0	0
pH	114	0	34	28
Nitrate	176	0	0	0

1. Assessed waterbodies were evaluated for trends that would indicate that SWQS would not be met within 2 years as per USEPA's definition of "Threatened". Many water quality trends were improving. Where adverse water quality trends were found, none were strong enough to indicate that SWQS would not be met within 2 years.

The second round of biological sampling was completed in the Upper Delaware Water Region (WMA's 1, 2 and 11), allowing trends to be reported. See Figure II-1. Between the first sampling in 1993 and the second round in 1998, 71% of stations did not change impairment rating, while 13% improved and 16% declined.

Other Waterbodies

Additional data collection and assessments are needed to support evaluation of trends in remaining waterbodies.

1.5 Causes and Sources of Impairment

A qualitative assessment of causes and sources of impairment is provided in this report. In the future, as additional assessments are completed, these assessments will become more rigorous and more quantitative. It is expected that through development and implementation of Total Maximum Daily Loads (TMDLs), causes and sources of impairment will be better characterized in terms of severity and spatial extent to inform management priorities that can be implemented through Watershed Management Plans, ongoing programs and partnerships with the regulated community and local citizens and groups.

Rivers and Streams

Through studies and assessments, aquatic life (i.e., benthic) impairments have been generally attributed to water quality, sediment quality, habitat alterations (e.g., erosion, sedimentation), flow alterations (e.g., flashiness, low or high flows, drought) and natural population shifts. As the second round of data are collected, additional habitat evaluations are becoming available. Projects are being planned in the Whippany Watershed (in WMA06) and statewide to identify specific causative factors and sources of the problems.

Recreational designated use impairments are caused by elevated levels of fecal coliform. As discussed earlier, these river data are not appropriate for assessing risks to human health from swimming, and further, New Jersey bathing beaches are thoroughly monitored and very safe for swimming. Fecal pollution is primarily due to nonpoint sources, such as geese, storm drains and overland runoff; compliance at wastewater treatment plants is very high. Localized issues arise due to combined sewer overflows, failing wastewater and septic infrastructure and occasional wastewater treatment plant malfunctions. The role of livestock is also being explored.

Fish consumption designated use impairments in rivers and streams are caused primarily by mercury contamination. Mercury comes from air sources and historical pollution, including application of mercury based pesticides.

Lakes

Most of New Jersey lakes are in-stream impoundments that are highly prone to eutrophication. Historical Clean Lakes Program data show that many of New Jersey's public lakes are threatened by eutrophication, which is caused by excess nutrients and sedimentation. These conditions can lead to blooms of algae and aquatic weeds, which can cause low dissolved oxygen as they decay impairing biota, and can also degrade the recreational value of a lake for swimming and boating.

The natural transformation of lakes to wetlands is being accelerated by point and nonpoint source contributions of nutrients and erosion caused by stormwater. Erosion transports nutrients and suspended sediments to lakes, where they accumulate along with decaying plant materials, eventually filling in these waterbodies. The significance of these loads relative to in-stream concentrations and loads will be evaluated as TMDLs are developed.

Estuaries and Oceans

Nutrient inputs from rivers and streams, point and nonpoint sources including air deposition and natural actions of currents can contribute to algal blooms and depressed dissolved oxygen in estuaries and the ocean.

NJDEP recognizes that multi-media approaches to environmental assessment and management are best when dealing with contaminants that may be transported through differing media. Understanding the effects of air deposition and other non-point sources of pollution to coastal waters, including contaminant composition and magnitude of potential load, is critical to scientists and policy makers in formulating watershed-based management strategies and regional solutions to environmental issues.

NJDEP has established the statewide New Jersey Atmospheric Deposition Network (NJADN) which samples gaseous, particulate, and precipitation concentrations of a number of contaminants at nine sites throughout the State. The NJADN, through the collection of data that address wet and dry deposition and air-water exchange of atmospheric pollutants, will provide estimates of direct loadings to surface waters. Such data will be especially important for aquatic systems that have large surface areas relative to watershed areas, such as coastal areas. Preliminary findings of the NJADN are available for a number of pollutants. A study of Barnegat Bay indicated that over 75% of the nitrogen input to the bay is from atmospheric deposition.

In addition, historical inputs of toxics and current releases from contaminated sites and wastewater treatment plants contribute contaminants to sediments. Through the process of bioaccumulation, some of these contaminants can accumulate in the food chain and concentrate at levels of concern for human consumption. Fish are mobile animals, and the contamination may have occurred in New Jersey's waters or elsewhere.

1.6 Programs to Correct Impairments

The NJDEP Strategic Plan and NEPPS Agreement provide over-arching umbrellas to assess and prioritize environmental problems, to align program strategies to protect waters that currently meet designated uses and to improve impaired waters. Major strategies include adopting and implementing Water Quality and Watershed Management Rules, developing and adopting revisions to NJSWQS, enhancing monitoring and assessment programs, and development of TMDLs for impaired waterbodies. Additional information is provided in Part II-Background, Chapter 3- Water Pollution Control Programs.

1.7 Plan for Comprehensive Coverage

Rivers and Streams: Implementation of the Redesigned Ambient Stream Monitoring Network began in October 1997. A project is underway to estimate the spatial extent covered by this network. Data assessments, including spatial extent will be available for the 2002 Water Quality Inventory Report.

An assessment by the United States Geological Survey (USGS) indicates that benthic macroinvertebrate monitoring in the 820 station AMNET program is representative of New Jersey streams. Thus, aquatic life designated use attainment is comprehensively assessed in this program.

Lakes: Trophic status of New Jersey lakes has been comprehensively assessed through the Clean Lakes Program. Additional data and assessments are needed to identify use impairments in these lakes. Data from Fish and Wildlife's Warmwater Fisheries Programs provide a comprehensive assessment of fisheries resources in lakes.

Estuaries and Oceans: New Jersey coastal waterbodies have been comprehensively assessed through the Marine and Estuarine Water Quality Monitoring, National Shellfish Sanitation Program, Cooperative Coastal Monitoring Program and USEPA's Helicopter Program.

Toxics in Fish Tissue: Additional data collection and assessment are needed to evaluate waters that have not been monitored and to update advisories that are more than 10 years old.

NJDEP is participating in USEPA's national workgroup to develop a Comprehensive Assessment and Listing Methodology (CALM). This workgroup is charged with developing an integrated approach to assessing designated use attainment for Water Quality Inventory Reports (305b) and listing impaired waterbodies for Impaired Waterbodies Lists (303d). Results of this workgroup will be used to inform assessment and listing procedures, including the spatial extent of assessments.

1.8. Summary of Special State Concerns and Recommendations

Special state concerns and recommendations were grouped by designated use impairment. Recommendations include strategies that can be implemented by New Jersey, as well as at the regional and national levels.

Concern: Aquatic Life Designated Use Impairment

Published results show about 500 of 800 sites (65% of monitoring stations) are impaired and preliminary data indicate that there may a trend toward moderate impairment over time. Some locations that were severely impaired in the early 1990's were moderately impaired in the late 1990's and some that were not impaired in the early 1990's were moderately impaired in the late 1990's. Preliminary information indicates that impairments may be related to natural and human-induced physical habitat disturbances.

Recommendations:

- Continue implementation of ongoing water pollution control programs
- Protect and improve stream corridors through Conservation Resource Program (CRP) and preservation of open space
- Implement Stormwater Planning and Management at the municipal level
- Collect site specific data and conduct additional evaluations to assess causes of impairment; target program implementation as appropriate, utilize Nonpoint Source Management (319h) funds to address nonpoint sources that contribute to impairment.
- Improve aquatic life assessments by integrating fisheries and other databases

Concern: Fish Consumption Designated Use Impairment

Advisories, and for some locations and species, consumption bans are in place due to historical pollution, air deposition and ongoing releases from contaminated sites. Advisories for chlorinated organics are based on data that are more than 10 years old and may not reflect current conditions.

Recommendations:

- Continue to implement, and improve as needed, point source controls on mercury and PCBs
- Develop and implement source reduction strategies, including source trackdown projects
- Manage contaminated sediments through dredging, capping
- Evaluate and manage as appropriate the contributions from air

- Implement routine fish tissue monitoring to evaluate older advisories, evaluate toxics in shellfish
- Improve and expand advisory outreach and education

Concern: Maintain and Improve Recreational Designated Use Attainment at Beaches; Improve Sanitary Quality in Rivers

Ocean, bay and lake beaches routinely meet designated uses, but occasional closures occur, typically related to storm events. Recreational designated uses in monitored rivers are generally not met, although river monitoring is not targeted to locations used for swimming and boating.

Recommendations

- Ensure continued compliance at wastewater treatment plants and address wastewater and stormwater infrastructure problems near beaches
- Continue to implement Clean Shores Program and the Beach Closing Action Plan
- Target river monitoring to locations where swimming and boating is likely
- Work with USEPA to evaluate pathogen indicators

Concern: Shellfish Harvest Designated Use Attainment

New Jersey is a national leader in opening shellfish beds, but nonpoint pollution sources threaten near coastal shellfish waters.

Recommendations:

- Implement the Shellfish Action Plan which targets specific harvest areas
- Continue to implement statewide point source management programs
- Proactively manage stormwater from shore municipalities and marinas
- Evaluate toxics in shellfish

Concern: Protect Drinking Water Designated Uses

Although levels of nitrate in finished drinking water remain consistently below the Maximum Contaminant Level allowed under the Drinking Water Quality Standards, stream monitoring data indicate that rising levels of nitrate may be an issue in some surface water supplies. Nitrate above the drinking water MCL has adverse health effects and is difficult and expensive to remove from drinking water. It is important to note that drinking water MCLs for nitrate were met in public water supplies.

Recommendations:

- Continue to monitor and evaluate levels of nitrate in finished drinking water
- Identify sources and management strategies at affected intakes

Chapter 2 New Jersey's Water Resources

New Jersey is the fifth smallest state in the nation and contains a wide variety of land use types, water resources, geologic characteristics, and natural biota and fauna. Within the state's 7,788 square miles are 127 miles of coastline; 8,020 miles of rivers and streams (based upon USEPA's River Reach File #3 (RF3) hydrology; and 113 square miles (72,590 acres) of lakes and ponds larger than 2 acres. In addition, there are 1,482 square miles of fresh and saline marshes and wetlands, and 725 square miles of estuarine waters. A summary of the state's population and water resources is presented in Table II-2.1 below:

Table II-2.1: New Jersey Water Resources Atlas

Resource	Extent
State Population (1990)	7,730,188
State Surface Jurisdictional Area	8,919 sq. miles[1]
State Surface Area	7,788 sq. miles[2]
Rivers and Streams	
Miles of rivers and streams (total)	8,020
Miles of nontidal rivers and streams	6,500
Miles of tidal river and streams	1,520
Miles of perennial rivers and streams (nontidal and tidal)	7,710
Miles of intermittent (non-perennial) streams (nontidal and tidal)	310
Miles of ditches and canals[4]	1,235
Border miles shared rivers/streams (nontidal and tidal)	197
Lakes, Ponds and Reservoirs	
Number of lakes/reservoirs/ponds (2 acres and larger)	3,600
Acres of lakes/reservoirs/ponds (2 acres and larger)	72,590
Number of significant publicly owned lakes/reservoirs/ponds	380
Acres of significant publicly owned lakes/reservoirs/ponds	24,000
Estuaries and Ocean	
Square Miles of Estuaries/Harbors/Bays	725[3]
Miles of Ocean Coast (linear miles)	127
Miles of Ocean Coast (sq. mi. of jurisdictional waters)	446
Wetlands	
Acres of Freshwater Wetlands	739,160
Acres of Tidal Wetlands	209,269

Notes:

1 Includes coastal waters within New Jersey jurisdiction as shown on Figure II-2, based on the sum of 151 HUC-11 watersheds using 1986 Land Use/Land Cover GIS coverage.

2 Excludes coastal waters within New Jersey jurisdiction as shown on Figure II-1, based on the sum of 5 Water Regions using 1986 Land Use/Land Cover GIS coverage.

3 Includes all waterbodies below the head of tide.

4 Not included in the total miles of rivers and streams

It should be noted that the number of river miles presented in this report (8,020 miles) are notably larger than the 6,450 miles reported in prior New Jersey Water Quality Inventory Reports. River miles in this report are determined by a computer based mapping system which presents hydrology accurate down to a USGS 1:100,000 scale map. This provides the state's hydrology with much greater detail and accuracy than the maps used to estimate total river mileage presented in earlier reports. In addition, tidal rivers and streams are included in total estuary area to prevent double counting.

The five Water Regions in the state are shown on Figure AII-1 in the Appendix**.** These include the Northwest (1,226 sq. miles), Lower Delaware (2,228 sq. miles), Northeast (953 sq. miles), Raritan (1,284 sq. miles) and Atlantic Coastal (2,877 sq. miles). Drainage areas include New Jersey portions only.

The 5 Water Regions have been divided into 20 Watershed Management Areas (WMA's) for Management purposes, as shown on Figure AII-1 in the Appendix. Watershed Management Areas are comprised of 151 HUC-11 watersheds, which are shown on Figure AII-2. These 151 HUC-11 watersheds are part of a national system of watershed based hydrologic units (HUC's) developed by the United States Geological Survey, United States Soil Conservation Service and the US Environmental Protection Agency.

Chapter 3 Water Pollution Control Programs

The following section provides a summary of major accomplishments and changes to NJDEP's Water Pollution Control Programs focused on calendar years 1998 and 1999. Information regarding major strategies to maintain and improve water quality is provided in each designated use assessment. Information regarding ongoing activities in the water pollution control programs was described in detail in the 1996 and 1998 New Jersey Water Quality Inventory Reports (NJDEP 1996, 1998). Additional information can be found at the NJDEP website: *www.dep.state.nj.us*

3.1 Strategic Plan & National Environmental Performance Partnership System

NJDEP's Strategic Plan and National Environmental Performance Partnership System (NEPPS) are being used to develop and implement Results Based Management in NJDEP. Major components of the Strategic Plan and NEPPS include establishing environmental goals, milestones and objectives, orienting program activities toward meeting goals and using environmental indicators to measure progress. Relevant goals, milestones and objectives for Water Resources and Land And Natural Resources are provided in Appendix A3.1. Additional information regarding NJDEP's Strategic Plan and NEPPS can be found at NJDEP's website.

NJDEP and USEPA developed a one year extension to the 1999-2000 Performance Partnership Agreement. The extension includes major changes and new commitments to ensure that NJDEP can be awarded the Performance Partnership Grant for Fiscal Year 2001. The water component of NEPPS has been expanded to include water supply and efforts are underway to develop and improve indicators in coastal and estuarine waters. To the extent possible, water quality indicators will be used in this report.

3.2 Watershed Approach

NJDEP is accelerating implementation of watershed management. As of July 1, 2000, NJDEP was active in 9 Watershed Management Areas (WMA's) and plans to be active in all 20 WMA's by October, 2000. Major activities include establishing watershed partnerships, developing issue lists, identifying and implementing Action Now projects and planning TMDLs.

In addition, NJDEP recently proposed major revisions to the Water Quality Management Planning Rules. These proposed Water Quality and Watershed Management Rules are intended to facilitate implementation of the State Development and Redevelopment Plan by encouraging new development in already sewered areas. Additional rigor has been added to environmental analyses required to amend wastewater management plans.

3.3 Water Quality Standards

New Jersey's Surface Water Quality Standards draft proposal is undergoing final legal review prior to proposal during the summer of 2000. The proposal will provide direction for implementation of the State's antidegradation policy.

3.4 Water Quality Data Collection and Development

Major accomplishments of the Division of Watershed Management's Water Monitoring

Management Program include plans to expand water chemistry monitoring to include 200 new locations on tidal and non-tidal-freshwater streams, bringing the total number of water chemistry monitoring stations to about 315.

Major accomplishments of the Division of Science, Research and Technology's Water Assessment Team include publication of Surface Water Quality Characterization and Assessment Reports for WMA's 1, 2, 12 and 19. The WAT also has completed or ongoing projects to fill data and information needs related to watershed management. Projects to develop a model to support TMDL development for nonpoint source impacts to lakes, trackdown PCBs in the Delaware Estuary, assess wetlands quality and function are filling information gaps.

The Office of Information Resources Management's Geographic Information and Analysis Program provided 1995/97 Anderson Level II land use/ land cover GIS data for 12 WMA's. The new dataset includes impervious cover and allows for an analysis of land use changes from the 1986 land use/land cover dataset. This project is expected to be completed by October, 2000. Data are available at the NJDEP website.

New Jersey is assessing the vulnerability of drinking water sources to existing and potential pollution sources through the Source Water Assessment Program (SWAP). The SWAP in New Jersey was developed based on the 1996 amendments to the Federal Safe Drinking Water Act (NJDEP, 1999). Under the program, New Jersey will delineate areas which have the potential to influence waters (surface and ground) serving as public drinking water sources based upon hydrogeology. These areas include the delineation of watersheds upstream of surface water intakes, wellhead protection areas and to the extent possible, ground water recharge areas. Within these areas, the state will identify the origins of all contaminates regulated under the Federal Safe Drinking Water Act, and identify the vulnerability of the water systems to these contaminants. The program will also delineate sources at risk in the future. As part of the assessment, an evaluation of the types of treatment currently in place will be performed to determine if the processes provide adequate protection to meet current and potential water quality concerns.

3.5 TMDL Development

During 1998 and 1999, TMDLs were developed for the Whippany River Watershed (fecal coliform), Hackensack River (nickel), Upper and Lower Sylvan Lakes (total phosphorus) (NJDEP, 2000a). TMDLs were approved for Strawbridge Lake in September, 2000(total phosphorus) (NJDEP, 2000b). Appendix A3.5-1 describes the lake TMDLs.

The TMDL development schedule was amended by an agreement between USEPA and NJDEP, in letters dated November 19, 1999 and December 6, 1999, respectively, and Amendment 1" signed by USEPA on March 9, 2000, and NJDEP on March 27, 2000 and is provided as Appendix A3.5-2 to this chapter.

3.6 Point Source Programs

Major accomplishments of the Permitting Program include:

The NJDEP's Division of Water Quality issued several new NJPDES General Permits and renewed two additional general permits. General permits reduce permit processing time because a standard set of conditions, specific to a discharge type or activity, are developed (rather than issuing individual permits for each activity).

Swimming Pool General Permit covers discharges from municipal, commercial and other non-residential swimming pools. These discharges result from the back-flushing of filtration equipment used to remove solids and other material from pool water and the emptying/draining of pools at the end of the swimming season or for maintenance. This permit relies on a Best Management Practice (BMP) approach.

Hydrostatic Test Water Discharge General Permit covers discharges occurring during the hydrostatic testing of storage tanks and pipelines that have been cleaned pursuant to recognized federal, state or general industry documented procedures. The general permit does not authorize the discharge of the cleaning water or tank bottom water. This permit also uses a BMP approach along with the submission of a certification form.

Construction De-watering Discharge General Permit authorizes discharges of groundwater that result from lowering the groundwater table during construction. This general permit also includes Best Management Practices (BMP's) and/or provides temporary treatment units as well as self-monitoring rather than numeric limitations.

Residuals Transfer Facilities General Permit authorizes certain residuals transfer facilities that temporarily store liquid sewage sludge (which includes domestic septage) and grease (which meets the definition of a domestic pollutant) prior to transfer to a duly permitted or approved residuals management operations for ultimate management. The new general permit incorporates BMP's and operation, maintenance, and inspection requirements. Currently, six facilities are authorized under this general permit.

General Petroleum Products Clean-Up Permit Renewal authorizes discharges of decontaminated groundwater into surface waters of the state or separate storm sewers. These discharges result from remediation projects and de-watering and pump test activities where groundwater has been contaminated by petroleum products. The renewed permit addresses methyl *tert* butyl ether (MTBE) and *tert* butyl alcohol (TBA). These compounds are fuel oxygenate additives that are typically present in modern reformulated gasoline. The scope was expanded to allow discharges that have other pollutants in addition to petroleum related constituents to be regulated under the general permit.

Existing Sanitary Septic Systems General Permit was issued for discharges to ground water from existing sanitary subsurface disposal systems. In the past, these dischargers were regulated under individual permits— a permit requiring an in-depth review by the division and substantial monitoring and reporting requirements for permittees. The Standards for Individual Subsurface Disposal Systems (N.J.A.C. 7:9A) required all facilities with a design flow in excess of 2,000 gallons per day to apply for an individual NJPDES-DGW permit. As a result of discussions with the regulated community, engineers, geologists and consultants, the division decided these types

of ground water discharges could be regulated more effectively using a general permitting regulatory approach. To date, over 300 facilities have been authorized under the new permit.

The "Scrap Metal Permit" general stormwater permit was reissued and expanded to include stormwater discharges to both surface waters and ground water from vehicle dismantling, crushing and scrap metal recycling and shredding facilities. The permit relies on Best Management Practices (BMP's) to control the discharge of pollutants. Control of fluids by proper dismantling procedures and secondary containment was emphasized in original permit for those facilities with surface water discharges.

Effluent Trading - Two industrial facilities discharging into the Passaic Valley Sewerage Commissioners (PVSC) system have completed an effluent trade—the first of its kind in the nation. Effluent trading is a regulatory method allowing dischargers achieving greater pollutant reductions than required to sell "credits" for their excess reductions to other dischargers not able to cost effectively reduce their own pollutants. The division has worked with the PVSC, the USEPA, USEPA's consultant - Industrial Economics, and various industry representatives to develop the trade program. Under the program, two users in the PVSC district have successfully completed a trade for copper. Twenty percent of the copper credit purchased was "banked" and is no longer available to be discharged—a plus for the environment.

Reclaiming Wastewater for Beneficial Reuse (RWBR) - The Division has been actively promoting beneficial reuse of wastewater from domestic and industrial wastewater dischargers. RWBR has a myriad of application potentials including the spray irrigation of crops, parks, and golf courses; dust control; fire fighting; and toilet flushing, to list a few. The high-level of disinfection and effluent treatment is required to protect the public health and environmental quality. During the 1999 Drought Emergency, a total of 17 facilities were authorized to use wastewater as a replacement water source. Many facilities are now evaluating how to implement reuse at their facility. The division prepared a guidance document to assist facility operators and owners interested in pursuing the reclamation of their wastewater.

Sludge Quality Assurance Regulations were readopted on May 17, 1999 at N.J.A.C. 7:14C. The readopted rules change the parameters required to be reported for all domestic and industrial treatment works. The reporting frequency for industrial treatment works was also changed.

New Jersey Environmental Management System (NJEMS) – The Department has embarked on a multi-media computer system to store air, water and waste facility information. Modules for NJPDES permitting, Treatment Works Approvals and Water Compliance and Enforcement have been completed and will be fully operational July 1, 2000. The new system will enable the NJPDES/TWA programs to share and process data more efficiently with each other as well as the rest of the department. Case managers will be able to manage their projects within the confines of one database system, allowing for ease of management oversight and coordination among the various internal program areas such as Enforcement, Planning, and Water Supply. Better data management and faster, more accurate permit generation will result in a time savings for both the department and the regulated community.

* The General Permit for Combined Sewer Systems was reissued on February 24, 2000 in accordance with N.J.A.C. 7:14A-6.13. The General Permit is issued to control the discharge of pollutants from Combined Sewer Systems through Combined Sewer Overflow (CSO) points. The most significant modification to the permit was the incorporation of provisions for the automatic renewal of existing authorizations as provided by N.J.A.C. 7:14A-6.13(d)9. Existing authorizations were renewed automatically when the General Permit was issued.

* A new database was developed to track and monitor permit processing for Treatment Works Approvals (TWA). Staff was trained on the use of the new database, NJEMS-TWA System, in November and December 1999. Final testing and debugging of the system occurred in January and February 2000. On April 1, 2000, the new system went on-line and is fully operational.

Combined Sewer Overflow Program: The Department's Statewide CSO Program consists of several regulatory efforts following parallel and concurrent tracks that are unified into a single control strategy. These regulatory efforts reflect the mandates that serve as the basis of the Statewide CSO Control Program requirements. These mandates include the New Jersey Sewerage Infrastructure Improvement Act (SIIA), the National CSO Control Policy, the New/New Jersey Harbor Estuary Program Comprehensive Conservation and Management Plan (NY/NJ HEP CCMP), and the National Environmental Performance Partnership System (NEPPS).

The first track of the program addresses the mandates of the SIIA. Under the SIIA (Enacted in 1988), the Department initiated a program which provides, in part, planning and design grants for the development and implementation of Solids/Floatables Controls and Dry Weather Overflow identification and elimination. The program requires permittees of CSO Points to develop and implement control measures that capture and remove solids/floatables materials from CSO discharges and to remediate and/or modify the combined sewer systems to eliminate dry weather overflows.

To date, SIIA planning activities have been completed for all of the known CSO Points. Design activities are ongoing or have been completed for 84 % of the known CSO Points. 10% of the planned CSO Solids/Floatables Control Facilities have been completed and are operating.

The following are achievements have resulted from the implementation Solids/Floatables Control Measures.

- The Edgewater MUA had 9 CSO Points and 222 acres of land served by combined sewers in Edgewater Borough. To date, EMUA has eliminated 4 CSO Points through the creation of separate storm water and sanitary sewers. This activity eliminated the 96.2 acres of drainage area that contribute surface water runoff to the combined sewer system. This represents a reduction of the areas served by combined sewers by 43%. When completed, the Edgewater MUA proposes elimination of 8 of the 9 CSO Points through sewer separation and a 78% reduction in the combined sewer system service area. One CSO Point will remain with a Solids/Floatables Control Facility.

- The Towns of Harrison and Guttenberg, the Village of Ridgefield Park, and the North Bergen MUA (North Bergen Township) have completed construction and initiated operation of all of Solids/Floatables Control Facilities for at all of their CSO Points.

- The City of New Brunswick has eliminated its last remaining CSO Point through sewer separation.

- The City of Trenton has completed construction and initiated operation of Solids/Floatables Control Facilities for its only CSO Point. City also has implemented a Long-term Control Plan that significantly reduces the frequency and duration of CSO discharge events.

The second track of the program is reflected in the General Permit for Combined Sewer Systems and other similar enforceable commitments (e.g., Administrative Consent Orders, Judicial Consent Orders and Individual NJPDES Permits). In this track of the CSO Control Program permittees which own and/or operate any portion of a combined sewer system are required to develop and implement technology-based control measures including the Nine Minimum Control Measures identified in the National CSO Control Policy. Additionally, these enforceable commitments initiated the first phase of the planning activities of National CSO Control Policy's Long-term Control Planning (LTCP) Process. These planning activities include the performance of a significant landside monitoring and modeling of the combined sewer systems to characterize the frequency, duration and nature of combined sewer overflow discharges.

In the third proposed track of the Statewide CSO Control Program, the Department intends to complete the remaining elements of the National CSO Control Policy LTCP Process by integrating the regulatory and facility planning obligations of the Combined Sewer System (CSS) permittees with the Watershed Management/TMDL planning processes. Activities proposed in this process include development and implementation of water quality-based corrective action plans for CSO and non-CSO sources of pollution.

3.7 Finance (SRF) Programs

Major accomplishments of the Division of Water Quality's Municipal Finance and Construction Program include:

* In September 1998, the Municipal Finance and Construction Element certified 15 clean water projects for low-interest loans through the Environmental Infrastructure Financing Program. The DEP and the Environmental Infrastructure Trust (Trust) closed on the loans, totaling over $67 million, with the project sponsors on November 5, 1998. The interest rate on the blended loans was 2.4%. Major improvements at the Somerset Raritan Valley Sewerage Authority STP and the Florence Township STP were included in the 1998 Financing Program. Environmental Infrastructure Trust Projects for 1998 are listed in Appendix A3.7-1.

* On November 4, 1999, 18 new clean water projects closed on their loans borrowing more than $64 million from the DEP and the Trust. The interest rate for the 1999 Financing Program was 2.72%. The 1999 Financing Program provided funds to install solids/floatables control

facilities at combined sewer overflow (CSO) locations throughout Jersey City, improve treatment capabilities at the Passaic Valley Sewerage Authority STP and for other infrastructure improvements. Environmental Infrastructure Trust Projects for 1999 are listed in Appendix A3.7-1.

* With the readoption of the Financing Program rules published in the July 3, 2000 New Jersey Register, the Financing Program has expanded the scope of stormwater and nonpoint source (NPS) projects that qualify for financial assistance. Eligible stormwater and NPS projects focus on the water quality benefits associated with preventing, reducing, or controlling the amount of contaminated runoff adversely impacting ground and surface water. Amendments were adopted into the rule to make such areas as landfills (for closure and new cell construction), land acquisition, site remediation, and well sealing eligible for low-interest loans. Highlights of an SRF nonpoint source project to restore Colonial Lake are provided in Appendix A3.7-2

3.8 Nonpoint Source Management Program

Major accomplishments of the Department's Nonpoint Source Management Program include:

- updating the NPS Management Program plan (*Updated NJDEP Nonpoint Source Management Program Plan*, June 19, 2000) to meet the 9 minimum criteria. The updated plan was approved by EPA on August 10, 2000 (Highlights of the plan are included in Appendix 3.8-1);

- initiating use of the GRTS system. The data for all 1998-1999 319h projects was entered into the GRTS system. (A printout of projects in the GRTS system are included in Appendix 3.8-2);

- enhanced requirements in guidelines for 319h projects to assess 319 project effectiveness. (New Jersey's 2001 guidelines are available on the DEP web page.);

- numerous education and outreach efforts to promote water quality improvements including public meetings to report nonpoint source project success and guidance to developers and watershed partners with respect to measures addressing specific types of NPS pollution.

- Two new guidance documents *Revised Manual for New Jersey: Best Management Practices for Control of Nonpoint Source Pollution from Stormwater* May 2000 and *Revised Manual for New Jersey: Best Management Practices for Control of Nonpoint Source Pollution from Stormwater* August , 2000 are available on the DEP web page; and,

- implementation of agricultural best management practices (BMP) using federal and state grants through the Environmental Quality Incentive Program and Conservation Cost Share Program.

3.9 Site Remediation Program (SRP)

The remediation of contaminated sites falls under the purview of the Site remediation program (SRP). Due to New Jersey's lengthy industrial history, numerous hazardous waste sites and

landfills have been identified which caused environmental impacts to soil, surface and ground water, and air. At many sites, soil was contaminated; at fewer sites, multiple environmental media were contaminated. To prevent new contaminated sites, manufacturing facilities using toxic chemicals are required to develop pollution prevention plans.

NJDEP began to control and mitigate contamination to protect communities and the environment. As of July 1999, 10,526 areas of concern (partial sites) or sites have been remediated and received a No Further Action (NFA) letter. An NFA letter indicates that the contamination has been cleaned-up, mitigated or controlled, is no longer under the oversight of the SRP, and the site is no longer a threat to the environment. In the last year alone, NJDEP oversaw $100 million in completed cleanups at contaminated sites and had more than 8,000 sites in the remediation process.

All potentially contaminated sites in the State are included in a Comprehensive Site List and each site is ranked using a Remedial Priority System (RPS). The RPS is the scoring system used to prioritize sites based on impacts or potential impacts to various media. Responsible Parties can work with the Department through a Memorandum of Agreement at any time. Once a site becomes a priority base on the RPS score, the responsible party must enter into an Administrative Consent Order with the department to investigate and remediate the site. Sites which fall under the purview of the Industrial Site Recovery Act (ISRA), or the Underground Storage of Hazardous Substances Act (UST) are required by statute to investigate and remediate the sites. If the responsible parties fail to undertake the remediation, the State can step in under the authority of the New Jersey Spill Act or CERCLA (Superfund) to ensure the remediation is completed.

As of July 1999, the number of sites where one or more ground water criteria were known to be exceeded was approximately 6475. The remediation of these sites is implemented on a priority "worst first" basis.

Classification Exception Areas (CEA) - The Site Remediation Program (SRP) and Bureau of Water Allocation (BWA) are currently developing a process that will enable BWA to coordinate the issuance of well permits with the location of CEA's. CEA's are areas of known and projected ground water contamination above state standards. This application will allow staff to enter proposed well locations and determine if such location is in or near a CEA. Well permit applicants, current owners of the property where the well is proposed to be drilled, and County and Municipal Health Departments (local administrative authorities), where applicable, will be notified of the existence of the CEA through issuance of the well permit decision. In addition, the person responsible for the contamination, if known, will be advised of the well permit decision.

Underground Storage Tanks - More than 10,000 tanks were upgraded or closed in 1999. Since the passage of tank upgrade laws, more than 60,000 tanks have been closed and 10,000 reported discharges cleaned up, helping to protect ground and surface water. SRP conducted a tank owner assistance effort for upgrades to ensure compliance with leak detection requirements at remaining tank locations.

3.10 Coordination With Other Agencies

Coordination with other agencies has been expanded to include numerous watershed partners as Public and Technical Advisory Committees are formed. An important focus for estuarine-coastal activities in New Jersey has been through multi-state regional efforts under the National Estuary Program which USEPA administers through the States. NJDEP in conjunction with other partners petitioned and received designation of three New Jersey estuaries as nationally significant.

Chapter 4. Costs and Benefits

NJDEP's Division of Science, Research and Technology is planning to hire an environmental economist. With this additional expertise, an evaluation of the economic and social costs and benefits of water pollution control programs and the value of water resources that meet designated uses can be assessed.

Chapter 5. Special State Concerns and Recommendations

Water resources concerns that are important in New Jersey and recommendations to address these concerns are discussed in the following section of the New Jersey Water Quality Inventory Report. Concerns are grouped by waterbody type and designated use affected. Recommendations include strategies that can be implemented in New Jersey as well as at the regional and national levels.

Rivers and Streams

Special State Concern: Aquatic life designated use impairment

Aquatic life designated uses in freshwater rivers and streams are assessed using populations of bottom dwelling organisms (i.e., benthic macroinvertebrate). Over 800 stations are sampled once every 5 years. (See Part III for additional information.) The second round of sampling has been completed in several water regions and results have been published for the Northwest Region (WMA's 1,2,11). Published results show about 500 of 800 sites (~65%) are moderately impaired and that there is a trend toward moderate impairment over time. These data indicate a lack of progress toward the goal of 50% attainment of aquatic life designated uses by 2005.

Suspected causes of impairment include: Stormwater and runoff from developed land uses such as agricultural and urban containing sediment, nutrients, pesticides and other toxics; adequate stream flow (water consumption, inter-basin transfer of water and wastewater, drought, and flooding); habitat destruction including erosion

Recommended Strategies, in addition to continued implementation of ongoing programs:

- Buffer agricultural stream corridor easements and purchases (CREP);
- Protect and purchase open space for Water Quality and Quantity benefit, linking DWQ and Green Acres
- Encourage additional wastewater reuse and ground water recharge (identify opportunities and remove impediments)
- Encourage additional wastewater reuse and ground water recharge (identify opportunities and remove impediments)
- Develop and implement Municipal Stormwater Permitting and Management Program
- Adopt Water Quality and Watershed Management Rules.
- Develop a composite index to address "fishable" and "swimmable".
- Implement Action plan to address areas of biological impairment
- Develop new and interim milestones for meeting SWQS
- Accelerate the pace of watershed management with additional funds
- Explore development of a new milestone along the lines of "reducing all discharges to streams by 50% by 2003" (clarification needed)
- Develop TMDLs with emphasis on air deposition data

Rivers and Coastal Waters

Special State Concern: Non-attainment of Fish Consumption Designated Use

Much of the data used to establish the fish consumption advisories in New Jersey are over ten years old. Specifically, all PCB/dioxin/pesticide based advisories are from the mid-1980s. Recognizing that this data is old and that the sources of the bioaccumulated contaminants have been subjected to regulatory source reduction over the ensuing years, NJDEP views these advisories as based on *evaluated data* thereby listing the affected waterways uses as "threatened" Fish consumption advisories based on *monitored data* (data collected within the last 10 years) in New Jersey is limited to mercury contamination and NJDEP views these data to establish "not supporting" or "partially supporting" uses. It should be noted however that the primary source of mercury contamination is atmospheric deposition associated with coal fired power plant emissions. Source reduction strategies targeted at these are multi-media in nature. The funding to address these data gaps and routinely update advisories as needed has not been available for several years. A continuous stable source of funding to maintain the State's monitoring of fish and waterways impacted by consumption advisories should be established.

Recommended Strategies, in addition to continued implementation of ongoing programs:

- Examine effectiveness of current advisory education and outreach effort, and expand or re-focus as necessary.
- Assess air deposition monitoring and modeling results in terms of contribution to food chain, especially commonly-consumed fish species.
- Establish routine state-wide fish tissue monitoring network-contamination, target species and target water bodies
- Based upon available monitoring results, evaluate appropriateness of current fish consumption advisories and need for modifications.

Ocean, Bay, Lake Bathing Beaches and Rivers

Special State Concern: Recreational Designated Use Attainment

Maintaining attainment of recreational designated uses at ocean, bay and lake bathing beaches is critical to New Jersey economy. Diligent management of wastewater treatment plants and associated infrastructure must be coupled with management of nonpoint sources of fecal coliform to continue meeting this goal. Improving sanitary quality of streams which are not designated bathing areas, primarily through management of nonpoint sources, is also needed to make progress toward designated use attainment in rivers. In addition, efforts are underway at the national level to shift from the currently used fecal coliform indicator to enterococcus in saline waters and e.coli in freshwaters.

Recommended Strategies, in addition to implementation of ongoing programs

- Implement beach closing action plan (Atlantic City, Wreck Pond, South Bath Avenue)
- Continue aggressive CSO enforcement for solids and floatables
- Develop and implement a statewide geese management plan with Division of Fish and Wildlife

Estuarine and Ocean Waters

Special State Concern: Shellfish Harvesting Designated Use Attainment

New Jersey is a national leader in opening shellfish beds for harvest and is nearing the state's established milestone of 90% of waters available for shellfish harvest by 2005. This progress can be attributed to proactive upgrades and compliance at the 15 facilities that discharge to the ocean. Continued diligent management of these facilities and control of nonpoint sources will be critical to attainment of this goal and increasing the amount of waters that can be harvested without restriction. In addition, evaluation of toxics in shellfish is also needed.

Recommendations, in addition to continued implementation of ongoing programs:

- Implement shellfish action plan to meet Clean and Plentiful Water milestone of 90% harvestable by 2005
- Many of the strategies used to manage sanitary quality at beaches also apply to shellfish harvest.

Table A1.2-1: Designated Use Support Summary Tables

Individual Use Support Summary Table: Rivers and Streams (National Uses)

Rivers and Streams Designated Use	Miles Assessed	Miles Fully Supporting	Miles Fully Supporting but Threatened	Miles Partially Supporting	Miles Not Supporting	Miles Not Attainable
Overall Use Support						
Aquatic Life Support [1]	330	121	0	206	3	
Primary Contact Recreation	176	30	0	28	118	
Agricultural Use	176	176	0	0	0	
Industrial Use	176	114	0	64	0	
Drinking Water	185	176	0	9	0	
Fish Consumption	124	0	30[2]	94[3]	0	

[1] based upon assessments of benthic macroinvertebrate communities
2 based on evaluated data (greater than 10 years old)
3. based on monitored data (less than 10 years old – mercury) for only largemouth bass and chain pickerel.

Individual Use Support Summary Table: Lakes (National Uses)

Lakes Designated Use	Acres Assessed	Acres Fully Supporting	Acres Fully Supporting but Threatened	Acres Partially Supporting	Acres Not Supporting	Acres Not Attainable
Overall Use Support						
Aquatic Life Support [1]	9,875	5,950	2,635	1,290	0	
Primary Contact Recreation [2]	17,473	11,343	0	4,571	906	
Fish Consumption	14,245	0	114[3]	14,131[4]	0	

[1] Lakes in this category are assessed via the Bureau of Fresh Water Fisheries.
[2] This table is based on 167 of 376 lake bathing beaches which have been located on GIS. GPS locations of remaining lakes are being collected and will be available for a future report.
3 based on evaluated data (greater than 10 years old) for Chlordane in Camden area lakes.
4. based on monitored data (less than 10 years old – mercury) for only largemouth bass and chain pickerel.

Individual Use Support Summary Table: Estuaries (National Uses)

Estuarine Designated Use	Sq. Miles Assessed	Sq. Miles Fully Supporting	Sq. Miles Fully Supporting but Threatened	Sq. Miles Partially Supporting	Sq. Miles Not Supporting	Sq. Miles Not Attainable
Overall Use Support						
Aquatic Life Support [1]	264	203	0	61	0	
Primary Contact Recreation	269	264	NA	5	0	
Fish Consumption [2]	NA	NA	NA	NA	NA	
Shellfish Consumption [3]	614	456	0	115	43	

[1] Based upon water column dissolved oxygen levels
[2] All estuarine advisories reported by DRBC and IEC
[3] These numbers reflect all waters located within New Jersey's jurisdiction including Delaware Bay, Sandy Hook Bay and Raritan Bay. The Interstate Environmental Commission submits a 305b Report for interstate waters which includes parts of Raritan and Sandy Hook Bays and the 305b Report submitted by the Delaware River Basin Commission includes portions of Delaware Bay. NJ will work with RTI to identify NJ waters assessed by IEC and DRBC to eliminate double counting these waters in the national 305(b) Report.

Individual Use Support Summary Table: Ocean (National Uses)

Ocean Designated Uses	Sq. Miles Assessed	Sq. Miles Fully Supporting	Sq. Miles Fully Supporting but Threatened	Sq. Miles Partially Supporting	Sq. Miles Not Supporting	Sq. Miles Not Attainable
Overall Use Support						
Aquatic Life Support [1]	446	94	352	0	0	
Primary Contact Recreation	446	446	0	0	0	
Fish Consumption	215	0	215[2]	0	0	
Shellfish Consumption	439	352	0	0	87	

[1] Based upon water column dissolved oxygen levels
2 based on evaluated data (greater than 10 years old) for only striped bass in coastal waters.

Individual Use Support Summary Table: Coastal [1] (National Uses)

Coastal Waters Designated Use	Sq. Miles Assessed	Sq. Miles Fully Supporting	Sq. Miles Fully Supporting but Threatened	Sq. Miles Partially Supporting	Sq. Miles Not Supporting	Sq. Miles Not Attainable
Overall Use Support						
Aquatic Life Support [2]	710	297	352	61	0	
Primary Contact Recreation	715	710	0	5	0	
Fish Consumption	215	0	215[3]	0	0	
Shellfish Consumption[4]	1053	808	0	115	130	

[1] This table provides a sum of Estuarine and Ocean tables
[2] Based upon water column dissolved oxygen levels
3 based on evaluated data (greater than 10 years old) for only striped bass in coastal waters.
[4] These numbers reflect all waters located within New Jersey's jurisdiction including Delaware Bay, Sandy Hook Bay and Raritan Bay. The Interstate Environmental Commission submits a 305b Report for interstate waters which includes parts of Raritan and Sandy Hook Bays and the 305b Report submitted by the Delaware River Basin Commission includes portions of Delaware Bay. NJ will work with RTI to identify NJ waters assessed by IEC and DRBC to eliminate double counting these waters in the National 305(b) Report.

Table AII-1: New Jersey Watersheds and HUC11 Codes

ID	WATERSHED NAME (HUC 11)	HUC 11 CODE
1	Shimers Brook / Clove Brook	02040104090
2	Rutgers Creek tribs	02020007000
3	Papakating Creek	02020007020
4	Walpack Bend / Montague Riverfront	02040104110
5	Wallkill River (below road to Martins)	02020007030
6	Big Flat Brook	02040104140
7	Little Flat Brook	02040104130
8	Paulins Kill (above Stillwater Village)	02040105040
9	Wallkill River (above road to Martins)	02020007010
10	Flat Brook	02040104150
11	Wanaque River	02030103070
12	Pequannock River	02030103050
13	Trout Brook / Swartswood Lake	02040105030
14	Ramapo River	02030103100
15	Van Campens Brook / Dunnfield Creek	02040104240
16	Paulins Kill (below Stillwater Village)	02040105050
17	Rockaway River	02030103030
18	Hackensack R (above Hirshfeld Brook)	02030103170
19	Pequest River (above/incl Bear Swamp)	02040105070
20	Bear Creek	02040105080
21	Musconetcong River (above Trout Brook)	02040105150
22	Hudson River	02030101170
23	Passaic River Lower (Saddle to Pompton)	02030103120
24	Stony Brook / Delawanna Creek	02040105060
25	Pompton River	02030103110
26	Hackensack R (below/incl Hirshfeld Bk)	02030103180
27	Beaver Brook	02040105100
28	Pequest River (below Bear Swamp)	02040105090
29	Passaic River Upr (Pompton to Pine Bk)	02030103040
30	Lamington River	02030105050
31	Whippany River	02030103020
32	Raritan River SB (above Spruce Run)	02030105010
33	Passaic River Lower (Nwk Bay to Saddle)	02030103150
34	Musconetcong River (below incl Trout Bk)	02040105160
35	Passaic River Upr (above Pine Bk br)	02030103010
36	Pohatcong Creek	02040105140
37	Raritan River NB (above Lamington)	02030105060
38	Pophandusing Brook / Buckhorn Creek	02040105110
39	Rahway River / Woodbridge Creek	02030104050
40	Raritan River SB (3 Brdgs to Spruce Run)	02030105020
41	Lopatcong Creek	02040105120
42	Elizabeth River	02030104020
43	Newark Bay / Kill Van Kull / Upr NY Bay	02030104010
44	Raritan R Lower (Lawrence to Millstone)	02030105120
45	Morses Creek / Piles Creek	02030104030
46	Raritan River NB (SB to Lamington)	02030105070
47	Hakihokake/Harihokake/Nishisakawick Ck	02040105170
48	Raritan River Lower (Millstone to NB/SB)	02030105080
49	Raritan River SB (NB to Three Bridges)	02030105040
50	Lockatong Creek / Wickecheoke Creek	02040105200
51	Neshanic River	02030105030

ID	WATERSHED NAME (HUC 11)	HUC 11 CODE
52	Raritan R Lower (below Lawrence)	02030105160
53	Millstone River (below/incl Carnegie Lk)	02030105110
54	Atlantic Coast (Sandy Hook to WhalePond)	02030104920
55	Raritan Bay / Sandy Hook Bay	02030104910
56	Raritan / Sandy Hook Bay tributaries	02030104060
57	Lawrence Brook	02030105130
58	Stony Brook	02030105090
59	Alexauken Ck / Moore Ck / Jacobs Ck	02040105210
60	Manalapan Brook	02030105140
61	Navesink River / Lower Shrewsbury River	02030104070
62	Matchaponix Brook	02030105150
63	Millstone River (above Carnegie Lake)	02030105100
64	Shrewsbury River (above Navesink River)	02030104080
65	Assunpink Creek (above Shipetaukin Ck)	02040105230
66	Assunpink Creek (below Shipetaukin Ck)	02040105240
67	Whale Pond Bk / Shark R / Wreck Pond Bk	02030104090
68	Atlantic Coast (Whale Pond to Manasquan)	02030104930
69	Manasquan River	02030104100
70	Duck Creek and UDRV to Assunpink Ck	02040201030
71	Crosswicks Ck (below Doctors Creek)	02040201070
72	Metedeconk River NB	02040301020
73	Doctors Creek	02040201060
74	Toms River (above Oak Ridge Parkway)	02040301060
75	Metedeconk River SB	02040301030
76	Crosswicks Ck (Doctors Ck to New Egypt)	02040201050
77	Crafts Creek	02040201090
78	Blacks Creek	02040201080
79	Union/Ridgeway Branch (Toms River)	02040301070
80	Metedeconk River	02040301040
81	Atlantic Coast (Manasquan to Barnegat)	02040301910
82	Assiscunk Creek	02040201100
83	Burlington/Edgewater Park Delaware tribs	02040201110
84	Crosswicks Ck (above New Egypt)	02040201040
85	Rancocas Creek	02040202080
86	Kettle Creek / Barnegat Bay North	02040301050
87	Pompeston Creek / Swede Run	02040202090
88	Toms River (below Oak Ridge Parkway)	02040301080
89	Rancocas Creek NB (below New Lisbon dam)	02040202040
90	Rancocas Creek NB (above New Lisbon dam)	02040202020
91	SB Rancocas Creek (below Bobbys Run)	02040202070
92	Cooper River	02040202110
93	Greenwood Branch (NB Rancocas Creek)	02040202030
94	Pennsauken Creek	02040202100
95	Rancocas Creek SB (above Bobbys Run)	02040202050
96	Barnegat Bay Central & Tribs	02040301100
97	Rancocas Creek SB SW Branch	02040202060
98	Woodbury / Big Timber / Newton Creeks	02040202120
99	Cedar Creek	02040301090
100	West Branch Wading River	02040301190
101	Forked River / Oyster Creek	02040301110
102	Cedar Swamp / Repaupo Ck / Clonmell Ck	02040202140
103	Mantua Creek	02040202130
104	Basto River	02040301150

Table AII-1: New Jersey Watersheds and HUC11 Codes

ID	WATERSHED NAME (HUC 11)	HUC 11 CODE
105	Oswego River	02040301180
106	Mullica River (above Basto River)	02040301160
107	Raccoon Creek / Birch Creek	02040202150
108	Great Egg Harbor R (above HospitalityBr)	02040302030
109	Waretown Ck / Barnegat Bay South	02040301120
110	Oldmans Creek	02040202160
111	Manahawkin/Upper Little Egg Harbor tribs	02040301130
112	Atlantic Coast (Barnegat to Little Egg)	02040301920
113	Salem R(above 39d40m14s dam)/Salem Canal	02040206030
114	Scotland Run	02040206130
115	Still Run / Little Ease Run	02040206120
116	Mullica River (GSP bridge to Turtle Ck)	02040301200
117	Lower Little Egg Harbor Bay tribs	02040301140
118	Mullica River (Turtle Ck to Basto River)	02040301170
119	Great Egg Harbor R (Lk Lenape to HospBr)	02040302040
120	Salem River (below 39d40m14s dam)	02040206040
121	Muddy Run	02040206150
122	Alloway Creek / Hope Creek	02040206060
123	Maurice River (above Sherman Ave Bridge)	02040206140
124	Cohansey River (above Sunset Lake)	02040206080
125	Great Bay / Mullica R (below GSP bridge)	02040301210
126	Stow Creek	02040206070
127	Menantico Creek	02040206180
128	Great Egg Harbor R (below Lake Lenape)	02040302050
129	Atlantic Coast (Little Egg to Absecon)	02040302910
130	Maurice River (Union Lk to Sherman Ave)	02040206160
131	Reeds Bay / Absecon Bay & tribs	02040302010
132	Absecon Creek	02040302020
133	Cohansey River (below Cornwell Run)	02040206090
134	Tuckahoe River	02040302070
135	Delaware Bay (Cape May Pt to Fishing Ck)	02040204910
136	Maurice River (Menantico Ck to Union Lk)	02040206170
137	Patcong Creek/Great Egg Harbor Bay	02040302060
138	Manamuskin River	02040206190
139	Back / Cedar / Nantuxent Creeks	02040206100
140	Atlantic Coast (Absecon to Great Egg)	02040302920
141	Maurice River (below Menantico Creek)	02040206200
142	Dividing Creek	02040206110
143	West Creek / East Creek / Riggins Ditch	02040206210
144	Cape May Bays & Tribs East	02040302080
145	Dennis Creek	02040206220
146	Cape May Tribs West	02040206230
147	Pochuck Creek	02020007040
148	Saddle River	02030103140
149	Pennsville / Penns Grove tribs	02040206020
149	Pennsville / Penns Grove tribs	02040206020
150	Atlantic Coast (34th St to Cape May Pt)	02040302940
151	Atlantic Coast (Great Egg to 34th St)	02040302930

Table AII-1: New Jersey Watersheds and HUC11 Codes

Appendix A3.1: NEPPS Goals, Milestones and Objectives for Water Resources and Land and Natural Resources

CLEAN AND PLENTIFUL WATER GOAL: New Jersey's rivers, lakes and coastal waters will be fishable, swimmable and support healthy ecosystems. Surface and ground water will be clean sources of water. Every person in New Jersey will have safe drinking water. Adequate quantities of surface and ground water will be available for all needed uses.

SURFACE WATER GOAL: Our surface waters (tidal and non-tidal) will support human and ecosystem health and applicable uses such as recreation, fishing, drinking water supply, agriculture and industry.

Surface Water

Subgoal 1. Protect and enhance aquatic life designated uses.

Milestones/Objectives:

By 2005, 50% of assessed non-tidal river miles will support healthy, sustainable, biological communities (**Baseline**: 35% of assessed non-tidal river miles support healthy biological communities based on benthic macroinvertebrate data).

Maintain and enhance aquatic life designated uses in assessed tidal waters.

Subgoal 2. Protect recreational designated uses in tidal and non-tidal waters.

Milestones/Objectives:

Maintain and improve the current number and quality of suitable lake, ocean and bay bathing beaches in NJ.

By 2005, 100% of New Jersey's coastal recreational beach waters will be safe for swimming (**Baseline**: Between 1995 and 1998, 76% of New Jersey's 179 ocean and 138 bay bathing beaches have not been susceptible to recurrent beach closings).

By 2000, the recreational lake beach waters will have been assessed and water quality improvement projects will have been prioritized (**Baseline**: 189 lake bathing beaches have been identified for assessment).

Subgoal 3. Protect fish and shellfish consumption designated use.

Milestones/Objectives:

Evaluate fish tissue for contamination, update advisories and provide public education. Reduce toxic contamination in fish tissue, and therefore reduce the need for fish consumption advisories.

By 2005, 90% of New Jersey's classified waters will provide shellfish that are safe to harvest (**Baseline**: 87% of New Jersey's classified waters provide shellfish that are safe to harvest).

Analyze fish and shellfish tissue for radioactivity to ensure no radiologic pathogens

Subgoal 4. Protect surface water supply designated uses.

Milestones/Objectives:

By 2005, the Department and regional interests will cooperatively address all regional water supply deficits projected through 2030 to ensure that such deficits are not realized (**Baseline**: Based on the 1995 State Water Supply Plan, 8 of 23 planning areas were in deficit in 1990 and 2 additional planning areas are projected to be in deficit in 2040. The remaining planning areas have water surpluses. The long term trend is toward greater stress on all water supplies.).

GROUND WATER GOAL: To protect and enhance the quality of ground water and assure that adequate quantities of ground water will be available for domestic, municipal, industrial and other purposes, as well as serving a vital role in maintaining the aquatic ecology by providing ground water base flow to receiving surface waters.

Subgoal 1. Ground water quality will meet all standards for designated uses and ground water discharging to surface water will not adversely impact the surface water system.
Milestones/Objectives:
Reduce or control nitrate levels in ground water.

Reduce or control pesticide levels in ground water

Reduce the number of potable wells with fecal coliform contamination.

Reduce or control volatile organic compound (VOC) contamination in ground water

Reduce or control selected metals contamination in ground water.

Determine the presence of unidentified or tentatively identified synthetic organic compounds in ground water.

Identify and characterize radioactivity in ground water.

Prevent future or continued ground water contamination through pollution prevention, education/outreach or other activities.

By 2005, the status of shallow groundwater quality will be assessed (**Baseline**: 5% of the shallow ground water quality in the state has been assessed, as a function of land use, using a stratified random site selection approach).

Subgoal 2. Protect and insure adequate ground water quantity for designated uses and for base flow to surface waters.
Milestones/Objectives:
By 2005, the Department and regional interests will cooperatively address all regional water supply deficits projected through 2030 to ensure that such deficits are not realized (**Baseline**: Based on the 1995 State Water Supply Plan, 8 or 23 planning areas were in deficit in 1990 and 2 additional planning areas are projected to be in deficit in 2040. The remaining planning areas have water surpluses. The long term trend is toward greater stress on all water supplies.).

Protect and maintain recharge to aquifers

DRINKING WATER GOAL/MILESTONES

GOAL: Every Person in New Jersey will have safe drinking water

A. By 2005, 95% of the public water systems (and 95% of the population served) will provide water that meets the microbiological drinking water standards (**Baseline**: In 1997, 99% of the community water systems and 95.3% of the population served met the microbiological drinking water standards).

B. By 2005, 95% of the public water systems will provide water that meets the New Jersey chemical drinking water standards (**Baseline**: In 1997, 87.2% of the community and nontransient, noncommunity water systems met the chemical drinking water standards).

C. By 2000, 90% of public water systems will have compliance evaluations that are acceptable (**Baseline**: In 1997, 78% of the compliance evaluations conducted for community water systems were acceptable).

Subgoal 1: All source water in New Jersey used for drinking water will be protected from pollution.

Milestones/Objectives

By 2003, all surface water intakes will have a completed source water assessment (**Baseline**: No source water assessments for surface water intakes have been completed).

By 2003, all public water system wells will have a completed source water assessment (**Baseline**: No source water assessments for ground water systems have been completed).

Subgoal 2: The consumption of drinking water shall not cause detectable waterborne infectious diseases.

Milestones/Objectives

All public water systems will deliver drinking water that does not result in detectable waterborne infectious disease (**Baseline**: The last waterborne disease outbreak from a drinking water source was in 1989 at a camp ground).

Determine the occurrence of pathogens of public health concern in New Jersey's waters.

Subgoal 3: Every person in New Jersey should drink water with lead concentrations less than 15 ppb.

Milestones/Objectives

In the period from 1992 to 2000, reduce the number of samples that exceed the lead action level by 50% (**Baseline**: Since lead sampling was phased in over a 4 year period, the baseline is 1992-1995. In this period, 35% of the samples collected from large systems, 20% of the samples collected from medium systems, 11% of the samples collected from small systems, & 10% of the samples collected from noncommunity systems exceeded the lead action level).

By 2005, determine the extent of lead contamination in New Jersey homes served by private wells.

Subgoal 4: Every person in New Jersey should drink water with nitrate concentrations less than 10 ppm.

Milestones/Objectives

In the period from 1993 to 2005, reduce the number of public water systems with nitrate concentrations above the MCL by 80% (**Baseline**: Between 1993 & 1995, nitrate concentrations above 10 ppm remained the same in community water systems - 0.6% - & decreased in both nontransient noncommunity water systems - 3.7% 1.4% - and transient noncommunity water systems - 1.6% 1.2%).

Develop a plan to address the issue of nitrate contamination in private wells by the year 2005.

Subgoal 5: Every person in New Jersey should drink water with mercury concentrations less than 2 ppb.

Milestones/Objectives

Determine the extent of mercury contamination in New Jersey private wells by the year 2005.

Subgoal 6: Every person in New Jersey should drink water with VOC concentrations less than the MCLs.

Milestones/Objectives

In the period from 1993 to 2005, reduce the number of CWS and NTNC with VOCs greater than their New Jersey MCLs by 50% (**Baseline**: The baseline is 1993-1995, when 8% of CWS & 6.8% of NTNC had detections of VOCs greater than the NJ MCLs. From 1996-1997, 6.9% of CWS had detections of VOCs greater than the NJ MCLs).

Develop a plan to address the contamination of private wells by VOCs by the year 2005.

Subgoal 7: Every person in New Jersey should drink water that contains the minimum concentration of disinfection byproducts without compromising microbiological safety.

Milestones/Objectives

By 2001, reduce the annual average concentration of TTHM in all water systems using surface water to 80ppb or less (**Baseline**: In 1995, 4 surface water systems had annual average concentrations of total trihalomethanes above 80ppb).

Determine the concentrations of haloacetic acids in CWS distribution systems.

Subgoal 8: Every person in New Jersey should drink water with radiological concentrations less than the MCLs.

Milestones/Objectives

By 2005, 95% of the samples from CWS will meet the radiological standards (gross alpha, radium 226/228) (**Baseline**: In 1997, 0.5% of the systems which sampled exceeded the gross alpha & radium 226/228 standard).

By 2001, develop a plan to address the issue of radon and unregulated radionuclides in both PWS and private wells.

Reduce or control tritium, gross Beta and specific Gamma levels in Drinking Water

Subgoal 9: Protect and insure adequate ground and surface water quantity for drinking water use.

Milestones/Objectives

Reduce or prevent overuse of ground water resources used for drinking water.

Reduce or prevent overuse of surface water resources used for drinking water.

By 2005, the Department and regional interests will cooperatively address all regional water supply deficits projected through 2030 to ensure that such deficits are not realized.

LAND & NATURAL RESOURCES

GOAL: Maintain, enhance and restore functioning ecosystems and sustainable communities.

Subgoal 1. Wetlands: Improve quality and function and achieve no net loss. Explore innovative techniques for creation, enhancement and maintenance of New Jersey wetlands.

Achieve no net loss of wetlands by year 2005 and implement effective techniques for increased creation of wetlands (**Baseline**: It has been estimated that there were approximately 1,000,000 acres of wetlands in New Jersey based on 1977 US Fish and Wildlife Service estimates of 300,000 acres of estuarine wetlands and the 1986 NJDEP calculation of 730,862 acres of freshwater wetlands. These estimates will be updated as NJDEP is currently updating its 1986 based Land use/Land cover data set.).

Subgoal 2. Headwaters and Riparian Corridors: Maintain and restore headwaters, riparian corridors and associated buffers for water quality and wildlife habitat, flood control, public safety, streambank stability.

Maintain and restore vegetative bank cover and buffers adjacent to headwaters and stream corridors by 2005 (**Baseline**: Research priority).

Subgoal 3. Coastal Resources and Flood-Prone Areas: Maintain and restore the functional integrity of the coastal system for water quality and wildlife habitat, storm protection, public safety, shoreline stability.

Maintain existing natural estuary and marine waterfront acreage and restore the functional integrity of the natural coastal system (**Baseline**: Priority data need).

Subgoal 4. Soil Erosion and Soil Contamination: Minimize soil erosion and contamination caused by human activity on land.

By 2005, all municipalities will adopt and implement ordinances to reduce erosion through the reduction of peak runoff rates after development, and set goal of 80% reduction of TSS for BMPs (**Baseline**: Priority data need).

By 2005, increase by greater than 20% the amount of agricultural land which will have an erosion rate with tolerable limits (tolerable limit = "T" value; sustainable erosion per soil type) (**Baseline**: Priority data need).

Subgoal 5. Forest Resources: Maintain and restore New Jersey's forest resources.

Subgoal 6. Patterns in Land Development: Accommodate growth while protecting natural resources in New Jersey through implementation of the State Development and Redevelopment Plan.

Annually increase the number of acres of undeveloped land developed consistent with the SDRP (**Baseline**: Priority data need).

Support the SDRP through consistent implementation through NJDEP rules, regulations, and programs (**Baseline**: Under development).

Subgoal 7. Preserve, protect, and restore biodiversity within all landscape types in New Jersey.

By the year 2008, the State's rare, threatened and endangered species populations will be stable or have improved status (**Baseline**: Under development).

Subgoal 8. Open Space: Preserve open space for current and future protection of natural resources, biological diversity, and recreation.

Federal, State and local programs will strive to preserve and protect through fee simple acquisition or other means an additional 300,000 acres of open space by the year 2002 and a total of 1,000,000 acres of open space by 2008 (**Baseline**: As of November 1998, more than 905,000 acres of open space have been preserved. Since 1961, the Green Acres program has assisted in the acquisition of more than 271,685 acres of open space).

Subgoal 9. Environmentally Damaged Land: Return environmentally damaged land to productive uses.

Annually increase the numbers of acres of environmentally damaged land available for beneficial use, including development or recreation (**Baseline**: The September 1997 edition of *Known Contaminated Sites in New Jersey* included the number of contaminated sites that received a No Further Action designation during Fiscal Year 1997. Of the 10,782 sites identified in this report, 1,845 received a No Further Action designation. This represents 17% of the known universe captured in this edition).

Appendix A3.5-1: Lake TMDL Highlights

Sylvan Lake TMDL: Upper and Lower Sylvan Lakes (see NJDEP, 2000a) are located in Burlington Township, Burlington County, within the Rancocas River watershed. Upper and Lower Sylvan Lakes had been included on 1996 and 1998 Impaired Waterbodies Lists (303d List) due to excessive total phosphorus (TP) and sedimentation. In addition to these, Upper Sylvan Lake was listed also for past bathing beach closures due to Fecal Coliform violations. Both lakes were labeled eutrophic based upon the exceedences of applicable SWQS criteria (TP) as well as Clean Lakes Program guidance values for trophic status.

In response to these problems, several significant management measures were implemented in Upper Sylvan Lake which included:

- dredging to remove unconsolidated sediment,
- aeration,
- erosion control and stormwater infiltration to control additional nonpoint source pollution,
- re-routing of all stormwater pipes to below Sylvan Lake and
- public education.

These measures resulted in attainment of SWQS criteria for TP and reductions in sediment load within the Upper Lake. In addition, bathing beach data collected by Burlington County Health Department indicate full support of swimming at the lake beach. Thus, designated uses of Upper Sylvan Lake are now met and are expected to continue to be met. NJDEP intends to pursue de-listing from the 303d List for Total Phosphorus (TP), sedimentation and bacteria in Upper Sylvan Lake.

In Lower Sylvan Lake a TMDL has been developed for Total Phosphorus. In order to implement the TMDL, plans exist to dredge Lower Sylvan Lake to remove the phosphorus-rich sediments thereby achieving the required 95% reduction of phosphorus load from the sediment. This is expected to be completed by summer of 2001. Also planned is a lake restoration plan to lower phosphorus inputs to the lake. These include erosion and sediment controls and an environmental education program.

A year-long post-dredging monitoring program will be established by NJDEP to sample for phosphorous to ascertain the reduction levels in the lower lake. If the phosphorous levels are acceptable, then the Department will pursue de-listing for the subsequent 303(d) list.

Strawbridge Lake TMDL: Strawbridge Lake (see NJDEP, 2000b) is located in Moorestown Township, Burlington County, New Jersey. The lake is 32.9-acres and has an average depth of 2.4 feet and a maximum depth of 8.0 feet. The Lake has undergone dredging several times including very recently. The lake and the park that surrounds the perimeter of the lake are heavily used for picnicking bird watching and fishing. There are no swimming beaches on the lake, and before dredging, no canoes or shallow boats could be used.

Strawbridge Lake has been included on 1996 and 1998 Impaired Waterbodies Lists (303d List) due to sedimentation and elevated phosphorus and chlordane contamination in fish tissue. Sedimentation has reduced the mean lake depth from 4.9 to 2.4 feet thereby reducing the lake's

aesthetic appeal. Sediment has also limited the lake's recreational value by impairing the fishery, contributing to eutrophication and preventing the use of small boats. In-lake data for total phosphorus collected from Strawbridge Lake during the early 1990's show levels to be marginal in the upper and middle basins when compared to applicable SWQS criterion; and unacceptable in the lower basin.

Chlordane became a contaminant of concern for the North Branch of Pennsauken Creek and Strawbridge Lake in April of 1978. Due to concern about the levels of pesticides found in fish tissue, a ban of fishing, swimming and boating was announced in 1978. Although the exact nature and source of the contamination is unclear, an NJDEP funded study indicated that possible improper use of chlordane as a termaticide could have resulted in significant runoff and transport to the waters from the residential housing surrounding the lake. Subsequent fish sampling in 1981-1982 and again in 1986 indicated that the levels of chlordane had decreased since 1978 but were still unacceptable. In 1988, limited sampling showed levels had dropped to acceptable levels, and an ongoing investigation should clarify current conditions.

In response to the water quality problems in Strawbridge Lake, a Total Maximum Daily Load (TMDL) for watershed loads for total phosphorus was calculated.. In order to attain the TMDL, it was estimated that an overall load reduction of 63.6% in total phosphorus from the watershed would be necessary. The Department has chosen to apply the reductions throughout the watershed, and to focus on sources that can be affected by BMP implementation.

Prior to the development of a TMDL and in response to a Diagnostic-Feasibility Study, the following actions have been taken to initiate the remediation of Strawbridge Lake:

- Dredging.
- The lake shore was stabilized and retrofitted to create a 10-20 feet vegetative buffer with tall grasses and shrubs to discourage Canada Geese.
- The retrofitting of stormwater outfalls with biofilter (pocket) wetlands and the retrofitting of commercial stormwater outfalls.
- The passage in 1999 of a Stream Corridor ordinance in Moorestown Township for new development which stipulates the restoration and preservation of the vegetation in the 100-year flood plain and the development of a minimum 25 foot vegetative buffer.

To insure success of the lake remediation effort, NJDEP will initiate a lake monitoring program which will follow the completion of all dredging and begin one year after all dredge materials are removed from the site. Results will be used to evaluate trophic status and compliance with Surface Water Quality Standards (N.J.A.C. 7:9B). If compliance with SWQS is demonstrated, delisting will be proposed. If SWQS are exceeded, delisting will not be pursued, and as appropriate, additional management measures will be implemented; the following components of an Implementation Plan have been recommended.

- Concentrating BMPs in the Pennsauken Creek drainage basin as modeling indicates that the lower basin of the lake receives the highest pollutant loadings.
- Farm conservation plans for the remaining farmland in the watershed in order to further reduce phosphorous loadings.

- Encourage forest preservation/mitigation. Reductions in remaining forested areas of the watershed will increase the already very high loadings in this watershed. All efforts should be directed at acquiring as much of the natural forested areas as possible through acquisition strategies now being used by the state.
- Recommending the passage of ordinances in Mt. Laurel/Evesham Townships designed to contribute to reductions in nonpoint source loadings.

The Department has reasonable assurance that implementation of these measures will achieve the necessary load reductions delineated in the TMDL. These steps may be taken one by one as necessary with monitoring after each step to see if the required phosphorus reductions have been attained. It is very possible that not all these actions will need to be taken.

Appendix A3.5-2: TMDL Development Schedule

Waterbody	Due Date
1999	
NY/NJ Harbor Metals (Cu, Ni, Pb)	6/30/1999
Delaware Estuary Volatile Organics	9/30/1999
Whippany River Watershed	12/31/1999
2000	
Strawbridge Lake	12/31/2000
Sylvan Lake	12/31/1999
2002	
Rancocas, Cooper, Pennsauken	6/30/2002
Manasquan River	6/30/2002
Pompton, Ramapo, Pequannock, Wanaque	6/30/2002
Lower Passaic (non-tidal)	6/30/2002
Upper Passaic, Rockaway	6/30/2002
Delaware Estuary Dissolved Oxygen	9/30/2002
2003	
Millstone River	6/30/2003
North & South Branch Raritan River	6/30/2003
Saddle River	6/30/2003
Hackensack River, Pascack Creek	6/30/2003
Raritan and South Rivers, Lawrence Brook	6/30/2003
Walkill, Pochuck, Papakating	6/30/2003
Lower Delaware Tributaries	6/30/2003
Delaware River/Estuary Metals, PCBs, DDT & Derivatives	9/30/2003
2004	
Upper Delaware River Tributaries	6/30/2004
Cohansey River	6/30/2004
Monmouth Watershed	6/30/2004
Maurice River	6/30/2004
2005	
Elizabeth, Rahway, Woodbridge Rivers	6/30/2005
Crosswicks Creek	6/30/2005
Delaware River/Estuary Fecal Coliform	9/30/2005
2006	
Mullica and Wading Rivers	6/30/2006
Great Egg Harbor, Tuckahoe River	6/30/2006
Barnegat Bay Watershed	6/30/2006
2007	
Central Delaware Tributaries	6/30/2007
Cape May Watersheds	6/30/2007
NY/NJ Harbor PCBs, Dioxins, PAHs, Pesticides, Mercury, DO, FC	6/30/2007

Appendix A37-1: 1998 and 1999 Environmental Infrastructure Financing Program Projects

1998 Projects

New Brunswick City
Certified Loan Amount $1,294,412 – Project #S340437-08
The project consists of the construction of approximately 2,300 feet of new storm sewers in Paterson Street, Bayard Street and Joyce Kilmer Avenue, as well as modifications of the chamber at Albany and George Streets. These improvements are necessary to complete the final phase of the City's combined sewer separation project.

North Bergen MUA
Certified Loan Amount $3,627,512 – Project #S340652-02
The project includes the construction of nine netting facilities and one static bar rack within the City of North Bergen to reduce solids/floatables from being discharged from ten combined sewer overflow points into tributaries of the Hackensack River and Hudson River.

Florence Township
Certified Loan Amount $14,913,699 – Project #S340352-02
The project includes the expansion of the Township's sewage treatment plant from 1.5 million gallons per day (MGD) to 2.5 MGD (average flow), the construction of sludge dewatering facilities, and a facility to house an office, laboratory and garage to store maintenance equipment.

Passaic Valley Sewerage Commissioners
Certified Loan Amount $8,600,000 – Project #S340689-04
The project involves the rehabilitation and/or replacement of certain sections of the interceptor sewers in the service area, including the Kearny-Harrison-Newark branch interceptor, the Kearny-East Newark-Harrison branch interceptor, the Rutherford-East Rutherford branch interceptor, Brown Street branch interceptor, the Sixth Avenue connection and the Main interceptor.

Somerdale Borough
Certified Loan Amount $566,634 – Project #N92 338-02
The project involves a sewer repair/replacement program including Arlmay Avenue to the Atlantic Avenue Pump Station, the Holyoke Avenue Sewer Main and various improvements to manholes and other deteriorated sections of sewer main.

Lopatcong Township
Certified Loan Amount $200,000 - Project #N92 264-01
The project includes the replacement of the gravity line along Route 22, the upgrade of the Baltimore and Route 57 Pump Stations and the elimination of the Striker Road Pump Station.

Pine Hill Borough
Certified Loan Amount $602,578 – Project #N92 274-01
The project involves improvements to the storm drainage system in the Borough.

Kearny Town
Certified Loan Amount $3,014,742 – Project #S340259-01
The project includes the construction of a new storm sewer system and the utilization of existing sewer as a separate sanitary sewer. As a result, one of the combined storm and sanitary overflow points in the Town will be eliminated.

Somerset Raritan Valley RSA
Certified Loan Amount $19,922,447 – Project #S340801-04
The project involves various improvements at the treatment plant site which are necessary to replace facilities which are deteriorating due to age and to modify certain facilities to handle current peak flows. In addition, the project includes the conversion of the existing gaseous chlorine and sulfur dioxide disinfection process to a liquid chemical based process for safety and other concerns. The treatment plant improvements include the replacement of the influent pump station and the effluent discharge outfall to Cuckles Brook with new facilities, the construction of new final clarifiers and a sludge pumping station within the existing tankage.

Ocean County UA
Certified Loan Amount $5,228,360 – Project #N92 372-21
The project consists of a new effluent flow equalization basin and pump station, a new final clarifier, two new return sludge pumps with variable frequency drives, modifications to the distribution control system and graphics panel and other mechanical, electrical and instrumentation improvements.

Gloucester County UA
Certified Loan Amount $3,700,000 – Project #S340902-02
The project includes improvements to the treatment facilities' six aeration tanks and the rehabilitation of the existing sludge incinerator.

Delanco Township SA
Certified Loan Amount $1,053,732 – Project #S340956-01
The project involves the construction of a new sewage pump station in Delanco and 3,500 feet of 8-inch force main from Delanco to Beverly Sewerage Authority's treatment facility.

Lawrence Township
Certified Loan Amount $1,170,190 – Project #N92395-01
The project involves the removal of up to 60,000 cubic yards of silt from Colonial Lake and the installation of a sediment sump area for future silt removal.

Millburn Township
Certified Loan Amount $2,082,746 – Project #S340355-01
The project includes the construction of a low flood wall along the East Branch of the Rahway River and a low earthen dike floodguard along an existing wetland area.

Mercer County Improvement Authority
Certified Loan Amount $1,105,960 – Project #S340536-04

The project involves the installation of retaining walls and various vegetative planting in order to stabilize lake banks and reduce sedimentation. Additionally, the project will provide structural improvements to storm drain inlets.

1999 Projects

Village of Ridgefield Park - $2.1 million for the abatement of combined sewer overflows (CSOs) discharging into the Hackensack River.

Jersey City MUA - $3.8 million for the abatement of CSOs discharging into the Hackensack and Hudson rivers.

Bayonne MUA - $5 million for relining of oval shaped brick sewers, and the rehabilitation of three pumping stations.

Harrison Town - $1.3 million for the abatement of CSOs discharging into the Passaic River.

Old Tappan Borough - $6.4 million for the construction of a sewage collection system to serve areas of the borough where on-site sewage systems have malfunctioned.

Passaic Valley Sewerage Commissioners - $23.2 million for improvements to sludge handling facilities.

Plainfield Area Regional Sewerage Authority - $3.1 million for the replacement of deteriorated sewer lines.

City of Millville - $2.4 million for rehabilitation of the city's existing 100 year old collection system.

Old Bridge Municipal Utilities Authority - $2.1 million for the relining of sanitary sewers and manholes.

River Edge Borough - $573,254 for the construction of conveyance lines to divert flow from two aging pump stations to the Borough of Paramus' collection system.

Pine Hill Borough Municipal Utilities Authority - $1.5 million for the replacement of an existing pump station and the replacement and rehabilitation of sewer lines.

Runnemede Sewerage Authority - $866,806 for the rehabilitation and replacement of sewer lines to prevent infiltration/inflow of stormwater.

Ship Bottom Borough - $2.1 million for the repair and rehabilitation of sections of its sewage collection system.

Longport Borough - $2.5 million for the replacement of the sewage collection system in approximately one quarter of the borough.

Maplewood Township - $388,524 for the rehabilitation of parts of the storm drainage system and construction of a new storm drainage pipeline.

Randolph Township -$2.1 million for the construction of a new interceptor, a pump station and force main.

Oaklyn Borough - $688,918 for the repair of deteriorated and damaged sewer lines.

Ewing Township - $4.2 million for the construction of three stormwater detention basins and the stabilization of the bank of the West Branch of the Shabakunk Creek and the purchase of street, stream, and sewer cleaning equipment.

Appendix 3.7-2: Highlights of an SRF Nonpoint Source Project at Colonial Lake

Colonial Lake is located in the southern portion of Lawrence Township, Mercer County, and was formed by impoundment of the Shabakunk Creek. The lake is approximately 17 acres with a maximum depth of 6.5 feet and a mean depth of 3.4 feet. The lake had been determined to be highly eutrophic, and associated with this condition are recorded elevated nutrient levels, depressed dissolved oxygen levels and consistently high bacteria levels that frequently exceeded water quality standards. Another problem identified is sediment deposition, whereby up to 5 feet of unconsolidated, organic sediment has been measured in the lake's western arm, at the mouth of the Shabakunk Creek. This deposition has resulted in extremely shallow water depths of less than a foot in that area.

Most of the lake's problems can be attributed to decades of development within the lake's watershed. Currently the watershed is extensively developed with extensive impervious surface. Nutrient and bacterial sources are assessed to include road runoff, lawn fertilizers, and animal waste that enter the lake via stormwater runoff. The nutrient and bacterial problem is further aggravated by abundant waterfowl present on the lake.

In 1998, in response to these problems, first Lawrence Township and subsequently Ewing Township pursued funding ($1,170,190 and $4,233,530, respectively) through the Environmental Infrastructure Financing Program for construction projects to remediate the lake and to improve stormwater management within the Watershed. An initial lake project was submitted by Lawrence aimed at improving the water quality, the fish habitant and the aesthetic attributes of the lake to the extent possible. The initial project included the following measures:

- Dredging to remove of up to 60,000 cubic yards of organic and nutrient laden sediments from the up-stream section of Colonial Lake.
- The creation of a sediment sump at the head of the lake to facilitate collection and removal of the annual load of sediment.

It was obvious, however, that the water quality and habitat problems of Colonial Lake can not be completely corrected without addressing the upstream problems in the Shabakunk Creek watershed. The 1998 dredging project was regarded as the first phase of an overall effort to address the problems within the Shabakunk Creek watershed. It was understood that the erosion of stream banks needed to be reduced and additional measures must be taken to control nutrients and bacteria within the watershed. Towards that end, Lawrence Township intended to implement the following yearly maintenance activities:

- removal of the yearly sediment accumulation in the sediment sump;
- implementation of street cleaning on a regular schedule in the Lawrence Township portion of the Shabakunk Creek watershed; and
- frequent maintenance and debris removal from storm sewer systems within the Lawrence Township portion of the Shabakunk Creek watershed.

Because portions of the Colonial Lake watershed extend into Ewing Township; Lawrence Township and Ewing Township began working together toward the preparation of a joint Regional Stormwater Management Plan to address the problems in the watershed.

In 1999, Ewing Township also pursued funding through the Environmental Infrastructure Financing Program for construction projects to improve stormwater management within the Watershed. The proposed project included stabilization of approximately 25 percent of the stream banks of the west branch of the Shabakunk Creek through the installation of interlocking cellular concrete blocks. The project would also install water quality control detention basins to provide additional temporary storage capacity for floodwaters and to reduce erosive velocities within the waterways. In addition, a street sweeper and a catch basin cleaner would be purchased and used to reduce the amount of sediment reaching the stream from road surfaces and storm sewers. The overall goal here was to improve water quality within the West Branch and mainstem of the Shabakunk Creek, as well as Colonial Lake by reducing the suspension and transport of sediment along the stream corridors. The project is also expected to reduce adverse flooding impacts on area residents associated with 2-year storm (or less) along the majority of the West Branch of the Shabakunk Creek.

APPENDIX 3.8-1 Nonpoint Source Management Plan Highlights

New Jersey's Nonpoint Source Management Plan upgrade begins with two extensive goals that are linked to water quality and beneficial uses. The clean and plentiful water goals states that: "New Jersey's rivers, lakes and coastal waters will be fishable, swimmable and support healthy ecosystems. Surface and ground water will be clean sources of water. Every person in New Jersey will have safe drinking water. Adequate quantities of surface and ground water will be available for all needed uses. "NJDEP's healthy ecosystem goal states: "The health, diversity and integrity of New Jersey's ecosystems will be restored, protected, enhanced and sustained."

To support these tremendous goals, New Jersey has adopted several challenging long-term goals. Particularly noteworthy is the integration of the nonpoint source management program with the coastal nonpoint pollution control program under Section 6217 of the Coastal Zone Act Reauthorization Amendments of 1990 (CZARA). The statewide implementation of CZARA management measures within 15 years should lead to the expeditious achievement of water quality standards throughout the State. New Jersey has also made a commitment for it's waters to meet surface water quality criteria by the year 2015. In addition, New Jersey has committed to completing TMDLs by 2007 and implementing nonpoint source TIVOLs by 2015 as agreed to in the TMDL Memorandum of Agreement between NJDEP and EPA Region 2.

NJDEP included many short-term milestones in their NPS MP upgrade that are linked to their loncy-term goals. For example, by 2005, 100% of New Jersey's coastal recreational beach waters will be safe for swimming, there will be a net increase in wetland acreage and quality, and 90% of New Jersey's classified waters will provide shellfish that are safe to harvest. By 2005, NJ also intends to have a 20% increase in the acreage of agriculture lands eroding below tolerance level, and 50% of assessed non-tidal river miles supporting healthy, sustainable, biological communities. New Jersey will also complete a baseline assessment of it's waters by 2003, and by 2008, one million more acres of open space will be protected.

Partnerships

NJDEP has established partnerships with other State agencies, a private interest groups, and Federal Agencies both on a watershed-wide and state-wide basis. The NJ Nonpoint Source Advisory Committee has met consistently for over ten years and continues to serve as an information exchange network to discuss innovative technology, major statewide NPS programs, and NPS projects throughout the state. In addition, nonpoint source program staff work with and serve on numerous committees throughout the State such as the State Technical Committee, the NJ Municipal Stormwater Permitting Advisory Group, and the NJ State Soil Conservation Committee.

The state's watershed framework has a good process for identit~ina, watershed-specific partners. NJEP has been hosting public meetings in each of the 5 "water regions" and in the smaller watershed management areas (VVMAs) as needed. This process will identify stakeholders and present a summary of management planning in all 20 WMAs. NJDEP will be conducting watershed management planning in all 20 WMAs by the end of September 2000.

Nonpoint Source Abatement and Outreach Efforts

NJDEP uses several tools to abate nonpoint source pollution. Examples include statewide implementation of CZARA management measures and implementation strategies for TMDLs developed in priority watersheds. New Jersey also has numerous education and outreach programs to promote water quality improvement such as offering guidance to developers and partners with respect to measures that most effectively address specific types of NPS pollution. Recently, NJDEP initiated a new assessment process in coordination with Rutgers University Office of Continuing and Professional Education to develop and promote a series of volunteer monitoring workshops throughout New Jersey aimed at teaching citizens how to better understand their watershed. The combination of these various initiatives are great utilities in abating known water quality impairments and preventing significant threats.

Monitoring and Evaluation

New Jersey employs several monitoring and tracking systems to review and evaluate the effectiveness of its nonpoint source management program. NJDEP assesses it's nonpoint source control measures through the monitoring of their streams. Through the NJDEP Strategic Plan and participation in the National Environmental Performance Partnership Systems (NEPPS), NJDEP is implementing a results-based management system. Environmental goals and milestones have been systematically established, strategies are linked to the achievement of these goals, and indicators are being developed to measure progress. Using a results based management approach will identify and develop indicators to track causes pressures, current conditions and trends, and societal responses. These ongoing nonpoint source water quality monitoring efforts, tracking of current trends, and regular feedback from stakeholders provide valuable information for appropriate program decisions.

Funding

NJ is fortunate to have significant funds dedicated annually for the implementation of nonpoint source pollution abatement activities and other environmental priorities throughout the State. In addition to Section 319, some of these funding sources include the Environmental Infrastructure Financing Program/ Clean Water State Revolving Fund (CWSRF), TEA-21, State Conservation Cost Share/ Environmental Quality Incentive Program funds, and the New Jersey Corporate Business Tax (CBT). In FY 2000, an additional $3 million CBT dollars was appropriated to the Watershed Program. This funding is allowing NJDEP to contract with entities to ensure that all WMAs are undergoing Watershed Management Planning by the fall of 2000.

Conclusion

New Jersey has developed a well-designed nonpoint source management program which should produce results leading to improved water quality throughout the State. Many key parts of New Jersey's program have been in place for several years and the program continues to expand and develop according to the nonpoint source needs of New Jersey. EPA looks forward to working with NJDEP in the implementation of the Nonpoint Source Management Plan.

Appendix 3.8-2 EPA Funded 319(h) Projects Entered Into the GRTS Database

YEAR	RECIPIENT	PROJECT DESCRIPTION	BUREAU
1999	USGS	Toms River NPS Data Analysis	Northwest
1999	Rutgers Continuing Education		Education & Outreach
1999	Department of Agriculture	Non-Point Source	Northwest
1999	Cook College Office of Continuing/Professional Ed.	Marketing Landscape IPM Services	O&E
1999	Rutgers Cooperative Ext. Rutgers Fruit Research and Extension Station	Pesticide & Nutrient Input Reduction through Fruit ICM	O&E
1999	Marine Trade Association		Northwest
1999	Rutgers Cooperative Extension Forestry Extension	Implementation of Riparian Forest Buffer Systems for the Rancocas	Lower Delaware
1999	Heritage Conservancy	Woolman Lake Restoration Plan, Mount Holly Twp	Lower Delaware
1999	Middlesex County Planning Department	South Branch of the Rahway River- Channel restoration/protection-Erosion Stabilization	Raritan
1999	Urban Conservation Action Partnership, Inc.	Revitalizing the Rahway River Watershed: Reducing NPS Pollution through Riparian Restoration	Raritan
1999	Rutgers Cooperative Ext. Solid Waste Management	Best Management Practices for Horse Manure on Small Farms	Atlantic
1999	Rutgers Department of Civil & Env Engineering	Retrofitting Stormwater Detention Basins: Implementation and Education:	Northeast
1999	Ten Towns Great Swamp	Great Swamp Watershed Retrofit and Citizens Action Program	Northeast
1999	West Milford Township	NPS Pollution Management Program for the Belcher's Creek Subwatershed:	Northeast
1999	USGS	Toms River	
1999	Rutgers	Continuing education	O&E
1998	USGS	Toms River NPS Data Analysis	Northwest
1998	Rutgers Continuing Education		Education & Outreach
1998	Department of Agriculture	Non-Point Source	Northwest
1998	Alliance for a Living Ocean	Barnegat Bay Watch Monitoring Program	O&E
1998	Rutgers Cooperative Extension	A Greener Thumb	O&E
1998	Rutgers Cooperative Extension	Project NEMO (NPS Education for Municipal Officials)	O&E
1998	Rutgers Department of Environmental Services	BMPs for the use of Non-traditional Organic Wastes in Agriculture	Lower Delaware
1998	South Branch Watershed Association	South Branch Raritan River Remediation Project	Raritan
1998	North Jersey RC & D	A Collaborative Approach Toward Reducing Agricultural NPS Pollution in the Raritan River Watershed	Raritan
1998	Stony Brook Millstone Watershed Association	NPS Pollution Control and Management for the Stony Brook-Millstone Watershed	Raritan
1998	Monmouth County Planning Department.	NPS Pollution Abatement Program for Little Silver Creek	Atlantic
1998	Ten Towns/Morris 2000	Implementation of the Great Swamp Watershed Management Plan	Northeast

Chapter 1: Current Surface Water Monitoring Program

Surface water monitoring programs which provided data used for the surface water assessments in this report are described briefly below and summarized on Table 1.1 below. Additional information regarding these monitoring programs is provided with each assessment. Further information may also be found in the Department's the 1998 New Jersey Water Quality Inventory Report and at the Division of Watershed Management's Water Monitoring Management Website: www.state.nj.us/dep/watershedmgt/allwmm.htm.

Surface Water Quality Monitoring

The NJDEP and USGS have cooperatively operated the Ambient Stream Monitoring Network (ASMN) since the early 1970's. This report provides the first assessment of quarterly data collected between 1995 and 1997 for conventional parameters, including total phosphorus, fecal coliform, dissolved oxygen, nitrate, pH and total suspended solids. In previous reports, each of the 81 stations was assumed to represent 5 miles. For this report, the assessment of spatial extent was based on the stream reach length in which the station occurred, using USEPA's Reach File 3 system (RF3).

These data were used to assess status with respect to applicable Surface Water Quality Standards at N.J.A.C. 7:9B. (NJDEP, 1998a) In addition, data were used to conduct several new assessments, including designated use assessments for drinking water, industrial and agricultural supplies. In addition, a USGS trends report based on ASMN data collected between 1986 and 1995 was used to evaluate threatened waters (i.e., waters which currently meet applicable Surface Water Quality Standards, but statistically significant adverse trends indicate that standards will not be met in two years). Assessments were conducted using methods recommended by EPA for Preparation of Water Quality Inventory Reports. (EPA, 1997). Metals and other toxics will be discussed in the 2002 Water Quality Inventory Report.

The Ambient Stream Monitoring Network was cooperatively redesigned by NJDEP and USGS in 1997; sample collection under the new design began in October, 1997. Only 1998 data had been published by USGS at the time this report was written. In addition, work has not been completed on a project with Rutgers University to develop a data analysis guidance manual to ensure appropriate statistical analyses of the data collected in the new design. Thus, the assessment of data from the redesigned ASMN has been deferred until the 2002 Water Quality Inventory Report.

River/Stream Benthic Macroinvertebrate Monitoring

NJDEP evaluates aquatic life designated use support in non-tidal rivers and streams using benthic macroinvertebrate monitoring. Benthic macroinvertebrate organisms, including crustacea, larval insects, snails and worms, are ubiquitous throughout the state’s streams and are an important component of the aquatic food web. Benthic macroinvertebrate communities are examined using USEPA's Rapid Bioassessment Protocols - Level II (see Plaftkin, et al, 1989; NJDEP, 1992). Using this protocol, communities are examined for pollution tolerant and intolerant forms and the results are used to compute the New Jersey Impairment Score (NJIS).

Using this scoring system, the benthic macroinvertebrate population results were used to identify aquatic life designated use support for rivers and streams.

Currently in New Jersey, monitoring occurs in the Ambient Biological Monitoring Network (AMNET) at over 800 locations statewide on a 5-year rotating schedule. Round 1 sampling was conducted between 1992 and 1996, inclusive. The resulting designated use assessment results were reported in the 1992, 1994, 1996 and 1998 305(b) Reports. Round 2 sampling (1997-2001) is now ongoing. For this 2000 Water Quality Inventory Report, published assessments for Round 2 are reported, but are limited to the Upper Delaware Basin (WMAs 1, 2 and 11) as sampled between 1997 and 1998 (see Fig. A3.1.2-2a contained in Chapter 3), representing 139 monitoring stations. Round 2 data collection for the remaining portions of the state will be completed in May of 2001 and final reports are planned to be published during 2002. Published Round 2 reports will be used in subsequent New Jersey Water Quality Inventory Reports. Readers are referred to the 1996 or 1998 305(b) Reports for the current status of statewide aquatic life assessment results based upon the first round of sampling.

In addition to direct biological assessments, the current round of field work includes a qualitative assessment of stream habitat quality at each monitoring location, the results of which are used to compute a Habitat Assessment Score. Various components of the habitat are examined such as the amount of available cover along the stream bottom, amount of sediment deposition, bank stability, frequency of riffles, presence and amount of riparian vegetative cover, etc. These data are published in concert with the corresponding biological assessments in the Department's AMNET reports.

Lake Monitoring: Fin-fish Assessments

The aquatic life use support assessment for lakes in this report are based upon warm water fishery assessments supplied by the Department's Bureau of Freshwater Fisheries (BFF). Assessments of lake fisheries are performed based upon a priority list provided in the Division of Fish and Wildlife's Warmwater Fisheries Management Plan (NJDEP, 1998b) a document which serves as the primary guidance for warmwater fisheries management for the Department. Lake assessment frequencies as performed by the BFF vary depending upon the lake in question and its individual management needs.

Fish populations are sampling using electrofishing (spring or fall), shoreline seining (summer to assess fish reproduction), and/or gillnetting (fall). In addition, basic water chemistry parameters such as dissolved oxygen, pH and nutrients are recorded during the summer months when the water columns are most stratified. Fish population data are then assessed by experienced fishery biologists for the purpose of determining a lake's actual or potential recreational value as a fishery with recommendations subsequently being made to maintain or enhance the resource.

It is important to note that although the Bureau of Freshwater Fisheries is principally concerned with the recreational value of the fisheries they assess, the assessments they provide are based upon the diversity of a wide range of fish species and not just species of recreational value. Many sport fish are carnivores who depend upon an abundant and diverse forage base to support

their populations. Hence, although many of these lakes are stocked, assessment results are not affected by the stocking.

For this 305(b) Report, assessments were supplied by BFF based upon fish inventories of selected lakes and reservoirs over 100 acres with public access for recreational fishing. This resulted in 10 lakes and reservoirs totaling 9,875 acres being assessed using data collected between 1993 to 2000. NJDEP plans to enhance the use of fisheries data for aquatic life assessments in future New Jersey Water Quality Inventory Reports.

Lake Monitoring: Eutrophication and Aesthetics

The Clean Lakes Program was designed by EPA to facilitate identification and remediation of impaired public lakes. Public lakes with water quality issues were identified by lake associations, municipalities or other entities; studies were conducted to characterize water quality and as funding was available, remediation projects were conducted. Also during the 1980's and early 1990's, NJDEP collected water quality data on a number of public lakes. Data collection included a suite of indicators such as total phosphorus, Secchi disk transparency and chlorophyll *a* levels to determine the trophic state of lakes. Much of the impairments brought to the Department's attention through the Clean Lakes Program centered around nuisance algal growth impairing swimming and in some cases boating.

To date the Clean Lakes Program has assessed a total of 116 public lakes representing 10,462 acres. This represents 31% of public lakes and 44% of public lake acres. Many Clean Lakes assessments had been performed in the 1980's and early 1990's. Clean Lakes Program data had been used in previous Water Quality Inventory Reports to assess lake Aquatic Life Designated Use Support. Beginning in this Report, Aquatic Life Use Support in lakes is based upon warm water fishery assessments supplied by the Department's Bureau of Freshwater Fisheries (described above).

Coastal Water Quality Monitoring Programs

Aquatic Life Assessments: Water column dissolved oxygen (DO) status was used as an indirect indicator for aquatic life designated use assessment within New Jersey's coastal waters for the first time in this report. In addition to carrying out the sanitary monitoring to assess the fitness of estuary waters for shellfish harvesting, the NJDEP's Bureau of Marine Monitoring collects quarterly data for DO, salinity, temperature, pH, suspended solids and nutrients at approximately 200 sites in New Jersey's estuarine and ocean waters through the Marine and Estuarine Water Quality Monitoring Program. DO data from the estuarine portions of the network not contained within waters assessed by the Delaware River Basin Commission in their 305(b) report were used to assess aquatic life assessment in estuarine waters presented in this report. This represents 170 sites (see Chapter 5 Appendix, Figure A5.1-1) using subsurface dissolved oxygen levels recorded between 1995 and June 1997.

Aquatic life assessment for ocean waters within New Jersey's jurisdiction is based upon water column dissolved oxygen (DO) levels recorded by the USEPA helicopter during June through September, 1995 through 1998. (USEPA, 1999). A series of 10 transects extend east along the

New Jersey coastline from Sandy Hook south to Cape May with samples taken at 1, 3, 5, 7, and 9 mile points along each transect. Samples are collected eight to ten times during the summer. At each site, two samples are collected, one at one meter below the surface and one at one meter above the ocean floor. Ocean depths ranged from 20 to 75 meters. For the purposes of this assessment only data from the 1 and 3 mile points were utilized (both surface and bottom) in order to limit the assessment to waters within New Jersey's three mile jurisdiction (see Chapter 5, Fig. A5.1).

Recreational Assessments: The Marine and Estuarine Water Quality Monitoring Program described above also includes fecal coliform data. These data were used to assess open marine and estuarine waters, using data collected between 1995-97. Cooperative Coastal Monitoring Program, jointly operated by the New Jersey Department of Health and Senior Services (NJDHSS) and NJDEP assesses water quality at bay and ocean bathing beaches. Data collected between 1995-99 were used for this report.

Shellfish Program Monitoring

The National Shellfish Sanitation Program (NSSP) collects data on the levels of fecal coliform in shellfish and waters that are harvested for shellfish. The Department monitors the sanitary quality of estuarine and ocean waters by observing measurements of coliform bacterial concentrations (indicators of the presence of pathogens) in the water column and uses the results to classify bay, estuarine and ocean waters for shellfish harvesting. Currently, about 2,500 stations are used to monitor 1,053 square miles of waters classified for shellfish harvest in the Shellfish Sanitation Program. These stations are sampled between five and twelve times each year for total coliform and fecal coliform bacteria. This network has not changed since the 1996 Water Quality Inventory Report.

Toxics in Fish Tissue

Fish and shellfish monitoring for assessing potential human health impacts and fish consumption advisories began in New Jersey as far back as 1976. Initial sampling locations were chosen to include all major drainages and areas where known or suspected sources of persistent bioaccumulative toxics (PBTs) might be found (e.g., PCBs, dioxin, pesticides, and mercury). These included freshwater, estuarine and marine areas important to both recreational and commercial fisheries. Subsequent monitoring activities were primarily research projects targeted at select species and drainages where contamination was found. Fishing advisories and sampling locations are routinely listed at the NJDEP Website (i.e., www.state.nj.us/dep/fgw) and in the New Jersey Fish and Wildlife Digests (NJDEP 2000a and NJDEP 2000b). Much of the data that was used to establish fish consumption advisories in New Jersey are over ten years old. Additional funding to address these data gaps and routinely update advisories (as needed) has not been available for several years. In fiscal year FY 1998 a one-time special NJ appropriation was established for NJDEP to study chemical contamination in the State's fisheries allowing both data sets to be selectively re-assessed via new research monitoring in FY1999 and FY2000. A more continuous, stable source of funding to maintain the State’s monitoring of fish and waterways impacted by consumption advisories is currently under development.

Table 1.1: Monitoring and Assessment Summary

Assessment	Data Source for Assessment	Spatial Extent of Assessment	Time Period	Monitored/ Evaluated	Notes
Rivers and Streams					
Surface water quality	NJDEP-USGS Cooperative Ambient Stream Monitoring Network (ASMN)	Statewide	1995-97	Monitored	Trends from 1986-95 used to evaluate threats to water quality
Aquatic Life	NJDEP Ambient Biological Monitoring Network (AMNET)	Upper Delaware (WMAs 1, 2, 11)	1997-98	Monitored	Network is statewide; new data published on Upper Delaware WMAs
Recreation	ASMN - Fecal coliform data	Statewide	1995-97	Monitored	Trends from 1986-95
Drinking water	ASMN - nitrate data; finished drinking water quality	Statewide	1995-97	Monitored	Trends from 1986-95
Agriculture	ASMN - TDS, salinity, specific conductance	Statewide	1995-97	Monitored	
Industry	ASMN - pH, TSS	Statewide	1995-97	Monitored	
Lakes					
Aquatic Life	NJDEP Warmwater Fisheries Assessments	Selected lakes	1993-00	Monitored & Evaluated	Monitored: data after 1995
Recreation	NJDHSS & Local Health Dept lake beach monitoring	Statewide, all lake beaches	1999	Monitored	
Estuary and Ocean					
Aquatic Life	NJDEP Marine and Estuarine Water Quality Monitoring Program; USEPA Helicopter Program	All coastal waters	1995-97	Monitored	Based on Dissolved Oxygen; NJDEP: estuarine assessment; USEPA: ocean assessment
Recreation	NJDEP Coastal and Estuarine Monitoring Program; Cooperative Coastal Monitoring Program	All coastal waters	1995-99	Monitored	Coastal & Estuarine data: open waters; CCMP: bathing beaches
Shellfish Harvest	NJDEP Shellfish Sanitation Program	All coastal waters	1998-00	Monitored	Trends from 1976-00
All waters					
Fish Consumption	Issuance of fish consumption advisories or bans developed through research projects	Selected lakes, rivers and coastal waters	1976-98	Monitored & Evaluated	Monitored: advisories based on data less than 10 yrs old.

Chapter 2: Plan for Achieving Comprehensive Assessments

In order to evaluate status and trends in water resources, USEPA has asked states to develop plans to comprehensively assess their waters. Comprehensive assessments should consider waterbody types (i.e., rivers, lakes, coastal waters, wetlands) and important parameters of concern. (USEPA, 1997). Assessment of wetlands is discussed in Part III, Chapter 6 and ground water is discussed in Part IV.

The spatial component of water assessments, particularly in rivers and streams, is technically challenging. Statistically sound methods to extrapolate data along rivers with variable hydrologic conditions (i.e., tributary confluences, natural and human induced flow variations) and variable watershed characteristics (slope, soils/ geology, patterns of land use and land cover) are not fully developed or are so complex that only very advanced statisticians can conduct the analysis. Analyses are also hindered by limited datasets (e.g., quarterly sampling for parameters that are influenced by season and flow).

Nationally, USEPA has advocated random sampling as the preferred approach to support statistical extrapolation of data to non-monitored streams. Ability to use classical statistical techniques to estimate population characteristics (e.g., median and range of DO in NJ streams) in randomly sampled stations is the major advantage of this approach. Also, randomly selected stations can be useful to identify previously unknown (emerging) issues. However, randomly selected stations do not provide information regarding the sources and causes of pollution and large numbers of stations are needed to evaluate highly variable systems. More importantly for water resources managers, randomly selected stations cannot be used to monitor problem areas or to evaluate the effectiveness of management measures. Thus a combination of randomly selected and targeted stations are needed to comprehensively assess and manage water quality.

Regression techniques that relate water quality to other variables (e.g., land use, basin size, and effluent flow) are another approach to provide comprehensive assessments that can indicate potential sources and causes of pollution.

2.1 Comprehensive Assessments of Rivers and Streams

As described below, NJDEP has several efforts underway and is working with USEPA's Consolidated Assessment and Listing Methodology workgroup to develop comprehensive assessments of New Jersey's rivers and streams.

Non-tidal rivers and streams are monitored for chemical and sanitary water quality, toxics in fish tissue, and for aquatic health. As discussed below, the aquatic health assessments conducted by NJDEP in the Ambient Biological Monitoring Network (AMNET) provide comprehensive spatial coverage and efforts are underway to improve the spatial extent of monitoring for chemical and sanitary water quality and toxics in fish tissue.

Comprehensive Assessments of Aquatic Health in Rivers and Streams

The Ambient Biological Monitoring Network (AMNET) has increased from 760 to 820 monitoring locations. At least 1 monitoring station is located in each of the state's freshwater watersheds (HUC11). The United States Geological Survey (USGS) compared various stream and watershed characteristics to the AMNET stations. (See Appendix 2.1-1).

This assessment was based on 780 AMNET sites being monitored at the time the assessment was conducted. Stream segments and AMNET sites were compared to a variety of watershed characteristics including drainage area, point source flow, population density, agricultural and urban land use. Similarities in distribution frequencies indicate that AMNET monitoring provides a representative, and thus spatially comprehensive, assessment of NJ non-tidal streams. In the future, NJDEP will be working to integrate other biological datasets (e.g., fisheries) to provide more comprehensive indicators of aquatic health.

Plan for Developing Comprehensive Assessments of Chemical and Sanitary Water Quality Monitoring in Non-tidal Rivers and Streams

This 2000 Water Quality Inventory Report relies on Ambient Stream Monitoring Network (ASMN) data collected between 1995 and 1997 by NJDEP and USGS at 81 sites. Based on USEPA Guidance, each monitoring station was assumed to represent 5 miles. This approach did not provide a comprehensive spatial assessment.

As discussed in Part III, Chapter 3, the ASMN was redesigned in 1997. The new design provides statistically-based comprehensive spatial assessment of freshwater, non-tidal streams. At the time this report was prepared only data from 1998 had been published by USGS, limiting the data available for assessment to four samples per station. Therefore, data from the redesigned ASMN will be used in subsequent Water Quality Inventory Reports.

The statistically based redesigned ASMN includes 5 station types and approximately 115 stations. The network includes 40 Statewide Status sites (2 per Watershed Management Area) that are randomly selected each year, using a computerized random number selection program, from the 820 AMNET sites. Thus, a significant component (35%) of network resources are dedicated to randomly sampled stations. Since Statewide Status sites are selected each year, confidence in the representativeness of this random network component will increase each year.

In addition, 40 Land Use Indicator stations are located to indicate water quality at the two dominant land uses in each WMA and 18 of 20 WMAs also have Watershed Integrator stations at the downstream end of the WMA. Note that Watershed Integrator stations could not be located in Cape May and Hackensack WMAs (WMAs 16 and 5, respectively) because these WMAs are primarily tidal.

NJDEP is conducting a project with a Regional Geographic Initiative Grant from USEPA Region II to evaluate the redesigned Ambient Stream Monitoring Network and develop a data analysis guidance manual. The project advisory committee includes representatives from NJDEP's Water Monitoring Management, Water Assessment Team, USEPA Region II's 305b Program and

Monitoring and Assessment Branch and USGS. With a statistician from Rutgers University, the project advisory committee is evaluating site selection criteria, site locations and the representativeness of the randomly selected statewide status stations. A data analysis guidance manual will be published that will include methods for estimating spatial representativeness in sampled waters and in similar waters without monitoring stations. Water quality - land use regressions are being considered.

NJDEP is establishing the Existing Water Quality (EWQ) network of 200 sites located at confluences and basin outlets. At least 1 monitoring site is expected to be located in each HUC11. EWQ will compliment the ongoing NJDEP-USGS Cooperative Ambient Stream Monitoring Network (ASMN) to monitor over 300 stations quarterly for 2 years in freshwater and tidal-freshwater rivers and streams.

The 303d Evaluation Monitoring Program includes stations in all waters included on the 1998 Impaired Waterbodies List (303d List) for metals and nutrients. Monitoring for metals is intended to evaluate current concentrations of metals using clean sampling and analytical techniques. Monitoring for nutrients is intended to evaluate the spatial extent of known exceedences of Surface Water Quality Standards numerical criteria. (N.J.A.C. 7:9B).

NJDEP is also working with USEPA on Comprehensive Assessment and Listing Methods (CALM) Workgroup. This USEPA effort is intended to provide states with additional guidance on assessment methods, including spatial extent of assessments.

2.2 Comprehensive Assessment of Lakes

NJDEP maintains that New Jersey's public lakes have been comprehensively assessed by the Clean Lakes Program and local health agencies responsible for assessing lake bathing beaches. The trophic status of about one-half of New Jersey's public lakes were assessed in the Clean Lakes Program and 123 of 126 of these assessed lakes were eutrophic. These data strongly suggest that the remaining public lakes are eutrophic. Note that many of New Jersey's public lakes are man-made impoundments on streams and are thus highly prone to eutrophication.

Local health agencies are responsible for assessing lake bathing beaches during the summer bathing season. These data provide a comprehensive assessment of lake bathing beach quality.

The status of New Jersey's reservoirs will be assessed through the Source Water Assessment Program. Some reservoirs are currently monitored by water purveyors or operating authorities but these data are not required under federal or state regulation to be collected or provided to NJDEP.

Currently, the NJDEP's Division of Fish and Wildlife collects dissolved oxygen (DO) data in New Jersey lakes. These data can be used to indicate the aquatic health of lakes since adequate DO is required for aquatic life. NJDEP and USEPA Region 2 are developing and testing a protocol for benthic assessment of lakes, which can compliment the DO assessments.

2.3 Comprehensive Assessment of Estuaries and Coastal Waters

New Jersey has achieved comprehensive assessment of estuaries and coastal waters through the 200 station water quality Marine and Estuarine Water Quality Monitoring Network, the Cooperative Coastal (Beach) Monitoring Program, the 4000 station National Shellfish Sanitation Program. The Marine and Estuarine Water Quality Monitoring Network includes stations in tidal rivers, estuaries and inlets which represent the variety of water quality conditions in New Jersey's coastal waters. The Cooperative Coastal (Beach) Monitoring Program includes weekly sampling of every protected ocean and bay bathing beach in New Jersey. The National Shellfish Sanitation Program has been approved by the Food and Drug Administration to ensure the safety of shellfish harvested in New Jersey.

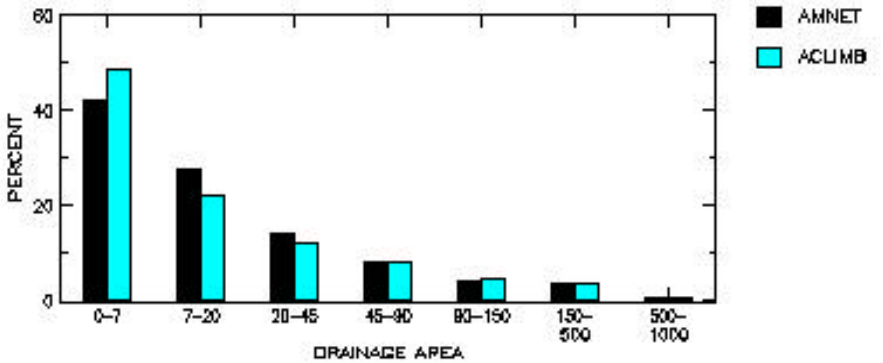
Aquatic life assessments in these waters are based on DO measurements collected by NJDEP's Marine and Estuarine Water Quality Monitoring Network and USEPA's Helicopter Network. To compliment these assessments, NJDEP will begin implementation of benthic monitoring in estuaries upon completion of the protocol by USEPA Region 2.

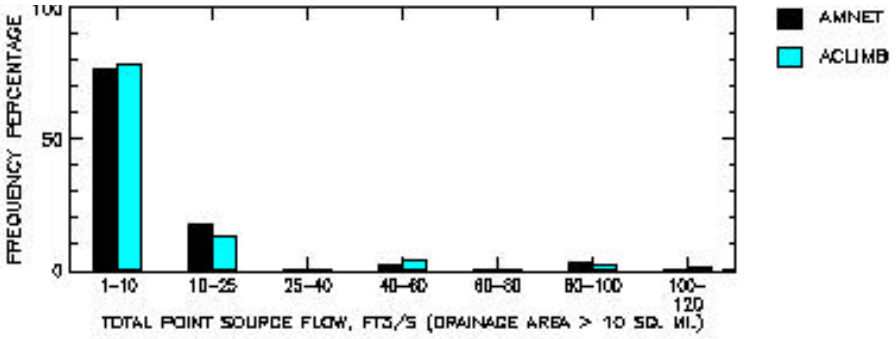
2.4 Toxics in Biota

New Jersey has achieved significant progress toward comprehensive assessments of toxics in biota and has issued fish consumption advisories based on these data. However, many advisories are outdated and thus do not reflect current conditions. As discussed in Part II, Special State Concerns and Recommendations, a routine fish tissue monitoring program is recommended to support evaluation of older advisories and as appropriate, collection of data in waterbodies that are currently lacking data.

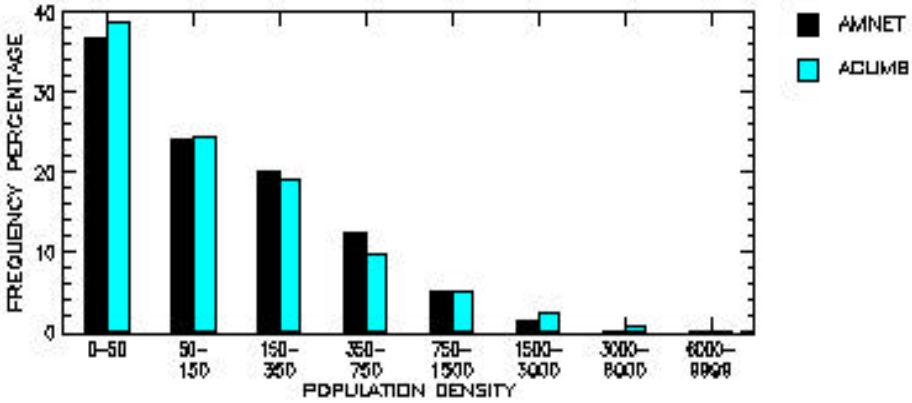
Appendix 2.1-1: Representativeness of NJDEP's AMNET Network

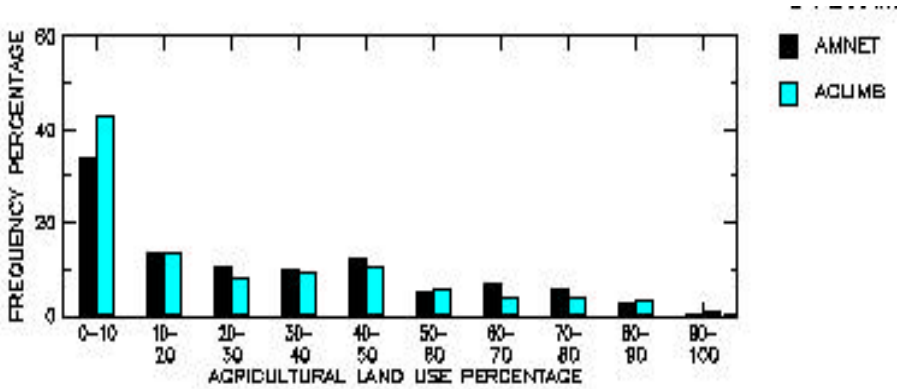
As part of the basis for the surface water-quality network re-design, the characteristics in the USGS ACLIMB GIS database of 7200 stream segments representing the entire population of the non-tidal streams in NJ were compared to the characteristics of the 780 NJDEP AMNET sampling sites. The figures to the right illustrate that the AMNET sites are a nearly perfect sub-sample of the streams in NJ and clearly demonstrates that the AMNET design and site selection procedure does indeed represent the potential diversity of streams and, hence, the biological communities in NJ. It also provided a very strong support to use the 780 AMNET sites as the basis for selecting the water-quality sampling sites.



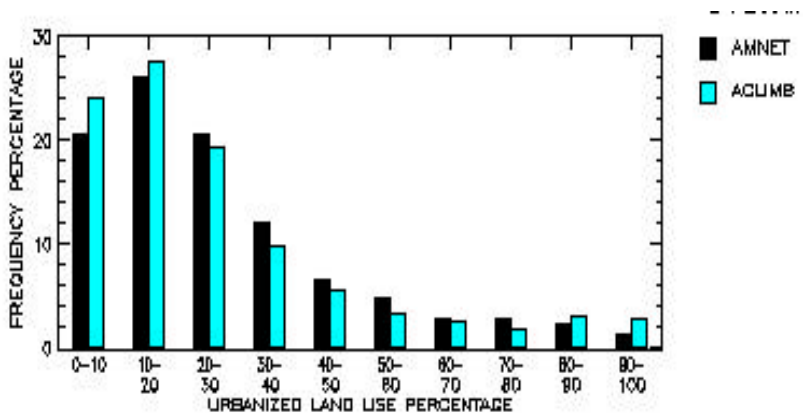


The decision to use the AMNET sites also added some very desirable operational overlap for the two programs. It provides water-quality and streamflow data to use with any future benthic invertebrate analyses of cause and effect and allow a more realistic comparison of the role of chemistry and flows (or their changes) on the health of NJ's biological communities. Since the sites were already thoroughly checked out while sampling for the invertebrates, it helped to minimize reconnaissance of the chemical sampling sites. It also helps to minimize the number of potential





sites to include in the 40-site random sample network design of the statewide status sites.



There was a concern that the redesigned Ambient Stream Monitoring Network (with 115 sites) would not be comprehensive enough to fully represent conditions in NJ. The design, however, actually considered this and a conscious effort was made to establish a basis (sites) that could establish a statistically based approach to estimating the quality of stream reaches not sampled by the network. The 40 semi-randomly selected land-use indicator sites along with the 40 randomly selected statewide status sites could be used to evaluate non-monitored location and perhaps to develop regression models of various water-quality constituents and land-use or basin characteristics.

Chapter 3: Rivers and Streams Water Quality Characterization

3.1 Water Quality Characterization

There are 8,020 miles of rivers, streams, canals in New Jersey. Of these, 6,500 miles (69%) are non-tidal rivers and streams, 1,520 miles (18%) are tidal rivers and streams, 1,235 miles (13%) are canals and ditches, and 197 river miles share a border with a neighboring state.

New Jersey's rivers and streams are used as water supplies for drinking water, industry and agriculture, trout and warm-water fisheries, recreation (e.g., boating, swimming) and wastewater disposal. Often, NJ rivers and streams are used for multiple purposes in close proximity.

The characterization that follows describes water quality in freshwater, non-tidal rivers and streams. Water quality status and trends with respect to Surface Water Quality Standards, and attainment of designated uses for aquatic life, recreation, drinking water, agriculture and industry.

Designated use attainment for tidal waters is discussed in Chapter 5, Estuary and Coastal Assessment. Wetlands are discussed in Chapter 6 and fish and shellfish consumption designated uses are discussed in Chapter 7, Public Health and Aquatic Life Concerns.

3.1.1 Surface Water Quality Standards

Water quality is evaluated with respect to Surface Water Quality Standards (SWQS) and water quality issues or concerns occur when SWQS are not met or are threatened. New Jersey s Surface Water Quality Standards (N.J.A.C.7:9B) establish the water quality goals and policies underlying the management of the state s water quality. These standards designate the use or uses of the water and establish policies and narrative and numerical criteria necessary to protect the uses. SWQS are explained below.

Water Quality Goals: National water quality goals were established in the Federal Clean Water Act. These goals state that surface waters should be fishable, swimmable and potable (after reasonable treatment). The national goals are reflected in the designated uses of waters established in New Jersey s Surface Water Quality Standards (SWQS) and the water goal statement developed under the National Environmental Performance Partnership Agreement (NEPPS).

Clean and Plentiful Water Goal: New Jersey's rivers, lakes and coastal waters will be fishable, swimmable and support healthy ecosystems. Surface and ground water will be clean sources of water. Every person in New Jersey will have safe drinking water. Adequate quantities of surface and ground water will be available for all needed uses.

Designated uses: The designated uses in freshwaters are: primary and secondary contact recreation (i.e., swimmable); maintenance, migration and propagation of the natural and established biota (i.e., fishable), agricultural and industrial water supply, and public potable water supply, after such treatment as required by law or regulation (i.e., potable). These uses

were established based on physical, chemical, biological, and hydrological characteristics of the waters and the economic considerations related to attaining various uses. Designated uses that apply in NJ are listed in the SWQS and are evaluated periodically. Designated uses in estuarine and coastal waters include primary and secondary contact recreation (i.e., swimmable); maintenance, migration and propagation of the natural and established biota (i.e., fishable) ; and shellfish harvesting.

Water Classifications: Surface waters are grouped into classifications as follows:

FW1: Fresh Water 1: Fresh surface waters that are to be maintained in their natural state and not subjected to man-made wastewater discharges or increases from runoff from anthropogenic activities.

FW2: Fresh Water 2: General fresh surface water classification applied to fresh waters that are not FW1 or Pinelands Waters.

FW- TP: Fresh Water - Trout Production waters are designated for trout spawning/nursery during their first year.

FW- TM: Fresh Water - Trout Maintenance waters are designated for the support of trout throughout the year.

FW- NT: Fresh Water - Non Trout: fresh surface waters that have not been designated TM or TP. These waters are generally unsuitable for trout because of their physical, chemical, or biological species, but are suitable for a wide variety of other fish species.

PL: Pinelands Waters: all waters within the boundaries of the Pinelands Area, except those designated as FW1.

SE: Saline Estuarine: general surface water classification applied to saline estuarine waters (salinity greater than 3.5 parts per thousand at mean high tide)

SC: Saline Coastal: general surface water classification applied to saline coastal waters

ND: Nondegradation waters are waters set aside for posterity because of their clarity, color, scenic setting, other characteristic of aesthetic value, unique ecological significance, or exceptional water supply significance. These include all waters designated as FW1 in this report.

C1: Category 1 waters are designated for implementation of antidegradation policies for protection from any measurable change in water quality. C1 may be applied to any surface water classification except those designated as FW1 or PL. Note: the Department is currently proposing a clarification between the definition of ND and C1 antidegradation policies

C2: Category 2 waters are waters that are not designated as Outstanding Natural Resource Water (i.e., FW1 or PL) or C1 for implementation of antidegradation policies.

Water Quality Policies: Anti-degradation policies apply to all surface waters of the State. Existing uses must be either maintained or protected, and no irreversible changes to water quality are allowed that would impair or preclude attainment of designated uses. Waters classified as nondegradation waters (i.e., FW1) must be maintained in their natural state, and are not to be subject to any manmade wastewater discharges. Narrative criteria that prohibit changes in natural water quality apply to high quality waters. Water quality characteristics that do not meet criteria must be improved to meet criteria.

Water Quality Criteria: States are required to adopt water quality criteria that will protect both the existing and designated uses of a waterbody with an adequate degree of safety. Numerical criteria are often established for chemical pollutants, sanitary quality, and physical characteristics of the water such as temperature and dissolved oxygen. Narrative criteria that prohibit toxicity in surface waters are established to protect against the effects of multiple pollutants. A summary of SWQS criteria is provided in Table A3.1.1-1 in the Appendix**.**

3.1.2 Water Quality Data Collection and Characterization

This water quality characterization provides comparisons to Surface Water Quality Standards criteria and trends over time. SWQS criteria were developed to protect a variety of designated uses in surface waters. These results provide a useful indicator of designated use attainment, but must be supported with other types of data (e.g., biological data) to comprehensively evaluate use attainment status. Currently, NJDEP is developing a method to formulate a "fishable index" that includes water quality, fish, benthic and eventually algal data. For this 2000 Water Quality Inventory Report, this water quality characterization is intended to provide useful information regarding status and trends in water quality, but is indirectly related to designated uses.

Water quality data for this characterization were collected from non-tidal rivers and streams between January, 1995 and December, 1997 through the 81 station Ambient Stream Monitoring Network (ASMN) shown in Figure 3.1.2-1. Table A3.1.2-1 in the Appendix provides a list of stations and stream classifications. The 1995-97 time period was chosen for this characterization because data collected prior to 1995 were described in the 1996 and 1998 NJ Water Quality Inventory Reports and the implementation of the redesigned Ambient Stream Monitoring Network began in October, 1997. Only 1998 data had been published by USGS at the time this report was written. In addition, work has not been completed on a project with Rutgers University to develop a data analysis guidance manual to ensure appropriate statistical analyses of the data collected in the new design. Thus, the assessment of data from the redesigned ASMN has been deferred until the 2002 Water Quality Inventory Report.

The redesigned Ambient Stream Monitoring Network provides data from 5 station types (background, land use indicator, watershed integrator, statewide status and synoptic). This design was intended to provide water quality data from a wide variety of stream characteristics and significantly expand the number of stream miles monitored by providing a strong statistical

basis for estimating water quality in streams with similar characteristics that are not monitored. A project funded by EPA is ongoing to identify the appropriate statistical techniques to apply to this dataset. Thus, data characterizations from this network will be provided in subsequent NJ Water Quality Inventory Reports. The redesigned ASMN is described in more detail in Appendix A3.1.2-2.

The ASMN has been operated cooperatively since the early 1970's by the NJDEP and USGS. Since this network was described in previous New Jersey Water Quality Inventory Reports, a brief overview is provided here.

Water quality samples were collected quarterly at 81 stations in freshwater, non-tidal streams and rivers using cross-sectional depth-integrated sample collection techniques. Concurrent measurement of stream discharge was also collected. Samples were sent to either the New Jersey Department of Health and Senior Services (NJDHSS) certified laboratory or the USGS National Laboratory in Denver for analysis. Laboratory results were thoroughly reviewed for quality assurance purposes and managed in EPA's STORET database. Raw data were reported by USGS in Water Year Reports. (USGS, 1995, 1996, 1997). Electronic data are available to be downloaded from EPA's STORET database at www.epa.gov/owow/STORET. Water quality parameters are provided below in Table 3.1.2-1

Table 3.1.2-1: Routine Water Quality Parameters

Date/ Time	Calcium	Nitrite
Instantaneous discharge	Magnesium	Nitrate + Nitrite
Specific conductivity	Sodium	Ammonia - total
pH	Potassium	Ammonia - dissolved
Water temperature	ANC Unfiltered	Ammonia + organic N -total
Barometric pressure	Sulfate	Ammonia + organic N - dis
Dissolved oxygen	Chloride	Total Nitrogen
DO % saturation (calculated)	Fluoride	Dissolved Nitrogen
BOD (5 day)	Silica	Total Phosphorus
Fecal Coliform	Solids (residue)	Dissolved Phosphorus
Enterococcus	Solids (calculated)	Dissolved Organic Carbon
Hardness	Residue at 105 C	Suspended Organic Carbon

Supplemental water column parameters are collected 2 times per year at 1/3 of the stations on a rotating schedule. Thus, all stations are sampled over 3 years. Parameters include:

Table 3.1.2-2: Supplemental Water Quality Parameters

Chemical oxygen demand	Arsenic	Beryllium
Boron	Cadmium	Chromium
Copper	Iron	Lead
Manganese	Mercury	Nickel
Selenium	Zinc	

Supplemental sediment parameters include metals, organic pesticides, herbicides and PCBs.

Under contract to NJDEP, USGS conducted a project to characterize water quality status and trends in NJ between 1986 and 1995. (USGS, 1999). The results were used in the characterizations that follow to summarize trends.

Characterization Method: Water quality data characterizations were conducted for a subset of water quality parameters through a project to improve water quality indicators. A subset of the routine parameters in Table 3.1.2-1 that are important to water quality characterization and TMDL planning were selected. Water quality data were compared to applicable NJ Surface Water Quality Standards (N.J.A.C. 7:9B) described in Section 3.1.1.

Metals were not included in this characterization. The metals monitoring in the ASMN includes only total recoverable metals. Many of the aquatic life criteria currently adopted in the SWQS are based on dissolved metals, so direct comparison to dissolved aquatic life criteria is precluded by lack of data. Since 1995, the Department and USGS have instituted improved sample collection and analysis procedures to avoid inadvertent sample contamination.

Given these concerns, NJDEP, with assistance from USGS, began the "303d Evaluation Monitoring" project to assess current levels of metals in streams included on the 1998 Impaired Waterbodies List. This project includes collection total recoverable and dissolved metals data, which are needed for comparison to both human health and aquatic life criteria. Stringent quality assurance measures in this project include the use of "Clean Methods" sampling techniques and collection of field equipment blanks. These data will be used to inform development of the 2002 Impaired Waterbodies List.

EPA Guidance for the Preparation of Water Quality Inventory Reports recommends that states consider the percent of samples exceeding applicable SWQS to identify impairments. (EPA, 1997). NJDEP applied the guidance to water quality data characterizations. EPA guidance for conventional (i.e., non-toxic) parameters is summarized on Table 3.1.2-3 below.

Table 3.1.2-3: Water Quality Data Characterization Method for Conventional Parameters

SWQS Met	Less than 10% of samples exceed applicable SWQS
SWQS Met but Threatened	Less than 10% of samples exceed applicable SWQS, but declining WQ trends indicate SWQS are likely to be exceeded in more than 10% of samples within 2 years
SWQS Partially Met	Between 11% and 25% of samples exceed applicable SWQS
SWQS Not Met	More than 25% of samples exceed applicable SWQS

Notes:
From: EPA Guidance for Preparation of Water Quality Inventory Reports, EPA, 1997.
Applicable to conventional (i.e., non-toxic) parameters

Results of a USGS study which characterized water quality trends between 1986 and 1995 were used to evaluate threats to full support. (USGS, 1999). USGS also conducted a study to evaluate

the relative contributions of constant sources (i.e., point sources and groundwater) and intermittent sources (i.e., nonpoint sources) of pollution to freshwater streams. The study included a statistical evaluation of water quality data collected in the Ambient Stream Monitoring Program. Water quality data for 20 parameters collected under high and low flow conditions were used to indicate the relative contribution or dominance of point and nonpoint sources. (USGS, 1998, 1999a, 1999b, 1999c, 1999d) Selected results are summarized in the Source and Cause Assessment Section for total phosphorus below.

Spatial Extent of Assessment: This assessment was based on data collected at 76 of 81 ASMN stations. The 5 Delaware River mainstem stations were not included because the Delaware River Basin Commission (DRBC) assesses this waterbody. (DRBC, 2000)

In previous NJ Water Quality Inventory Reports, each station was assumed to represent 5 miles of stream. For this assessment, each station was assumed to represent the stream reach that was monitored. Stream reaches have been defined by USEPA in the Reach File 3 system, which can be used on GIS. Reach File 3 (RF3) was mapped at a moderate 1:100,000 scale. Using RF3, the 76 ASMN stations represent 176of 6410 (2.7%) river miles. The RF3 reach identification number and reach length are provided in Table A3.1.2-1 in the Appendix. Using RF3 was considered an intermediate approach to the more refined spatial assessment that will be provided by the redesigned ASMN.

It is important to note that the monitoring design used to collect these data does not support extrapolating the assessment results to locations or streams that were not monitored. Streams that appeared to have the greatest impacts were prioritized in this network.

Relationship to Impaired Waterbodies List (303d): Under Section 303d of the Federal Clean Water Act, states are required to identify impaired waterbodies and publish a list of these waterbodies every 2 years. (40 CFR 130.7). New Jersey regulations for the Impaired Waterbodies List are currently found at N.J.A.C. 7:15-6. Revisions were recently proposed in Subchapter 3 with revisions to the Watershed Management Planning Rules (New Jersey Register) EPA also proposed revisions to the federal 303d and TMDL rules (Federal Register) which were recently approved by President Clinton.

Under current federal and state regulations, impaired waterbodies are those waters that do not meet applicable surface water quality standards. Water chemistry data were compared to applicable NJ SWQS and included on NJ Impaired Waterbodies Lists. Federal and state regulation requires that actions be taken to improve water quality, including development of TMDLs, and/ or implementation of more stringent point and non-point source control measures. Waterbodies must remain listed until new data show that applicable SWQS are now met or the original basis for the listing is no longer applicable (e.g., change in SWQS). As specified in federal and state regulations, the Impaired Waterbodies List is developed, proposed and adopted in a public forum.

The ASMN data have provided a primary source of information regarding impairments (i.e., exceedences of SWQS) in rivers and streams. The characterization provided below is intended to provide an overview of water quality status and trends and to inform TMDL planning. De-listing will be pursued for listed waterbodies that now meet applicable SWQS; listing will be pursued for waterbodies that currently do not meet applicable SWQS. Listing and delisting decisions will also consider data from the redesigned ASMN.

3.1.3 Water Quality Characterization

Dissolved Oxygen Water Quality Characterization

Dissolved oxygen is necessary for almost all aquatic life. Thus concentrations of dissolved oxygen (DO) in water also provide an indicator of the health of aquatic ecosystems. Between 1995 and 1997, 1259 DO measurements were collected in the ASMN. The average DO for all streams was 9.8 mg/l DO and 14 measurements (1%) did not meet SWQS. Results of the application of the use support assessment recommended by EPA are summarized in Table 3.1.3-1 below.

Table 3.1.3-1: Dissolved Oxygen Status (1995-97)

DO SWQS Status	# of Stations	% of Stations	# of Assessed River Miles	% of Assessed River Miles
SWQS Met	74	97.4%	172.7	97.9%
SWQS Met but Threatened	0	0%	0	0%
SWQS Partially Met	2	1.3%	3.7	2.1%
SWQS Not Met	0	1.3%	0	0%
Totals	76	100%	176.4	

Results for individual stations are depicted on FigureA3.1.3-1 and shown in Table A3.1.3-1 in the Appendix. Results for stations that exceeded criteria and their use support status with respect to DO are provided on Table 3.1.3-2 below.

Table 3.1.3-2: Stations with Exceedences of DO and % DO Saturation (1995-97)

WMA	Station #	Station Name	DO-#	DO-Mean (mg/l)	DO-# exc	DO-% exc	%DO-#	%DO-Mean	SWQS Attainment
6	01379000	Passaic R Nr Millington	16	6.050	4	25.0%	16	54.438	Partial
19	01466500	McDonalds Br in Lebanon Forest	7	4.429	3	42.9%	7	37.571	Full (see note)
6	01382000	Passaic R At Two Bridges	47	8.211	3	6.4%	47	79.660	Full
15	01410784	Great Egg Harbor R Nr Sicklerville	51	8.011	2	3.9%	51	74.304	Full

6	01381800	Whippany R Nr Pinebrook	15	7.687	2	13.3%	15	68.800	Partial

Notes:

- 74 of 76 stations met applicable DO criteria in 100% of measurements collected between 1995-97
- WMA: Watershed Management Area (see Figure II-1)
- Station #: USGS/ STORET station number (can be used to request data from STORET)
- DO-n: number of DO measurements collected between 1995-97
- DO-mean: average of DO measurements (mg/l DO)
- DO-# exc: number of DO measurements less than applicable SWQS
- DO % exc: percent of DO measurements less than applicable SWQS
- %DO-n: number of % DO saturation measurements calculated for 1995-97 data
- % DO-mean: average of % DO saturation measurement
- Lebanon State Forest and the Great Egg Harbor River at Sicklerville stations are located in an area dominated by ground water and low DO is a natural phenomenon, not due to pollution sources.

DO readings were taken during the day and thus do not characterize the natural diurnal DO cycle. NJDEP and USGS will be collecting diurnal DO data at about 30 locations during the summer of 2000. Selected locations included background stations in the redesigned ASMN, locations with exceedences of DO criteria and locations in WMA02 with low DO measurements that did not exceed criteria.

The % DO saturation values provide a way to account for changes in DO concentration caused by temperature and air pressure: at low temperature and high pressure, water can contain more DO. Due to lack of contact with the atmosphere, ground water has naturally low DO concentration and % DO saturation. The low % DO saturation at the Lebanon and Great Egg Harbor sites is due to the large ground water contribution to stream flow, not pollution. At the remaining locations, low % DO saturation indicates that pollution contributes to low DO.

There are several locations on the 1998 Impaired Waterbodies List for exceedences of DO where criteria are now met. This finding is consistent with historical improvements in water quality as wastewater treatment plants were upgraded and regionalized in the 1980's and early 1990's. These locations will be evaluated further to pursue de-listing as appropriate in the 2002 Impaired Waterbodies List. Considerations will include data collected after 1997, if available; diurnal DO readings and trends in DO.

Total Phosphorus Water Quality Characterization

Total phosphorus is a nutrient that has been found to be limiting in many freshwater systems. "Limiting nutrients" are present in pristine systems in very low concentrations and tend to limit the growth of aquatic algae and vegetation. Elevated nutrients can contribute to excessive primary production (i.e., growth of aquatic algae and vegetation). Waterbodies affected by excessive primary productivity are characterized by significant algae and weed growth and

episodes of low dissolved oxygen. In order to protect surface waters from excessive primary productivity, NJ SWQS include nutrient policies and criteria for total phosphorus. (See N.J.A.C. 7:9B-1.5(g) and 1.14(c)).

Between 1995 and 1997, 1265 TP measurements were collected in the ASMN. The average TP for all streams was 0.1 mg/l and 407 measurements (32.2%) did not meet SWQS. Between 1995 and 1997, 22 met SWQS criterion for TP in 100% of samples collected and 6 stations exceeded the criteria in 100% of samples collected.

Of 79 stations assessed for TP trends, statistically significant decreasing trends in concentration were found at 40 stations (50%) between 1985 and 1995. (USGS, 1999). Statistically significant trends were not found at 35 of 79 locations (44%) and a statistically significant increasing trend in concentration was found at only 1 station between 1986 and 1995. Trends ranged from 0.003 ppm per year, a very slow rate of change, to 0.096 ppm/year, and a very rapid rate of change. Results of the TP assessment are summarized below on Table 3.1.3-3. Results for individual stations are depicted on Figure A3.1.3-2 and on Table A3.1.3-2 in the Appendix. The trends assessment indicated that waters that currently fully meet TP criteria would continue to meet applicable criteria.

Table 3.1.3-3: Total Phosphorus Attainment Status (1995-97)

TP SWQS Status	# of Stations	% of Stations	# of Assessed River Miles	% of Assessed River Miles
SWQS Met	29	38.2%	67.3	38.2%
SWQS Met but Threatened	0	0%	0	0%
SWQS Partially Met	15	19.7%	24.7	14.0%
SWQS Not Met	32	42.1%	84.4	47.9%
Totals	76	100%	176.4	

Excessive primary productivity may impair aquatic life and recreational designated uses. Additional assessments are needed to identify designated use impairments due to excessive primary productivity and to evaluate the relative contributions of phosphorus, nitrate and other nutrients. Thus, it was not possible to link elevated concentrations of TP to use impairment. Some major considerations include:

- Attached periphyton is often the major location of primary productivity in streams- not free floating algae
- Nutrient cycling between water--sediments--aquatic periphyton community may result in water column nutrient measurements that are very low concentrations even though the waterbody is eutrophic (nutrients are fixed in aquatic plants and algae)
- Watershed Location is Critical: Depositional areas, wetlands, lakes, reservoirs are most prone to eutrophication, not fast flowing streams. Existing monitoring sites are not targeted to these areas.

- Season, stream flow, storm events have significant effects on primary production and nutrient limitation

Multiple lines of evidence are needed to evaluate use impairment, including biological, chemical and visual indicators. Data collection and assessment should focus on watershed locations that are susceptible to excessive primary productivity (e.g., lakes, reservoirs, wetlands, and estuaries).

- Biological Indicators of Eutrophication
  - Primary Productivity/ Total Biomass Measurements
  - Algal Biostimulation Assay
  - Periphyton Community Assessment
  - Benthic Community Assessment (i.e., dominance of filter feeders)
  - Impaired fisheries/ fish kills

- Water Chemistry Indicators of Eutrophication
  - Diurnal DO below 4 -5 mg/l
  - % DO saturation above 120%
  - TP concentration
  - Total Inorganic Nitrogen to Total Ortho-Phosphorus (TIN/TOP) ratios
  - TSS above SWQS/ depth of unconsolidated sediment
  - Elevated In-Stream BOD (biochemical oxygen demand)
  - Elevated In-Stream DOC- dissolved organic carbon and Elevated TOC- total organic carbon
  - Application of aquatic herbicides

- Visual Observation Indicators of Eutrophication
  - Nuisance aquatic weed growth
  - Invasive wetlands species
  - Stream flow (drought, water diversions may contribute to eutrophication)

In many cases, data for these indicators collected at appropriate locations are not available to evaluate use impairments associated with excessive primary productivity. However, additional data and assessments are expected to become available as TMDLs for nutrients are planned and watershed partnerships are established.

Characterization of Use Impairments Associated with Excessive Primary Productivity
As described below, significant efforts are underway to characterize primary productivity and the health of biological communities. These efforts will continue as total phosphorus TMDLs are planned.

- Algal biostimulation assays were conducted at 17 locations to identify limiting nutrients using a test algal species. Preliminary results indicate some locations are limited by

phosphorus, while others are limited by nitrate or other micronutrients (e.g., iron). Additional assays are planned.

- A periphyton study with the Academy of Natural Sciences was funded to evaluate periphyton communities in a range of locations, including pristine and disturbed watersheds.

- A watershed indicators study with USGS was funded to evaluate benthic communities using NJDEP's 820 station Ambient Biological Monitoring Network and identify factors that contribute to impairment

- Fisheries data were recently computerized and quality assurance checks are underway. This database will be used to identify impaired fisheries and can be linked to water quality data.

- Additional water quality data collection is being planned at 200 new locations, bringing the network to 300 stations. Diurnal DO data collection at locations with suspected impairment began in the summer of 2000. Additional water quality data will also be collected as needed to support development of TMDLs.

- Aquatic pesticide application locations, compounds and amounts are being put into a GIS database.

- The River Assessment Team program is encouraging stream walks by watershed partners. Ideally, this information can be used to identify areas affected by nuisance weed growth, erosion, sedimentation and to locate pollution sources.

Ammonia Water Quality Characterization

The un-ionized form of ammonia is regulated in NJ Surface Water Quality Standards because it is harmful to fish and other aquatic life. In non-trout (NT) and Pinelands waters, the criterion is set at 50 parts per billion (ppb or ug/l) and in trout production (TP) and trout maintenance, the criterion is set at 20 ppb. Since un-ionized ammonia is considered a toxic compound, waters with more than 1 exceedence in 3 years are classified as "not meeting SWQS with respect to un-ionized ammonia".

Prior to upgrades and regionalization of sewage treatment plants, ammonia exceedences were common in streams receiving effluent. Between 1995 and 1997, 1247 un-ionized ammonia samples were collected in the ASMN and 1183 were compared to SWQS criterion. Of 1183 samples, 99.91% were below applicable SWQS criteria. One sample of 13 exceeded the 20 ppb UIA criterion in the Raritan River at Stanton Station. Thus, additional monitoring is needed to evaluate UIA at this location. This finding is consistent with decreasing trends in total ammonia associated with reduction in ammonia in effluent. Results are summarized on Table 3.1.3-4 below and provided for each station in Table A3.1.3-3 in the Appendix.

Table 3.1.3-4: Un-ionized Ammonia Characterization (1995-97)

UIA SWQS Status	# of Stations	% of Stations	# of Assessed River Miles	% of Assessed River Miles
SWQS Met	76	100%	176.4	100%
SWQS Met but Threatened	0	0%	0	0%
SWQS Partially Met	0	0%	0	0%
SWQS Not Met	0	0%	0	0%
Totals	76	100%	176.4	

The Raritan River at Stanton Station was not included on the 1998 Impaired Waterbodies List for UIA. Additional data and data assessments are needed to evaluate whether the conditions that contributed to exceedence are likely to re-occur; if so, listing will be pursued in the 2002 Impaired Waterbodies List. Based on the 1995 to 1997 data, trends through 1995 and a review of more recent data collected in the Redesigned ASMN, the Department expects to pursue delisting of most or all streams included on the 1998 Impaired Waterbodies List for un-ionized ammonia in the 2002 Impaired Waterbodies List.

Nitrate Water Quality Characterization

See the Drinking Water Designated Use Assessment in Part III, Section 3.4.

pH Water Quality Characterization

pH is a measure of the acidity of water. NJ SWQS include criteria for pH due to effects on aquatic life at pH measurements that are too basic (i.e., greater than 8.5) or too acidic (i.e., less than 5.5). Criteria for the naturally acidic Pinelands waters require pH between 3.5 and 5.5 pH units. Criteria for the Delaware River require pH between 6.0 and 8.5 pH units. Thus, criteria for pH require pH between a specified range and exceedences of the criteria can occur if pH is either too low or too high.

Between 1995 and 1997, 1216 pH measurements were collected in 76 stations in the ASMN and 203 (16.7%) of these exceeded the allowable range. Results for individual stations are depicted in Figure A3.1.3-3 and in Table A3.1.3-4 in the Appendix. Results are summarized below.

Table 3.1.3-5: pH Status (1995-97)

pH SWQS Status	# of Stations	% of Stations	# of Assessed River Miles	% of Assessed River Miles
SWQS Met	54	71.1%	114.4	64.9%
SWQS Met but Threatened	0	0%	0	0%
SWQS Partially Met	11	14.5%	34.1	19.3%
SWQS Not Met	11	14.5%	27.9	15.8%
Totals	76	100%	176.4	

Total Suspended Solids Water Quality Characterization
In order to protect aquatic life from excessive sedimentation, total suspended solids criteria were established in the NJ SWQS. Criteria for the Delaware River have not been established by DRBC.

Relatively few TSS samples were collected in the ASMN between 1995 and 1997. In order to accurately characterize TSS, this assessment was limited to the 8 stations, representing 9.2 miles, with at least 5 measurements during this time period. Of 8 stations with sufficient data, 5 stations representing 3.46 miles, exceeded the SWQS in less than 10% of samples, indicating SWQS were fully met with respect to TSS; 2 of 7 stations representing 3.31 miles partially met SWQS with respect to TSS because between 11% and 25% of measurements exceeded SWQS criteria; SWQS with respect to TSS were not met in 1 of 7 stations representing 2.43 miles because >25% of samples exceeded SWQS criteria. Additional data collection is needed to fully evaluate status with respect to TSS criteria. Results for individual stations are summarized in Table A3.1.3-4 in the Appendix.

3.1.4 Source and Cause Assessment for Water Quality

Dissolved Oxygen Source and Cause Assessment
Potential causes of exceedences of DO criteria were identified using water quality data, field observations and best professional judgement. This cause assessment is considered preliminary. Further assessments will be done to evaluate relationships between flow, nutrients, BOD and DO and to evaluate point and nonpoint source contributions to DO exceedences as TMDLs are planned, developed and implemented.

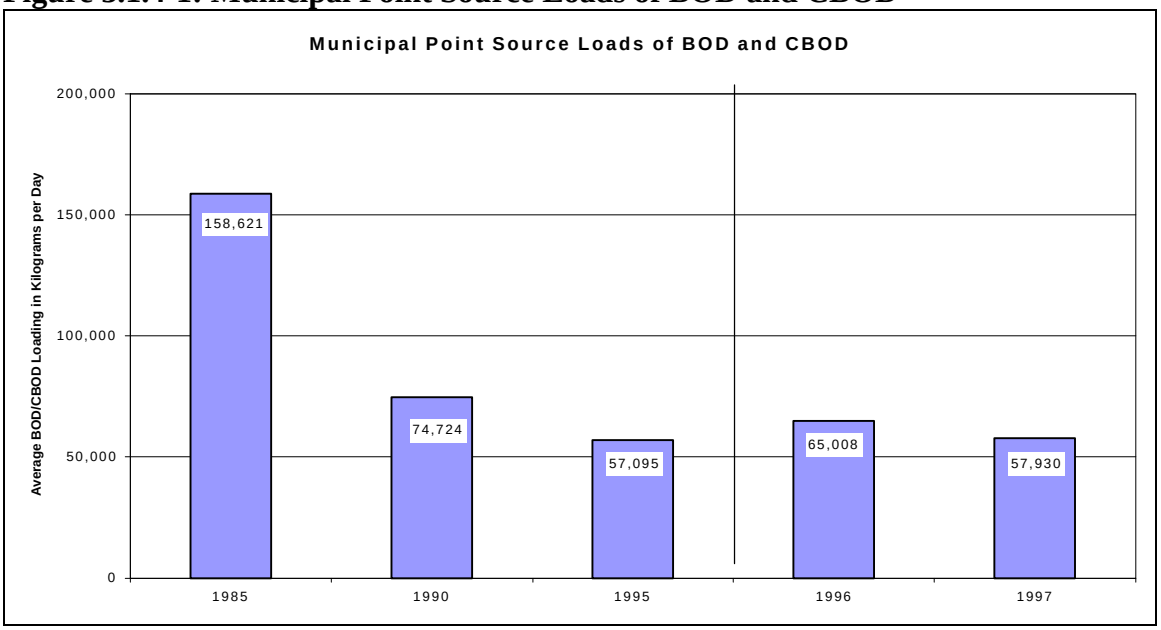
Table 3.1.4-1: Potential Causes of DO Exceedences- Preliminary Assessment

WMA	Station Number	Station Name	Potential Cause of DO Exceedences
6	01379000	Passaic R Nr Millington	Sluggish flow, swampy area; elevated nutrients from wetlands, wastewater treatment and nonpoint sources
19	01466500	McDonalds Br in Lebanon Forest	Significant ground water inputs with naturally low DO
6	01382000	Passaic R At Two Bridges	Sluggish flow due to water withdrawals; Elevated nutrients from wastewater treatment and nonpoint sources
15	01410784	Great Egg Harbor R Nr Sicklerville	Significant ground water inputs with naturally low DO
6	01381800	Whippany R Nr Pinebrook	Sluggish flow, swampy area; elevated nutrients from wetlands, wastewater treatment and nonpoint sources

Municipal Point Source Loads of BOD and CBOD Indicator: Biological Oxygen Demand (BOD) and Carbonaceous Biological Oxygen Demand (CBOD) indicate the amount of oxygen needed for biological degradation of organic materials in water and wastewater. Excessive BOD and CBOD loadings from point and nonpoint sources may reduce ambient dissolved oxygen

levels, stressing the aquatic community. As shown on Figure 3.1.4-1, municipal point source BOD and CBOD levels have decreased as a result of the Federal mandate for secondary treatment in 1988. As a result of improved wastewater treatment operations, BOD and CBOD loadings have been relatively stable since 1990, although the number of residents in sewered areas has increased. Additional detail is available from the NEPPS Environmental Indictor Technical Report. (NJDEP, 1997 and www.state.nj.us/dep/dsr).

Figure 3.1.4-1: Municipal Point Source Loads of BOD and CBOD



USGS evaluated 1998 in-stream BOD data from the Redesigned Ambient Stream Monitoring Network. Results from quarterly sampling were grouped by land use: background, forest, agricultural, urban. Results show that median levels for all land use types were below 2 mg/l BOD, however, in urban areas in-stream BOD sometimes exceeded 10 mg/l BOD. Point and nonpoint source contribution to these in-stream levels will be evaluated further through TMDL development.

Source Assessment for Exceedences of Total Phosphorus

As discussed in Section 3.1.1, elevated TP may contribute to excessive primary productivity in streams, lakes and reservoirs, Additional data and assessments are needed to evaluate whether excessive primary production is occurring and contributing to use impairments in streams. Eutrophic conditions have been found in 126 of 129 assessed public lakes.

Potential sources of nutrients(including TP) include domestic sewage effluent, municipal stormwater runoff, sediment flux, air deposition and contaminated groundwater. These sources were identified using water quality data, field observations and best professional judgement. This source assessment is considered preliminary. Further assessments will be done to evaluate relationships between flow, nutrients and primary productivity in rivers, lakes and reservoirs and

to evaluate point and nonpoint source contributions to TP exceedences as TMDLs are planned, developed and implemented.

Relative Contributions of Point and Non-Point Sources- Under contract to NJDEP, USGS conducted a study to evaluate the relative contributions of point and nonpoint sources of pollution to freshwater streams. (USGS, 1999) The study included a statistical evaluation of water quality data collected between 1976 and 1993 in the Ambient Stream Monitoring Network (ASMN) at 79 stations. Water quality data for 20 parameters collected under high and low flow conditions were used to indicate the relative contribution of constant sources (i.e., point sources and groundwater inflow) and intermittent sources (i.e., nonpoint and stormwater sources).

Relative contributions of point and nonpoint sources to total phosphorus concentrations from the USGS study indicate that point sources contribute relatively more total phosphorus at 15 locations (20%), nonpoint sources contribute relatively more total phosphorus at 12 locations (16%) and both point and nonpoint sources are important at 46 locations (63%). These results are shown on Figure A3.1.4-1 in the Appendix. The results of this study provide a general indication of relative contributions of point and nonpoint sources. However, additional assessment and modeling will be conducted to evaluate indicators of excessive primary productivity issues in the watersheds and to develop TMDLs as needed.

A preliminary assessment in WMA 2 indicated that the relative importance of point sources of TP has declined within that watershed management area and that nonpoint sources of TP should be carefully examined The inclusion of effluent limitations for phosphorus in some permits and the regionalization of other facilities have contributed to this decline. (NJDEP, 2000). Similar assessments will be conducted for the remaining watershed management areas. (See below).

As discussed in section 3.1.3, total phosphorus is a limiting nutrient in many freshwater systems and can contribute to excessive primary production (i.e., growth of aquatic algae and vegetation). In saline waters (i.e., salinity greater than 3 ppt), nitrogen is usually the limiting nutrient. Therefore, TP loads from point and non-point sources in estuarine and ocean waters are not likely to contribute to excessive primary productivity in coastal waters. Nitrogen loads to these waters may warrant additional investigation as a contributor to periodic low DO in the summer.

Contributions from Non-Point Sources- Nonpoint sources of pollution emanate from diffuse sources that are often dispersed and difficult to control. Nonpoint sources of pollution include municipal stormwater and contaminated runoff from construction, urban, suburban, agricultural lands, golf courses, waste disposal, contaminated sites, small septic systems, aquatic pesticide applications, sediment fluxes and air deposition. In New Jersey, municipal stormwater is categorized as a type of nonpoint source pollution even though it is discharged from a pipe because nonpoint sources pollute municipal stormwater. Additional data assessment is needed to characterize NPS loads of TP from various land uses, including consideration of nutrient cycling between water and bottom sediments in waters impaired by excessive primary productivity.

Elevated TP in Bottom Sediments- Between 1995 and 1997, streambed sediments were sampled once at 33 stations in the ASMN. The concentrations ranged from 40 parts per million (ppm) TP to 4,200 ppm TP; the average concentration was 510 ppm TP. TP in stream sediments is included in Table A3.1.3-2 in the Appendix and shown on Figure A3.1.4-1. Concentrations in sediments are significantly higher than those in the water column.

Future TP Assessment: An analysis of TP loads from regulated facilities, TP yields from land uses and sediment nutrient characterization is planned by NJDEP's Water Assessment Team. Data will be reviewed to evaluate the declining trends in phosphorus concentrations observed at 40 of the 79 stations in the ASMN. See Part III, Chapter 3.1.1 of this report. Results will be published and posted to the web.

TP Management Measures: Currently, NJDEP has included total phosphorus monitoring requirements or limits in NJPDES permits for 157 facilities that discharge treated effluent to freshwater rivers. In addition, the USDA is developing a policy to reduce or eliminate manure applications to farms based on TP concentrations in soils and TP needs of crops. The CREP program is expected to facilitate installation of buffer strips in 30,000 acres along agricultural stream corridors, further reducing TP runoff from agriculture. As TMDLs are planned and developed, areas with excessive primary productivity will be identified and targeted for management measures, including as appropriate, TP reduction strategies.

pH Source Assessment

pH measurements that are outside acceptable criteria ranges may occur because of natural conditions (e.g., naturally acidic soils) or due to runoff of liming agents and nutrients from fertilizer, failing septics and animal wastes. Additional assessments are needed to identify pH excursions attributable to natural conditions from those caused by pollution. Elevated pH measurements in the Pinelands Region, such as the Great Egg Harbor watershed, may be due to runoff of agricultural and lawn chemicals.

pH Management Measures: Areas that exhibit contravention of SWQS with respect to pH will be evaluated as TMDLs are planned and developed. The factors that contribute to these contraventions will be identified and managed according to the schedule developed in the TMDL MOA (See Appendix A2.5-1).

TSS Source Assessment

Elevated TSS may occur naturally in watersheds with highly erodable soils. Elevated TSS may also be caused by stream bank and streambed erosion and runoff due to land disturbance, stormwater discharges and other flow-related conditions. Additional assessments are needed to evaluate potential causes of elevated TSS in the 3 locations identified in this assessment (Raritan River at Queens Bridge, Stony Brook at Princeton and Neshanic River at Reaville).

TSS Management Measures: Areas that exhibit contraventions of SWQS with respect to TSS will be evaluated as TMDLs are planned and developed. The factors that contribute to these

contraventions will be identified and managed according to the schedule developed in the TMDL MOA (See Appendix A2.5-1).

3.2 River and Stream Aquatic Life Use Assessment

Aquatic Life Designated Use Milestone: By 2005, 50% of assessed nontidal river miles will support healthy, sustainable, biological communities.

Aquatic life designated use support assessments evaluate attainment of Federal and State Surface Water Quality Standards provisions for the protection and propagation of a balanced population of shellfish, fish and wildlife. This assessment and portions of the following discussion are taken directly from NJDEP (1999).

The NJDEP has a wide range of data available to utilize in assessing aquatic life use support including chemical, habitat and biological. USEPA Guidance for the Preparation of Water Quality Inventory Reports strongly emphasizes the use of biological data as the basis for assessing wade-able streams and rivers especially when the data quality is high, as in New Jersey. Therefore, NJDEP evaluated aquatic life designated use support in non-tidal rivers and streams using benthic macroinvertebrate monitoring.

Benthic macroinvertebrate organisms, including crustacea, larval insects, snails and worms, are ubiquitous throughout the state's streams and are an important component of the aquatic food web. These communities integrate the effects of multiple stressors including habitat quality (e.g., temperature, flow, erosion, sedimentation); chemical quality (e.g., contaminants in water and /or sediment) and natural shifts in population. Further, benthic macroinvertebrates may reveal the impacts of chronic stressors which may be overlooked by the short-term "snapshot" view provided by ambient chemical sampling. Thus, benthic data provide a useful indicator to screen the overall health of aquatic communities.

3.2.1 River and Stream Aquatic Life Use Assessment Method

Benthic macroinvertebrate communities were examined using USEPA's Rapid Bioassessment Protocols - Level II (see Plaftkin, et al, 1989; NJDEP, 1992). Using this protocol, communities are examined for pollution tolerant and intolerant forms and the results are used to compute the New Jersey Impairment Score (NJIS). Using this scoring system, the benthic macroinvertebrate population results were used to identify aquatic life designated use support for monitored stream miles as follows: **full support** (non-impaired), **partial support (**moderately impaired) and **no support** (severely impaired); see Table 3.2.1-1 below.

Table 3.2.1-1: River and Stream Aquatic Life Use Assessment

Aquatic Life Use Support Assessment	Rapid Bioassessment Rating
Full Support	Non-Impaired
Partial Support	Moderately Impaired
No Support	Severely Impaired

Currently in New Jersey, monitoring occurs in the Ambient Biological Monitoring Network (AMNET) at over 800 locations statewide on a 5-year rotating schedule. Round 1 sampling was completed in the mid-1990's and the resulting designated use assessment results were reported in

the 1992, 1994, 1996 and 1998 305(b) Reports. Round 2 sampling is now ongoing. For this 2000 Water Quality Inventory Report, published assessments for Round 2 are reported, which includes the Upper Delaware Basin (WMAs 1, 2 and 11) which was sampled between 1997 and 1998 (see Fig. A3.1.2-2). Round 2 data collection for the remaining portions of the state will be completed in 2001 and final reports should be completed in 2002. As Round 2 sampling results are published, they will be reflected in future Water Quality Inventory Reports. Readers are referred to the 1996 or 1998 305(b) Reports for the current status of statewide aquatic life assessment results based upon the first round of sampling. Because the data supporting the Aquatic Life Designated use assessment here are 5 years old or less, they are regarded as monitored.

In addition to direct biological assessments, the current round of field work includes a qualitative assessment of stream habitat quality at each monitoring location, the results of which are used to compute a Habitat Assessment Score. Various components of the habitat are examined such as the amount of available cover along the stream bottom, amount of sediment deposition, bank stability, frequency of riffles, presence and amount of riparian vegetative cover, etc.

Spatial Extent of Assessment: In former 305(b) reports, each AMNET site was assumed to represent 5 river miles (2.5 miles upstream and 2.5 downstream) with totals in each assessment category added up accordingly. This approach did not consider hydrology (e.g., the presence of lakes within the 5 mile length) and in fact some stations are less than 5 miles apart.

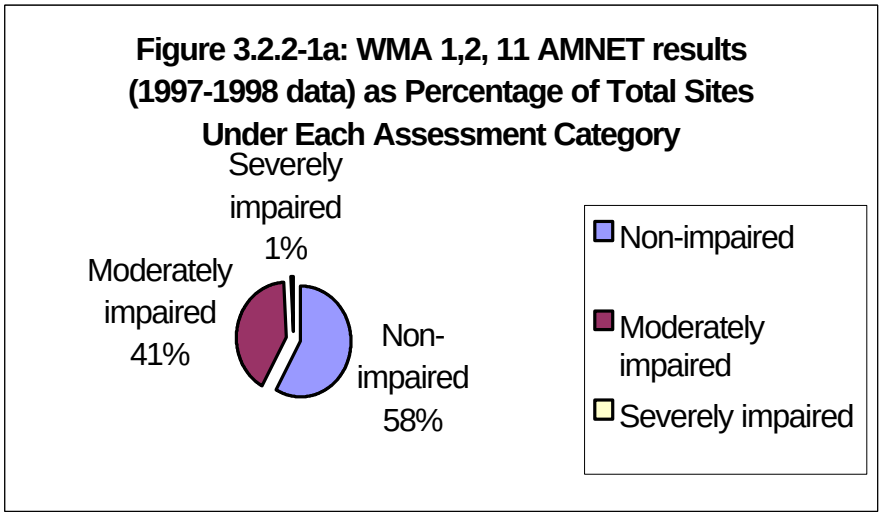
In order to address these issues, river miles assigned to each use support category were determined by assigning the specific AMNET site use assessment to the RF3 river segment containing that site for this report. Hence, if an AMNET site was assessed to be fully supporting and was associated with a 2 mile long RF3 segment, those 2 miles would be assessed as fully supporting. The total river miles fully, partially and not supporting represent the sum of all these RF3 segment lengths associated with AMNET sites which fell into one of the three categories. For this Report, 139 monitoring stations, representing 330 stream miles were assessed.

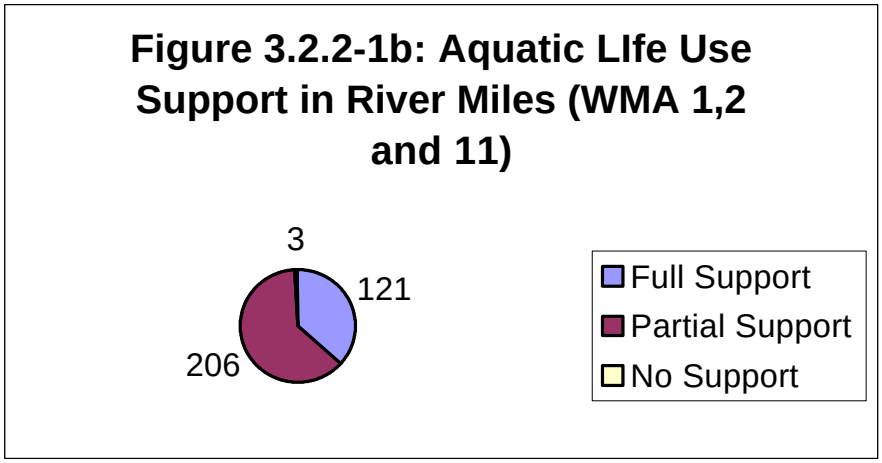
The current process results in a much smaller number of river miles assessed, while at the same time the use of RF3 coverage to estimate total river miles has somewhat enlarged the estimate of total river miles in the state (See Part 2: Background). As discussed in the Plan for Comprehensive Assessments provided in Part III, Chapter 2, the Department is developing methods to extend assessments determined at individual points such as AMNET sites and extrapolating the observed condition to contiguous portions of the reach not directly assessed. Results will be presented in future 305(b) reports.

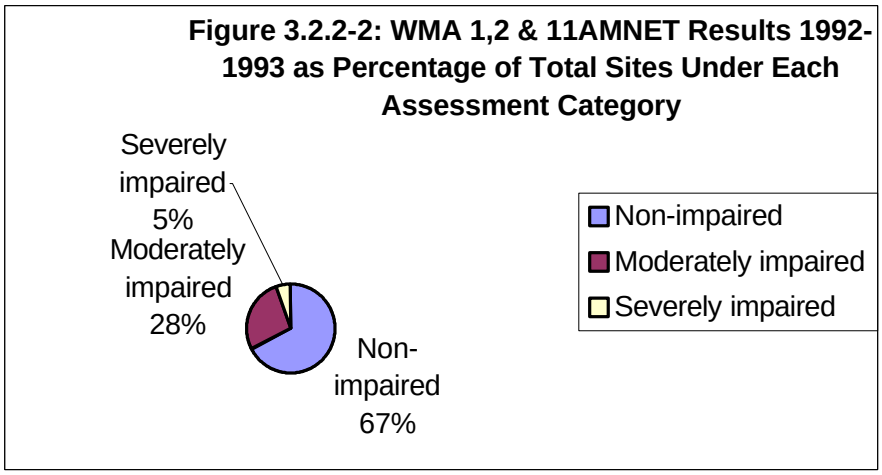
3.2.2 River and Stream Aquatic Life Use Assessment Results

Overall, out of 139 monitoring stations sampled in WMAs 1,2 and 11 during the most recent study period, 80 stations or 58% were rated as non-impaired, 57 stations or 41.3% were rated as moderately impaired, and one station (0.7%) was rated as severely impaired (see Figure 3.2.2-1 and Fig. A3.1.2-2). When translated into river miles (using RF3 segment lengths) the results are as follows: of a total of 330 miles assessed; 121 miles (36.7%) fully support the

use, 206 miles (62.4%) partially support the use and 3 miles (1%) do not support the use (see Figure 3.2.2-1b).







Comparison with 1992 - 1993 AMNET Results

In evaluating the 1997-1998 upper Delaware data against that for 1992–1993, a notable improvement or decline was considered to have occurred when the score (NJIS) changed the bioassessment rating. A complete list of site-by-site comparisons is presented in Table 3.2.2-2, where a (+) indicates an improvement, a (-) indicates a decline, and a (/) indicates no change in rating; a slash accompanied by a (+) or a (-) indicates that the score improved or declined, but the bioassessment rating did not.

For comparison, Figure 3.2.2-1a depicts the results of 139 monitoring sites during the current assessment period (1997-1998) as percentage of the total sites assessed. Figure 3.2.2-2 depicts the results of 127 monitoring sites within the same Watershed Management Areas that were sampled during the 1990 - 1993 study period. Note that Figures 3.2.2-

1a and 3.2.2-2 are based upon number of AMNET sites within each assessment category, not the number of river miles as seen in Figure 3.2.2-1b.

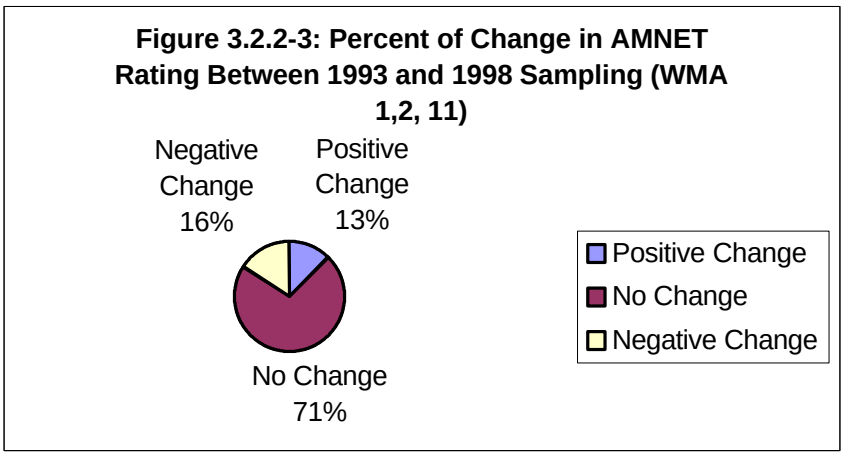


Figure 3.2.2-3 displays the percentage of change in rating that has occurred for the 127 sites that were sampled during both the 1993 and 1998 monitoring efforts. The light gray indicates a positive change, dark gray indicates no change, and white indicates a change for the worse (see Table 3.2.2-2). Notably, fewer severely impaired sites were found in 1998 than in 1993; however, the 1998 data also revealed more moderately impaired sites and fewer non-impaired sites (Figures 3.2.2-1 & 3.2.2-2). Strategies to identify factors that contribute to impairment and management measures to address impairment are discussed below in Section 3.2.4.

Results from Finfish Assessments

The US Geological Survey has recently completed an assessment of finfish communities in the Delaware, Passaic and Raritan River Basins (Chang, et al, 2000). This assessment was based on NJDEP and USEPA fish population data. The specific assessment tool employed is an "Index of Biotic Integrity" (IBI) which enumerates characteristics of fish communities such as species composition and ecological structure in order to measure the community's overall health. Comparisons were made between data collected in the 1970s and the 1990s. Conclusions in the Report state that "Although human population and urbanization have increased, higher IBI scores and improvements in stream condition in the Passaic, Raritan, and Delaware River Basins from the 1970s to the 1990s appear to reflect overall improvements in water quality" (pg. 3). Results are illustrated in Figure 3.2.2-4 below and are provided courtesy of the USGS. NJDEP is developing methods of assessing the biological health of New Jersey waters using multimetric methods which would incorporate finfish IBI assessments (discussed here), macroinvertebrates (currently employed), as well as other metrics (see "Next Steps" below).

Insert better fish map here

Figure 3.2.2-4: Summary IBI Scores for the Delaware, Passaic, and Raritan River Basins
Figure obtained courtesy of Jonathan Kennen, US Geological Survey

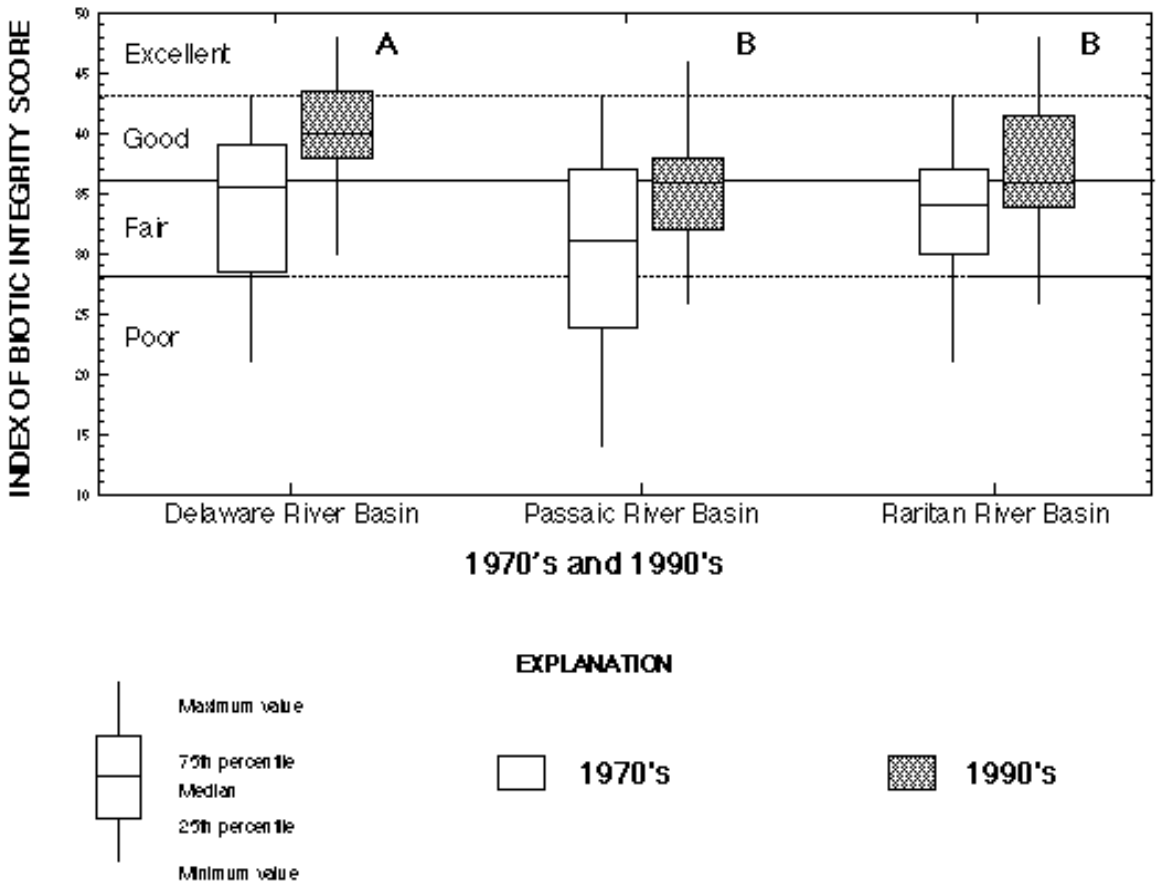


Figure 2

Recently Adopted Changes in Trout Water Classifications

Over the past several years New Jersey has adopted changes to the Trout Water Classifications of 18 river segments (Table 3.2.2-1 below). Of this total, 16 river segments received upgrades, one was downgraded (TM to NT), and one segment was confirmed in its current classification.

Of the upgrades delineated on Table 3.2.2-1, some may be due to improvements in water quality, however, concurrent water quality data needed to confirm this is as yet not available. Many of the upgrades are the result of additional information gathered in waterbodies whose classifications had been previously defaulted to adjacent segments with confirmed classifications based on monitoring. This is indicated in Table 3.2.2-1 when a previous classification is enclosed within brackets and the current one is bracket-free.

Table 3.2.2-1: Adopted Trout-Related Reclassifications (1992 to 1996)

Drainage Basin	Waterbody	Date Sampled	Previous Classification	Current Classification
Atlantic	Clear Stream (Jackson)	7/24/96	FW2-NT	FW2-TM
Delaware R	Paulins Kill trib. (Stillwater)	7/1/92	[FW2-TM]	FW2-TM
Passaic R	Crooked Brook trib. (East of Sheep Hill)	7/20/95	[FW2-NT]	FW2-TP(C1)
Passaic R	Meadow Brook (Wanaque)	8/16/93	FW2-NT	FW2-TP(C1)
Passaic R	Passaic River (Mendham)	8/10/94	FW2-NT	FW2-TP(C1)
Passaic R	Pequannock River (Newfoundland)	7/17/95 & 8/31/95	FW2-TM	FW2-TP(C1)
Passaic R	Scarlet Oak Pond (Mahwah)	8/18/94	[FW2-NT]	FW2-TM
Passaic R	Wanaque River (Pompton Lakes)	8/13/92	FW2-NT	FW2-TM
Raritan R	Drakes Brook trib. (Mt. Olive)	8/16/94	[FW2-NT]	FW2-TP(C1)
Raritan R	Lamington River trib. (Ironia)	9/15/95	[FW2-NT]	FW2-TP(C1)
Raritan R	Mine Brook trib. (East of Mine Mt.)	9/15/95	[FW2-NT]	FW2-TP(C1)
Raritan R	Raritan River - South Branch (Middle Valley)	8/11/95, 8/17/95 & 9/5/95	FW2-TM	FW2-TP(C1)
Raritan R	Mine Brook trib. (South of Mine Mt.)	9/15/95	[FW2-NT]	FW2-TP(C1)

Drainage Basin	Waterbody	Date Sampled	Previous Classification	Current Classification
Raritan R	Raritan River - South Branch trib. (Long Valley)	7/17/96	[FW2-TM]	FW2-TP(C1)
Raritan R	Raritan River - South Branch trib. (S. of Hoffmans)	7/18/96	[FW2-TM]	FW2-TP(C1)
Raritan R	Raritan River - South Branch trib. (S. of Schooley's Mt.)	7/17/96	[FW2-TM]	FW2-TP(C1)
Raritan R	Sidney Brook (Grandin)	7/18/96	[FW2-TM]	FW2-NT
Walkill R	Wallkill River trib. (Sparta)	7/1/92	[FW2-NT]	FW2-TP(C1)

Note: Brackets around a previous classification indicate that the waterbody was not specifically named in the Surface Water Quality Standards and had therefore, by default, assumed the classification given herein.

Other Indicators of Aquatic Life Use Attainment

As discussed in Part III, Chapter 3.1, dissolved oxygen and un-ionized ammonia are relevant to aquatic life uses: DO is required for most forms of aquatic life and un-ionized ammonia is toxic to aquatic life in elevated concentrations. Based on data collected between 1995 and 1997 in the Ambient Stream Monitoring Network, with few exceptions monitored rivers attain these SWQS criteria, or have water quality better than required by the SWQS.

3.2.3 Source and Cause Assessment

Benthic impairment has been generally attributed to

- water and sediment quality degradation,
- habitat alterations (e.g., erosion, sedimentation),
- flow alterations (decreasing base flow, flashiness) and
- natural factors (drought, population fluctuations).

Often, multiple factors play a role in observed impairments such as multiple ongoing anthropogenic activities in concert with residual contamination from historical point and/ or non-point sources.

Using NJDEP data collected at over 700 sites, USGS evaluated the relationships between watershed characteristics and benthic status (USGS, 1998) and found the following:

- the total area of forest and wetlands in a basin were the best predictor of an unimpaired benthic community
- the amount of urban land in close proximity to a sampling site was the best predictor of an impaired benthic community

- distance from pollution sources to sampling sites was significant.

Through the Long Island - New Jersey National Ambient Water Quality Assessment (LI-NJ NAWQA) program, extensive data collection was conducted at 36 sites, primarily in the Piedmont region of New Jersey. Concentrations of conventionals, volatile organic contaminants, pesticides in water and sediment, fish, algae and benthic populations, habitat quality data were collected. Advanced multi-variate statistics were used to identify factors that may contribute to benthic impairment. Results indicate that peak and base flows, percent cobble in the substrate and impervious surface cover in the upstream watershed were important factors that contribute to benthic impairment. Water and sediment quality were not identified as statistically significant contributing factors to benthic impairment in the LI-NJ NAWQA study area. Additional details will become available as results from the project are published in the near future. (M. Ayers, pers. comm).

3.2.4 Maintaining and Improving Aquatic Life Use Attainment

Currently, about 500 moderately and severely impaired locations are included on the 1998 Impaired Waterbodies List, including those in the Upper Delaware Watersheds. NJDEP and USEPA are jointly developing a protocol to identify factors that contribute to benthic impairment and identify appropriate management strategies. If water quality degradation contributes to impairment, TMDLs will be conducted.

As discussed below, efforts are underway to improve our understanding of the status of aquatic life use attainment, the factors that contribute to impairment and what are appropriate management measures. Through the implementation of Watershed Management, overall improvements in watershed quality are intended to lead to improvements in aquatic health.

Integration of Biological Datasets*:* NJDEP is expanding biological assessment tools to include fish population data to more comprehensively evaluate biological health using existing fisheries databases and to collect new data. A study is also underway to characterize algal communities and presence of rare and threatened species. Results of these projects will be integrated with benthic assessments to improve aquatic life designated use attainment assessments.

Integration with Water Chemistry Datasets: Dissolved oxygen measurements over a 24 hour cycle (diurnal DO) will be collected to improve this indicator of biological health. The redesigned Ambient Stream Monitoring Network includes water chemistry data at about 115 stations statewide. Many of these stations are co-located with benthic monitoring locations in the AMNET network. Field parameters (DO, pH, Temperature, Specific Conductance) data collected when AMNET stations are sampled are being computerized. NJDEP recently received funding to conduct quarterly sampling of conventional parameters at 200 additional locations for 2 years. Many of these locations are co-located with AMNET network stations. Thus, through these efforts, significant additional water chemistry data will become available at AMNET locations. If exceedences of SWQS criteria are identified through these monitoring efforts, TMDLs will be developed as appropriate.

Identification of Factors that Contribute to Impairment: In order to better evaluate the many potential causes of benthic impairment, NJDEP and USGS are cooperatively conducting a study over the next 2 years: "Development of Watershed Indicators and Realistic Stream Restoration Goals". This study will build upon the work done in the LI-NJ NAWQA project, using statewide benthic data collected in NJDEP's AMNET program and include advanced statistical and spatial analyses using many datasets to identify factors that contribute to benthic impairment. Factors that will be considered include point sources, golf courses, lake outlets, contaminated sites, landfills, stream flow, habitat quality, water quality, sediment quality, etc.

Field Investigations: The Watershed Indicators project described above includes the development of a "Watershed Characteristics Data Sheet" to provide a coordinated mechanism for recording information relevant to characterizing potential causes of benthic impairment. NJDEP's Water Compliance and Enforcement, Division of Watershed Management and Watershed Partners are conducting watershed stream walks to identify potential causes of impairment such as erosion, storm drains, etc.

Evaluation of Stations With Changes in Impairment Rating: Additional investigations and data assessments are needed to evaluate the apparent changes in biological health as reflected in AMNET scoring changes between 1990 and 1998 (16% of sites with a negative change, 13% with positive change). The Watershed Indicators project described above will include an evaluation of changes in watershed characteristics that may be related to changes in impairment rating.

Targeting Nonpoint Source Management (319h) Grants: The (319h) funding source provides over $3 million for Nonpoint Source Management Projects. This year, funding criteria for 319h grants included the identification of impairments to be addressed and the targeting of management measures to address these impairments. To the extent possible, projects are being targeted toward impairments identified through the AMNET monitoring program.

Future Strategies: As the Water Quality and Watershed Management Rules and Municipal Stormwater Management and Permitting programs are developed and implemented, improvements in management of stormwater flows, erosion and sedimentation are expected as new development occurs. In already developed areas, cross-connections and interconnections between sewage and stormwater infrastructure will be investigated and remediated.

Table 3.2.2-2: Comparative Scores / Ratings (see notes),
Watershed Management Areas 1, 2, and 11

Station	NJ Impairment Score		Change in Rating	Habitat Score		Station	NJ Impairment Score		Change in Rating	Habitat Score		Station	NJ Impairment Score		Change in Rating	Habitat Score	
	92 / 93	97 / 98					92 / 93	97 / 98					92 / 93	97 / 98			
001	9	9	/	97		040	24	21	—	155		081	27	30	/+	165	
002	18	21	/+	140		040A	-	18		162		082	30	30	/	171	
003	30	24	/-	167		041	30	30	/	156		083	24	30	/+	148	
004	30	30	/	194		042	0	21	+	98		084	21	21	/	144	
005	27	30	/+	162		043	30	27	/-	148		085	24	18	—	136	
005A	-	30		143		044	15	15	/	146		086	21	30	+	151	
006	30	30	/	170		045	30	30	/	113		087	27	24	/-	146	
007	30	30	/	184		046	30	24	/-	133		088	24	30	/+	148	
008	30	30	/	177		047	27	30	/+	165		089	30	30	/	138	
009	30	30	/	182		048	27	30	/+	163		090	9	15	/+	168	
010	-	30		196		049	30	30	/	147		091	24	21	—	165	
011	30	27	/-	183		050	30	30	/	159		092	21	21	/	163	
012	30	30	/	163		051	30	30	/	156		093	27	9	—	170	
013	-	-		-		052	27	24	/-	97		094	30	30	/	168	
014	21	30	+	146		053	9	24	+	116		095	30	24	/-	168	
015	18	15	/-	141		054	30	30	/	180		096	27	27	/	166	
016	27	15	—	147		055	12	15	/+	133		097	24	24	/	166	
017	18	24	+	107		056	30	30	/	147		098	30	30	/	166	
018	18	18	/	105		057	21	21	/	121		099	21	18	/-	141	
019	27	18	—	118		058	27	27	/	158		100	27	24	/-	144	
020	24	-		-		059	15	30	+	156		101	18	27	+	166	
021	30	30	/	171		060	30	30	/	146		102	24	27	/+	170	
022	15	18	/+	168		061	30	24	/-	120		103	18	30	+	166	
023	21	-		-		062	18	21	/+	124		104	9	18	/+	162	
023A	-	30		186		063	18	30	+	170		105	30	24	/-	166	
024	30	30	/	140		064	27	30	/+	181		106	24	24	/	140	
025	30	27	/-	144		065	24	27	/+	177		107	24	24	/	145	
026	24	27	/+	98		066	27	27	/	173		108	6	9	+	158	
027	21	30	+	87		067	24	30	/+	107		109	24	9	—	167	
028	30	30	/	182		068	24	21	—	123		109A	-	12		155	
029	30	30	/	146		069	30	30	/	148		109B	-	15		152	
030	15	21	/+	95		070	18	15	/-	165		110	6	12	+	147	
031	30	30	/	142		071	27	30	/+	159		111	6	12	+	128	
032	27	18	—	185		072	27	15	—	176		112	6	12	+	127	
032A	-	30		155		073	24	30	/+	185		113	3	15	+	132	
033	30	27	/-	155		074	30	27	/-	184		114	15	18	/+	121	
034	30	-		-		075	30	30	/	174		115	12	15	/+	92	
035	18	12	/-	127		076	30	30	/	176		115A	-	18		131	
036	24	9	—	126		077	27	30	/+	85		116	15	15	/	122	
037	30	30	/	164		078	30	30	/	171		117	0	6	/+	139	
038	24	21	—	144		079	21	30	+	146		118	12	9	/-	104	
039	27	27	/	149		080	30	30	/	180		294	30	21	—	164	

NOTES:

Station # 001 - 074, inclusive, lie in WMA 1; stations 075 - 118 lie in WMA 11. Station 294 - 309A lie in WMA 2.

Comparison of NJ impairment score with earlier study results:

+ indicates positive change in rating

— indicates negative change in rating

/ indicates no change in rating

/+ or /- indicates change in score, but not in rating

NJ Impairment Score	Value	Habitat Score	Value
Non-Impaired	24 - 30	Optimal	160 - 200
Moderately Impaired	9 - 21	Sub-optimal	110 - 159
Severely Impaired	0 - 6	Marginal	60 - 109
		Poor	< 60

Table 3.2.2-2 (continued)

Comparative Scores / Ratings (see notes)

Watershed Management Areas 1, 2, and 11

Station	NJ Impairment Score		Change in Rating	Habitat Score		Station	NJ Impairment Score		Change in Rating	Habitat Score		Station	NJ Impairment Score		Change in Rating	Habitat Score	
	92 / 93	97 / 98					92 / 93	97 / 98					92 / 93	97 / 98			
295	-	21		135													
296	-	9		148													
297	18	21	/+	191													
298	27	18	—	142													
299	24	18	—	174													
300	27	15	—	163													
301	18	21	/+	141													
302	24	21	—	156													
303	30	30	/	193													
304	21	12	/-	122													
305	27	27	/	184													
306	30	21	—	190													
307	30	18	—	90													
308	27	18	—	167													
309	18	15	/-	113													
309A	-	30		196													

NOTES:

Station # 001 - 074, inclusive, lie in WMA 1; stations 075 - 118 lie in WMA 11. Station 294 - 309A lie in WMA 2.

Comparison of NJ impairment score with earlier study results:

+ indicates positive change in rating
— indicates negative change in rating
/ indicates no change in rating
/+ or /- indicates change in score, but not in rating

NJ Impairment Score	Value
Non-Impaired	24 - 30
Moderately Impaired	9 - 21
Severely Impaired	0 - 6

Habitat Score	Value
Optimal	160 - 200
Sub-optimal	110 - 159
Marginal	60 - 109
Poor	< 60

3.3 Rivers and Streams Recreational Designated Use Assessment

All waters in New Jersey are designated for primary contact recreation (i.e., swimming) and secondary contact recreation (e.g., wading, boating). In order to protect human health, fecal coliform bacteria criteria were established in New Jersey Surface Water Quality Standards (SWQS). SWQS are described in Section 3.1.1 of this report. Fecal coliform bacteria levels in water provide an indication of pollution from human or animal fecal material, which may contain organisms that are harmful to human health.

Some of New Jersey's rivers and streams, particularly those in the Pinelands, are used for swimming and secondary contact recreational activities, such as canoeing. Other rivers are not accessible or safe for these activities (e.g., steep banks, rapids, private property). Water quality data on fecal coliform levels are collected at Ambient Stream Monitoring Network stations which are typically not located where swimming or secondary contact recreation occurs. In addition, this assessment considers sanitary quality of rivers, but does not consider recreational beach amenities or access to the stream. Thus, these data are not appropriate for assessing risks to human health associated with swimming in rivers.

As discussed in Part III, Sections 4.2 and 5.2, New Jersey's lake, bay and ocean beaches are thoroughly monitored and are very safe for swimming. Through information exchange with watershed partners, river locations used for swimming will be identified and targeted fecal coliform monitoring at these locations will be explored.

3.3.1 Rivers and Streams Recreational Designated Use Assessment Method

The surface water quality standard criteria for fecal coliform and monitoring are discussed in Section 3.1 of this report. Data collected between 1995 and 1997 were used for this assessment as shown on Table 3.3.1-1

Table 3.3.1-1: Recreational Use Assessment Method for Rivers and Streams	
Full Support	The FC geometric average was less than 200 MPN/100ml and less than 10 percent of individual samples exceeded 400 MPN/100 ml.
Full Support but Threatened	FC levels meet full support but statistically significant adverse trends indicate full support will not be attained in 2 years.
Partial Support	The FC geometric average was less than 200 MPN/ 100 ml, and more than 10 percent of individual samples exceeded 400 MPN/100 ml.
No Support	The FC geometric average exceeded 200 MPN/100 ml and more than 10 percent of individual samples exceeded 400 MPN/ 100 ml.
Notes: Adapted from: EPA Guidance for Preparation of Water Quality Inventory Reports, EPA, 1997. Compared to New Jersey SWQS for FW2; Secondary contact uses are considered to be met if SWQS for primary contact is met.	

Spatial Extent of Assessment: This assessment was based on data collected at 76 ASMN stations between 1995 and 1997. The 5 Delaware River monitoring stations were not included in this

assessment because recreational designated use is reported in the Delaware River Basin Commission's Water Quality Inventory Report. (DRBC, 2000). As discussed in Part III, Chapter 3.1, in previous New Jersey Water Quality Inventory Reports, each station was assumed to represent 5 miles of stream. For this assessment, each station was assumed to represent the stream reach that was monitored. Stream reaches have been defined by USEPA in the Reach File 3 system, which can be used on GIS. Reach File 3 (RF3) was mapped at a moderate 1:100,000 scale. Using RF3, the 76 ASMN stations represent 176 river miles. The RF3 reach identification number and reach length are provided in Table A3.1.2-1 in the Appendix. Use RF3 was considered an intermediate approach to the more refined spatial assessment that will be provided by the redesigned ASMN.

It is important to note that the monitoring design used to collect these data does not support extrapolating the assessment results to locations or streams that were not monitored. Streams that appeared to have the greatest impacts were prioritized in this network.

3.3.2 Rivers and Streams Recreational Designated Use Assessment

Between 1995 and 1997, 995 fecal coliform samples were collected in the ASMN. Geometric means at 75 stations ranged between 3.8 FC/100 ml and 2911.9 FC/100 ml. The percent of samples at individual stations exceeding 400 FC/100 ml ranged from 0% to 88.9%. As discussed below, an evaluation of trends in fecal coliform by USGS indicated that waters that currently fully support recreational uses will continue to support uses through 2002. (USGS, 1999). Results are summarized in Table 3.3.2-1 below and provided for individual stations in Table A3.3.2-1 and shown on Figure A3.3.2-1 in the Appendix.

Table 3.3.2-1: Fecal Coliform Attainment Status (1995-97)

Attainment Status	# of Stations	% of Stations	# of River Miles	% of Assessed River Miles
Full Support	16	21.3%	29.8	16.9%
Full Support but Threatened	0	0%	0	0%
Partial Support	17	22.7%	28.0	15.9%
No Support	42	56%	118.2	67.1%
Totals	75	100%	176	

Pinelands rivers, such as the Rancocas, Bass, Oswego and Mullica were fully swimmable at the monitored locations. The Great Egg Harbor River was fully swimmable at 2 locations: Sicklerville, near the headwaters and Folsom. Downstream at Weymouth, this river was partially swimmable.

It is important to note that New Jersey proactively adopted EPA's guidance as the basis for New Jersey's SWQS criteria. Adoption of this guidance into state's SWQS was encouraged but not mandated. Some states may report comparatively higher attainment of recreational designated uses than New Jersey, however, this may be a function of less stringent SWQS criteria in that

state. EPA is moving toward requiring states to adopt EPA criteria for e.coli and/ or enterococcus by 2003.

Trends between 1986 and 1995 were assessed by USGS (USGS, 1999). Statistically significant trends were identified at 12 of 75 New Jersey stations and 1 of 5 Delaware River stations. Of these, 5 locations had trends of environmental importance (i.e., change in concentration greater than 100 FC/100 ml per year). These trends are summarized on Table 3.3.2-2 below. Additional data assessments are needed to evaluate the reason(s) for improving water quality at 4 stations and worsening water quality at 1 station.

Table 3.3.2-2: Stations with Significant Trends in Fecal Coliform (1986-95)

Station #	Station Name	FC Geomean (MPN/100 ml) [1]	FC % >400 MPN/ 100 ml [1]	Trend (FC/ 100 ml per year) [2]
01393450	Elizabeth R at Ursino Lake	2508.8	85.7 %	- 4700
01464000	Assunpink at Trenton	2002.4	88.9 %	+ 870
01467069	NB Pennsauken Cr at Cherry Hill	231.6	35.7 %	- 400
01464515	Doctors Cr at Allentown	353.2	53.8 %	- 260
01398620	NB Raritan River nr Chester	106.9	14.3 %	- 210

Notes:
1. 1995-97 ASMN data
2. 1986-95 trends from USGS, 1999 (-) indicates declining concentrations and improving water quality; (+) indicates increasing concentrations and worsening water quality

3.3.3 Recreational Designated Use Source and Cause Assessment

Fecal coliform pollution causes non-attainment of recreational designated uses in rivers and streams. As stated earlier, these data are not appropriate to evaluate risks to human health from swimming in rivers and streams because monitoring stations are currently not located where swimming and secondary contact occur. Further, lake, ocean and bay bathing beaches are thoroughly monitored and very safe for swimming.

It is also important to consider the source of fecal coliform pollution. Contact with human wastes presents a significantly higher risk of illness than contact with animal wastes. Specific sources of fecal coliform pollution have not yet been identified. However, compliance with permit limits for fecal coliform at wastewater treatment plants is high and incidence of treatment plant failures are low. Thus, most fecal coliform pollution in freshwater rivers and streams is suspected to be derived from animal wastes.

Fecal coliform pollution is suspected to occur primarily from domestic pets, livestock and wild animal wastes which are transported to rivers and streams by municipal and industrial stormwater, overland runoff and by direct contact with water. Although Canada goose population data are not readily available, significant populations of these animals occur in and around many New Jersey waterways. In developed areas, domestic pet and bird wastes (e.g.,

pigeons) contribute to fecal coliform in stormwater. In agricultural areas, animal manure piles and access of livestock to streams can contribute to fecal coliform pollution.

In localized instances, fecal coliform pollution may be attributed to human wastes from combined sewer overflows, failing sanitary sewer infrastructure, failing or inappropriately located septic systems and occasionally from wastewater treatment plant failures. Compliance with permit limits for fecal coliform at New Jersey wastewater treatment plants is very high. (WCE, *Pers. Comm.*, 6/2000).

Combined sewer overflows (CSOs) are pipes that discharge combined sanitary and stormwater under wet weather conditions. The 300 CSO discharge points in New Jersey are located primarily in older cities in northeastern New Jersey and in Trenton and Camden. (See Figure A3.3.3-1 in the Appendix). Most CSOs discharge to tidal waters, except those located in Patterson. As shown in Appendix A3.3.3-1, levels of fecal coliform are higher downstream of the Patterson CSOs (i.e., at the Passaic River at Elmwood Park - station # 01389880) than upstream (i.e., Passaic River at Little Falls – station # 01389500). This assessment was conducted to support the CSO Program Memorandum of Agreement with EPA Region II. Efforts of the CSO program to manage CSO discharges are described in Part II: Water Pollution Control Programs.

3.3.4 Improving Stream Sanitary Quality

The following programs and activities are intended to improve the sanitary quality of New Jersey streams:

Evaluate Human Health Risk: Currently, fecal coliform monitoring occurs at locations that are sampled as part of the Ambient Stream Monitoring Network. Based on conversations with field sampling personnel, these locations are not widely used for swimming or boating in rivers. Through the Watershed Management process, the Department plans to identify river locations used for swimming and boating and explore cooperative monitoring at these locations. Fecal coliform data collected at locations used for swimming and boating will provide more relevant information regarding potential exposure to pathogens. Since exposure to human waste poses a greater health risk than exposure to animal waste, it may also be important to conduct additional testing to evaluate human and animal sources of pathogens, for example using bacteriopahge assays.

TMDL Development: Stream reaches with exceedences of fecal coliform have been identified on the 1998 Impaired Waterbodies List. Waterbodies remain on the Impaired Waterbodies List until new data show compliance with SWQS. Pollution control measures for point and nonpoint sources, including TMDLs, must be developed for waterbodies on the 1998 Impaired Waterbodies List in accordance with the schedule in the TMDL Memorandum of Agreement (MOA) (See Part II, Appendix A2.5-2).

Source Identification: As TMDLs are developed, sources of fecal pollution will be identified. Sanitary surveys to identify failing or inappropriately placed septic systems, cross-connections

and interconnections between sanitary and storm sewer infrastructure, livestock waste, pets and wildlife, etc. Sanitary surveys were successfully used in the Whippany River watershed to identify an area affected by failing septic systems.

Sanitary surveys have been a significant component of source identification in New Jersey's coastal waters to protect shellfish beds and bathing beaches. A discussion of source identification in Seaside Heights is provided in Part III, Chapter 7 as an example.

Source Management: Municipal Stormwater Planning and Permitting programs are implemented, connections between sanitary and storm sewers will be corrected. NJDEP is working with the New Jersey Department of Agriculture to identify and map confined animal feeding operations to ensure proper management of these facilities. Through Watershed Management and TMDL development, geese management strategies, pet waste ordinances, and storm sewer maintenance, septic system maintenance, siting and as appropriate, removal will be explored and implemented on a watershed specific basis. The Environmental Infrastructure Trust's State Revolving Fund and Nonpoint Source Grants can provide low interest loans and grants to address sanitary water quality problems. These programs and recent projects are described in Part II: Water Pollution Control Programs.

3.4 Rivers and Streams Drinking Water Designated Use Assessment

Drinking Water Designated Use Subgoal: Protect and insure adequate ground and surface water quantity for drinking water use.

All surface waters in NJ are designated as drinking water supplies under the NJ Surface Water Quality Standards (N.J.A.C.7:9B). There are 54 potable surface water supply intakes in the state, mostly clustered in northern NJ and many of these intakes are located on reservoirs. (See Figure 3.4-1 and Appendix A3.4-1.)

This Water Quality Inventory Report provides the first assessment of drinking water designated uses. This assessment provides an overview of finished drinking water quality, water quality in current source waters and water quality in surface waters that are designated as potable supplies but are not currently used for that purpose.

3.4.1 Rivers and Streams Drinking Water Designated Use Assessment Method

Ideally the Drinking Water Designated Use assessment should consider:

- Drinking water quality
- Water quality in current source waters
- Water quality in surface waters that may be used as drinking water sources.

Drinking Water Quality: Drinking water quality provided by water purveyors has been summarized as an environmental indicator for NEPPS. (NJDEP, 2000). This indicator provides excellent information regarding the quality of finished drinking waters, which are regulated for many constituents under Federal and State Safe Drinking Water Acts. In addition, New Jersey's Safe Drinking Water Act provides additional protection through the regulation of 28 constituents that are either not regulated under the Federal Safe Drinking Water Act or are regulated at lower concentrations in New Jersey.

However, there are some limitations to the finished drinking water environmental indicator. The indicator currently does not include information regarding the source of water (i.e., surface or ground water or a combination). Further, the indicator does not include information regarding the level of treatment required to meet the Federal and State Safe Drinking Water Act standards. Some facilities provide additional treatment to remove contaminants in source waters. These information needs will be addressed through the Source Water Assessment Program.

Source Water Assessment Program (SWAP) Under SWAP, New Jersey will delineate areas which have the potential to influence waters (surface and ground) serving as public drinking water sources (NJDEP, 1998). Within these areas, the state will identify the origins of a wide range of contaminants and identify the vulnerability of the water systems to these contaminants. The SWAP will delineate waters requiring only conventional treatment (coagulation, sedimentation and filtration,) and those requiring additional treatment methods. The program will also delineate sources at risk in the future.

Water Quality in Current Source Waters The Ambient Stream Monitoring Network (ASMN) provides data for surface water quality in New Jersey. The ASMN is described in Part III, Chapter 3.1. Only 4 of 81 ASMN stations are located near potable supply intakes: the Saddle River at Lodi monitoring station is near Haworth Water Supply Intake; Passaic River at Little Falls monitoring station is near Passaic Valley Water Commission Water Supply Intake; Matchaponix Brook at Spotswood is near United Water- Matchaponix Water Supply Intake; Delaware River at Trenton monitoring station is co-located with the Trenton Water Company Water Supply Intake. As discussed above, additional information regarding source water quality will become available through SWAP.

Nitrate was chosen as an indicator of Drinking Water Designated Use Attainment because it is difficult and expensive to remove from potable supplies. To protect against adverse health effects, nitrate is regulated at 10 ppm in the Federal and State Safe Drinking Water Act regulations and New Jersey Surface Water Quality Standards. The SWQS in the Pinelands was set at 2 ppm to protect the unique ecology of this area.

Water quality in surface waters that may be used as drinking water sources This assessment was based on 1254 nitrate samples collected at 81 stations between 1995 and 1997 through the Cooperative Ambient Stream Monitoring Network and trends assessment between 1986 and 1995 (USGS, 1999). These information sources were described in Section 3.1: Water Quality. The Drinking Water Designated Use Assessment for nitrate in rivers and streams was conducted as follows:

Table 3.4.1-1: Water Quality Data Assessment Method	
Full Support	Less than 10% of samples exceed applicable SWQS
Full Support but Threatened	Less than 10% of samples exceed applicable SWQS, but declining WQ trends indicate SWQS are likely to be exceeded in more than 10% of samples within 2 years.
Partial Support	Between 11% and 25% of samples exceed applicable SWQS
No Support	More than 25% of samples exceed applicable SWQS
Notes: From: EPA Guidance for Preparation of Water Quality Inventory Reports, EPA, 1997.	

Spatial Extent of Assessment: As discussed in Part III, Chapter 3.1, stations in the Ambient Stream Monitoring Network, as operated through 1997, assess 176.38 stream miles.

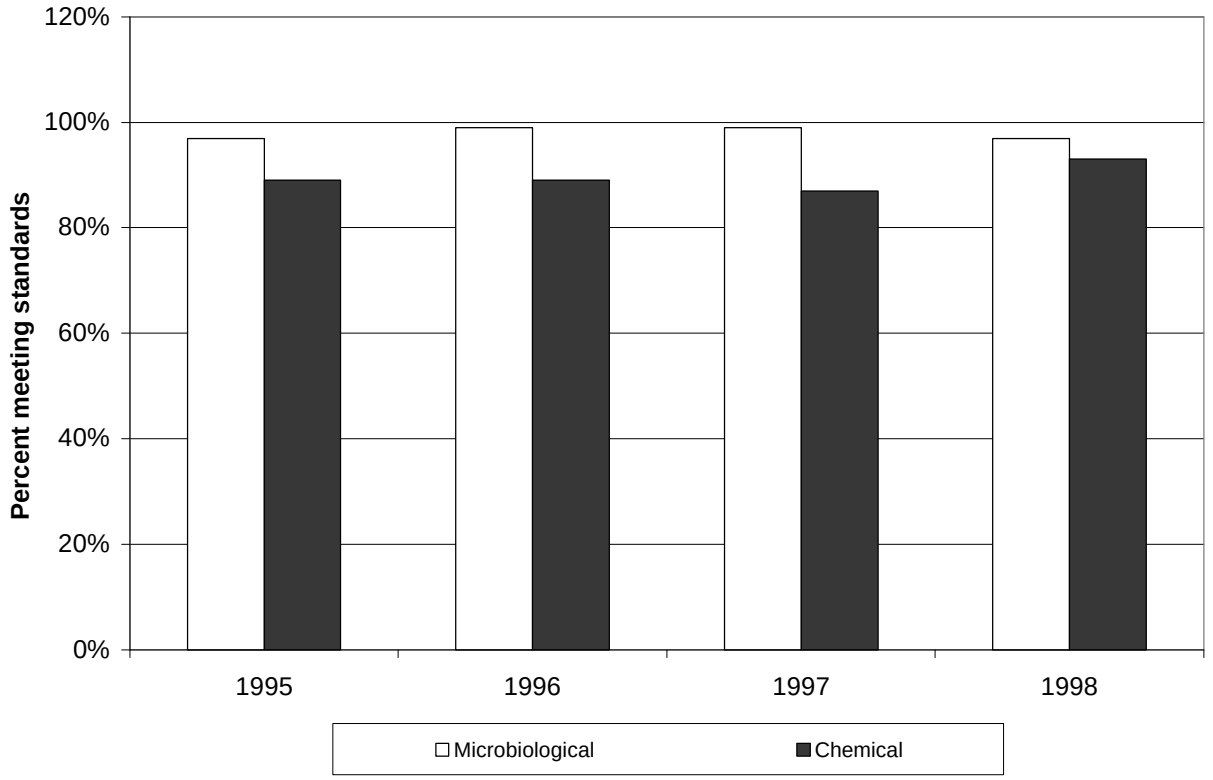
It is important to note that the monitoring design used to collect these data does not support extrapolating the assessment results to locations or streams that were not monitored. Streams that appeared to have the greatest impacts were prioritized in this network.

3.4.2 Rivers and Streams Drinking Water Designated Use Assessment Results

Drinking Water Quality Finished water from community water systems in this state is of high quality. Environmental indicators developed and reported as part of NEPPS have shown that

since 1995, the number of community water systems in New Jersey that have met all safety standards has remained consistently high - between 97% and 99% for microbiological standards and between 87% and 93% for chemical standards. (NJDEP, in press)

Figure 3.4.2-1: Drinking Water Complaince with Maximum Contaminant Levels (MCLs)



Water Quality in Current Source Waters As discussed above, nitrate was chosen as an indicator for source water quality because it is difficult and expensive to remove from drinking water. Results from the ASMN and USGS trends study are summarized for the four ASMN stations located near potable supplies. See Table 3.4.2-1 below.

Average concentrations are significantly below the SWQS and drinking water MCL for nitrate. Thus, a station with a mean of 2 ppm NO3 in 2000 and a trend of +0.3 ppm NO3 per year is estimated to have a mean concentration of 2.6 ppm NO3 by the next NJ Water Quality Inventory Report in 2002. However, elevated maximum concentrations and upward trends indicate that nitrate is an emerging issue for these potable supplies.

Table 3.4.2-1: Nitrate Status (1995-97) and Trends (1986-95) in Rivers Near Four Potable Supplies

Potable Intake	ASMN Station	# of River Samples	Average NO_3 in River (ppm)	Max NO_3 in River (ppm)	NO_3 Trends in River (ppm/yr)
Haworth Water Co.	Saddle R at Lodi	15	4.6	9.1	0.16
Passaic Valley Water Commission	Passaic River at Little Falls	44	2.6	7.2	0.27
United Water-Matchaponix	Matchaponix Bk at Spotswood	14	4.5	9.8	NSIG
Trenton Water Company	Delaware River at Trenton	12	0.8	1.5	NSIG

Notes:
- Based on Ambient Stream Monitoring Network data collected near potable supply intakes, not finished drinking water quality.
- Average and maximum concentrations based on routine quarterly sampling in the ASMN
- Trends reported by USGS 1999. NSIG - no significant trend

NJDEP reported nitrate concentrations in finished drinking waters as an environmental indicator. Between 1993 and 1995, less than 1% of 625 community water systems reported samples with nitrate concentrations above 10 ppm. However, 10-12% of all public water systems reported nitrate concentrations equal to or above 5 ppm between 1993 and 1995 indicating vulnerability to nitrate contamination. (NJDEP, 1998). Note that these results are for both surface and ground water sources.

Through the SWAP program, additional nitrate data collected by water purveyors is expected to become available. These data will be used to better characterize nitrate status and trends at intakes and in finished drinking water quality.

Water quality in surface waters that may be used as drinking water sources Average nitrate concentrations ranged from 0.020 parts per million (ppm) NO3 to 4.58 ppm and 1 of 1254 samples (0.01%) exceeded the 10 ppm SWQS criterion and drinking water MCL for nitrates. Average NO3 concentrations for 1995-97 are shown on Figure A3.4.2-1 in the Appendix. Status and trends information is summarized on Table A3.4.2-1 in the Appendix.

One of 13 samples (7.7%) collected at the South Branch of the Pennsauken Creek at Cherry Hill (WMA 18, station # 1467081) exceeded the 10 ppm NO3 criteria applicable to FW2 Waters. Statistically significant increasing trends in concentration were found at this location. However, mean concentration was below the applicable criteria and trends were small enough to indicate that these waters are expected to continue to fully meet drinking water designated uses.

Statistically significant declining trends in NO3 concentration were found 11 stations between 1986 and 1995, indicating improving water quality at these locations. No statistically significant trends were found at 44 stations between 1986 and 1995, indicating stable water quality at these locations. Statistically significant increasing trends in NO3 concentration were found at 24

stations between 1985 an 1995, indicating worsening water quality at these locations. However, the rate of change in NO3 concentrations was small, ranging from 0.01 ppm NO3 per year to 0.35 ppm NO3 per year. The trends assessment conducted by USGS indicates that drinking water designated uses, as indicated by nitrate in streams, will continue to be met through 2002.

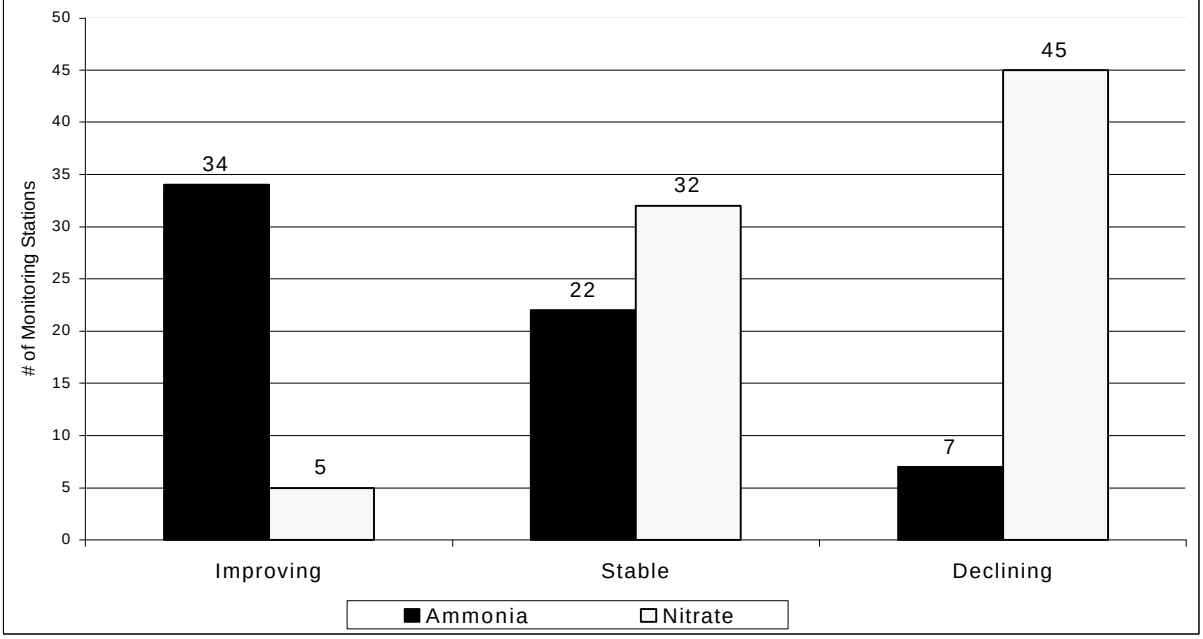
3.4.4 Drinking Water Designated Use Source and Cause Assessment

A qualitative assessment of nitrate sources is provided below. Both point and nonpoint sources contribute to nitrate rising levels of nitrate. Point sources contribute nitrate through secondary treated effluent while nonpoint sources contribute through the application of fertilizers to lawns and farms and through animal waste. Ground water may also contribute to rising levels in streams, particularly in southern NJ coastal plain as indicated by results from USGS's Long Island - New Jersey National Ambient Water Quality (NAWQA) studies. (Ayers, 2000)

Point Source Assessment: Upgrades of wastewater treatment plants to secondary treatment resulted in statewide compliance with un-ionized ammonia, which is toxic to aquatic life and elevated in primary treated sewage. See the Water Quality Section (Part III, Section 3.1). However, secondary treated sewage contains elevated nitrate.

A comparison of trends in total ammonia and nitrate between 1975 and 1994 using data from the ASMN illustrates the transition to secondary treatment. During this time period, concentrations of un-ionized ammonia decreased at 37 stations (54%), while concentrations of nitrate increased at 46 stations (55%). See Figure 3.4.4-1.

Figure 3.4.4-1: In-stream Trends in Ammonia and Nitrate (1975-1994)



Elevated nitrates in the Hammonton Creek at Westcoatsville have been attributed to the Hammonton Sewage Treatment Plant. An Environmental Infrastructure Trust loan has been awarded to remove this discharge from the stream and divert it to ground water. The project is ongoing and expected to be completed by March, 2001.

Nonpoint Source Assessment: Nitrates have been applied to land surfaces as fertilizers for agricultural purposes and lawns. Low concentrations of nitrate also arise from forests. Nitrates that are not used by plants (crops or lawns) travel through the soil to surficial aquifers, deeper ground water and streams. In the sandy NJ coastal plain, these fate and transport processes are well understood and can be modeled. Predictive modeling provides a useful tool to estimating future surface and ground water quality under various management scenarios.

Under the Long Island- New Jersey National Ambient Water Quality Assessment (NAWQA) program, nitrate concentrations in ground water and streams were predicted for the NJ coastal plain using MODFLOW and MODPATH. Nitrate concentrations were simulated under three nitrate management scenarios: (1) a fixed input of nitrate at the current level, (2) a reduction of input at a constant rate, and (3) an immediate ban on nitrate input. (Ayers, 2000). Results are shown on Figure 3.4.4-2. The model predicted that changes in nitrate input to the aquifer system are clearly different under each scenario and that change in nitrate concentration of water discharging to streams and wells will be slow. The historical component of the model shows that nitrate in ground water and streams has been steadily increasing since the 1950's as land has been developed for agricultural and residential uses.

Under the fixed use scenario, the concentration of nitrate in water that is recharging ground water and streams stays the same as it is in the year 2000. This scenario was used to estimate the effects of constant inputs of nitrate. The model predicts that nitrate concentration in wells and streams will continue to rise through 2050 and only slowly begin to level off at a concentration equivalent to the fractions of urban, agricultural, and undeveloped land use in the area.

For the reduction scenario, the effect of reducing nitrate in recharge linearly to zero by 2050 was modeled. This scenario was used to estimate well and stream responses to management measures that gradually eliminate inputs of nitrate to recharge water by 2050. The model predicted that the nitrate concentration continue to increase for about 10 years in streams and for about 20 years in wells. This delay is equivalent to the average age of water discharging to streams and wells, respectively. Water discharging to wells which are screened near the bottom of the aquifer is older than the water entering streams. Therefore, streams have a larger proportion of younger ground water than wells and will respond faster. Under this scenario, nitrate concentrations were predicted to drop to near background levels by 2100.

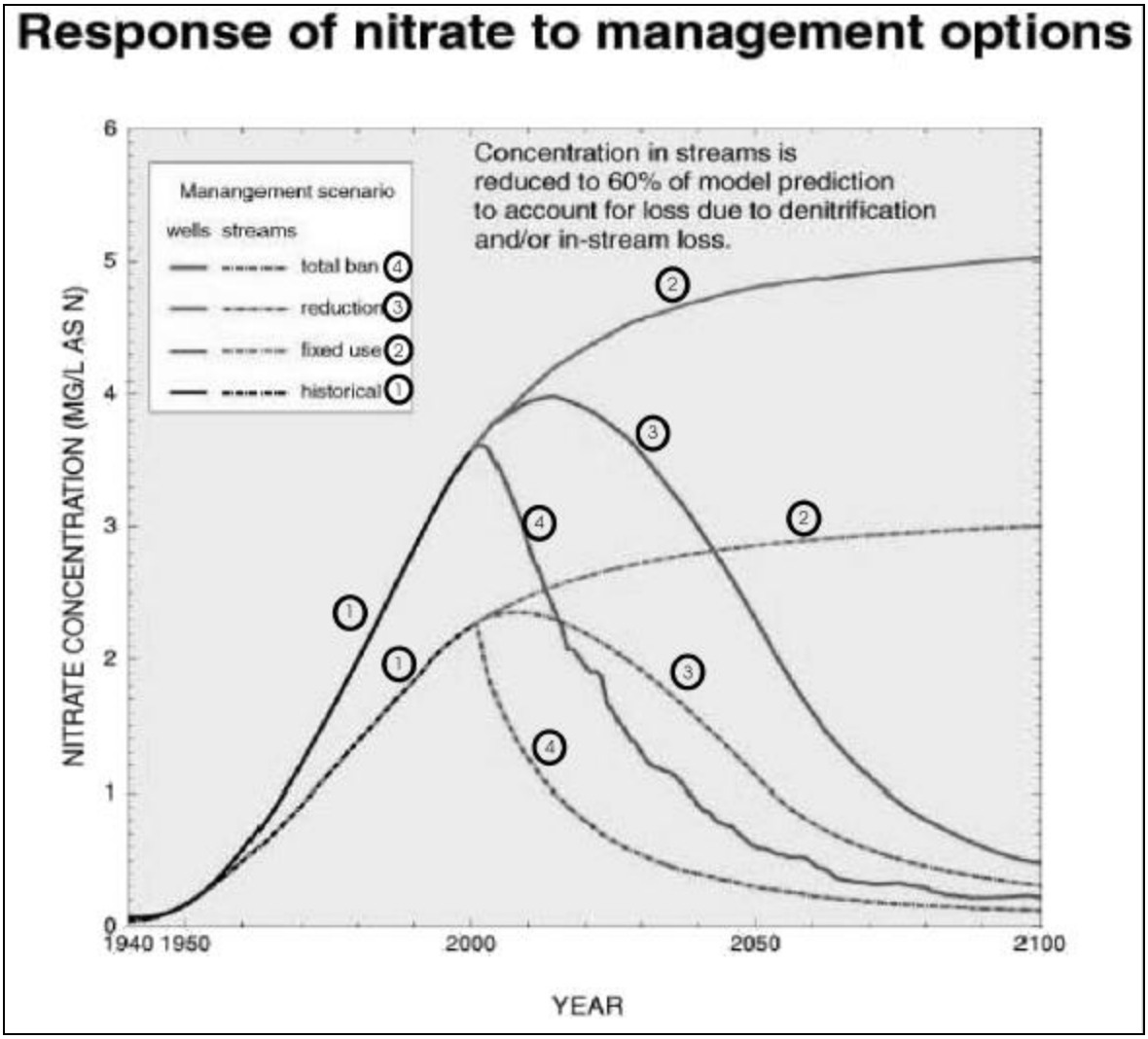


Figure 3.4.4-2: Response of Nitrate to Management Options in NJ Coastal Plain
Figure provided courtesy of LI-NJ NAWQA Program

For the total ban scenario, the effect of immediately reducing the nitrate concentration in recharge to zero was modeled. The model predicted that the concentration in ground-water discharge to streams will begin to decrease almost immediately as the result of the increasing influx of young, uncontaminated water (recharge concentration assumed to be zero). The decrease in nitrate concentration in wells and streams, however, will take several decades because some of the water entering these systems was recharged prior to the "ban" in year 2000.

For this Coastal Plain system, ground-water modeling strongly suggests that changes in chemical use or land management practices will take 1-2 decades before any substantial changes in wells and streams will be detected. Furthermore, the increase in nitrate use over the last decades is

likely to result in increasing nitrate concentrations in wells and streams because of the long residence time in the aquifer (about 10-20 years).

3.4.5 Strategies to Protect Potable Supplies: Nitrate

Nitrate concentrations are of particular concern in the Passaic River Basin due to intensive water uses, particularly under record low stream flow stream conditions that were experienced in recent years. In October, 1999 the NJDEP's Division of Water Quality and Water Supply Administration retained a consultant to initiate a demonstration project concerning the potential to reduce the amount of nitrates discharged from wastewater treatment plants into the Passaic River. The project evaluated a technique know as On-Off Aeration. By periodically turning their aeration systems on and off the facilities were able to show significant reductions in the amount of nitrates discharged as well as reductions in energy usage. These results are being evaluated for a next phase to be tested this year.

The status and trends in nitrate concentrations will continued to be examined in detail in the Safe Drinking Water Program. In addition, sources of nitrate that may affect potable supplies will be identified and targeted for management in the Source Water Assessment Program.

3.4.6 Case Study: Tracking Down TCE Contamination in the Rahway River

The following case study provides a discussion of how the Department is working to track down sources of an organic contaminant – tetrachloroethlylene (TCE) in the Rahway River. The Rahway River is located in WMA07, in a urban/ industrial environment. United Water Company - Rahway operates a potable water supply intake withdrawing 5-6 million gallons per day from the lower portion of this river. See Figure A3.4.6-1 in the Appendix.

In order to protect public health, New Jersey's Safe Drinking Water regulations (N.J.A.C. 7:10) includes a Drinking Water Maximum Contaminant Level (MCL) for of 1 part per billion (1 ppb) for trichloroethylene (TCE). Due to elevated levels in finished drinking water, TCE contamination was identified in the river source water: a violation of the MCL for TCE occurred in January 1993. A packed column aeration treatment unit was approved in November 1993 to remove the TCE from finished drinking water. A granular activated carbon filter was also added to treat taste and odor. TCE data collected subsequent to the installation of additional treatment were below the MCL, indicating that the treatment is effective.

The source of TCE contamination in the river was not located in previous sampling efforts. However, an industrial area near Route 22 was identified as a suspected source area based on these results. The NJDEP Site Remediation Program (SRP) Division of Publicly Funded Site Remediation's Environmental Measurements and Site Assessment Section designed a sampling program in an effort to identify the source(s) contributing to the TCE contamination detected in the Rahway River. SRP collected water and sediment samples at 34 stations located between the intake at Rahway and Route 22 in Springfield Township on the Rahway River. Preliminary results from 22 stations indicate concentrations of about 2 ppb near the intake which increase up to 16 ppb approximately 8 miles up-river near Kenilworth Boulevard (RTE 509) in Cranford Township. Results from 12 more sites are pending. Sampling will include river reaches adjacent

to industrial areas that are suspected sources of TCE contamination. If one or more sources of TCE are found, clean-up will be a high-priority in the SRP since a drinking water supply is affected. Based on this assessment, drinking water designated uses are partially met in the Rahway River.

3.5 Rivers and Streams Agricultural Designated Use Assessment

Surface Water Goal: Our surface waters (tidal and non-tidal) will support human and ecosystem health and applicable uses such as recreation, fishing, drinking water supply, agriculture, and industry.

3.5.1 Rivers and Streams Agricultural Designated Use Assessment Method

At the present time, New Jersey's Surface Water Quality Standards (N.J.A.C. 7:9B) have not established specifically for agricultural designated use. Although designated uses such as human health, ecosystem protection, drinking water supply, and fishing have Surface Water Quality Standards (SWQS) established that are applicable to agriculture, the water-quality standards suitable for agriculture are normally higher, precluding the need for criteria specific to agricultural uses.

In order to evaluate water supplies that support agriculture in New Jersey, guidelines were referenced from the U.S. Department of Interior Natural Resources Conservation and other states (Follet, 1999 and Bauder, 1998). These recommended standards provided a baseline to evaluate whether water supplies support common agricultural practices such as irrigation and livestock raising in the state.

For this assessment, total dissolved solids (TDS) and salinity were selected as the determining parameters for agricultural use. Salinity was chosen due to its adverse and immediate impact on all agricultural practices, while TDS has a similar impact as well as indicating other possible contamination from runoff. The lower of the recommended standards for irrigation and livestock was applied in this assessment as the acceptable level to fully support agricultural use. Acceptable levels for total dissolved solids and salinity were established as at or below 2,000 mg/l (Follet, 1999). If TDS or salinity data were not available, specific conductance was used as a surrogate with a specific conductance of 3,000 us/cm approximately equivalent to TDS and saline levels of 2,000 mg/l (United Nations, 1985).

It is understood that the impact on crops and livestock varies depending on non-water factors such as type of livestock, crop tolerance, soil type, drainage, irrigation methods and management; therefore the exceedence of these limits do not necessarily impair uses for agriculture. On the other hand, concentrations below these limits may restrict agricultural use in certain circumstances. Therefore, although surface water standards may be suitable to indicate full or partial support, the designated use category of no support is defined as only when a water supply no longer supports existing agricultural designated uses.

As shown below on Table 3.5-1, EPA Guidance for the Preparation of Water Quality Inventory Reports was applied to the selected indicators of agricultural use: salinity and TDS.

Table 3.5.1: Agricultural Use Assessment Method for Rivers and Streams	
Full Support	TDS > 2000 mg/l or Salinity > 2000 mg/l in less than or equal to 10% of samples.
Full Support but Threatened	Meets full support but statistically significant adverse trends indicate full support will not be attained in 2 years.
Partial Support	TDS > 2000 mg/l or Salinity > 2000 mg/l in greater than 10% of samples.
No Support	Termination of use as an agricultural supply.
Notes: Rivers and streams evaluated based upon SWQS categories FW2 and PL. This assessment does not include the Delaware River.	

Spatial Extent of Assessment: This assessment was based on data collected at 76 of 81 Ambient Stream Monitoring Network (ASMN) stations. The 5 Delaware River mainstem stations were not included because the Delaware River Basin Commission (DRBC) assesses this waterbody. (DRBC, 2000)

In previous New Jersey Water Quality Inventory Reports, each station was assumed to represent 5 miles of stream. For this assessment, each station was assumed to represent the stream reach that was monitored. Stream reaches have been defined by USEPA in the Reach File 3 system, which can be used on GIS. Reach File 3 (RF3) was mapped at a moderate 1:100,000 scale. Using RF3, the 76 ASMN stations represent 176.4 of 6420 (2.7%) river miles. The RF3 reach identification number and reach length are provided in Table A3.1.2-1 in the Appendix. Use Rf3 was considered an intermediate approach to the more refined spatial assessment that will be provided by the redesigned ASMN.

It is important to note that the monitoring design used to collect these data does not support extrapolating the assessment results to locations or streams that were not monitored. Streams that appeared to have the greatest impacts were prioritized in this network.

3.5.2 Rivers and Streams Agricultural Designated Use Assessment Results

Agricultural designated uses were fully supported in all river and stream reaches. There were no exceedences in any of the samples collected and no statistically significant adverse trends that would threaten agriculture were identified in the state. The assessment was based upon ASMN data collected from 1995 to 1997, thus this assessment was based on monitored data.

See Section 2.8 Nonpoint Source Management Program for programs that are reducing the impact of agriculture practices on water quality.

3.6 Rivers and Streams Industrial Designated Use Assessment

Surface Water Goal: Our surface waters (tidal and non-tidal) will support human and ecosystem health and applicable uses such as recreation, fishing, drinking water supply, agriculture and industry.

An industrial water supply designated use support assessment would evaluate attainment of the Surface Water Quality Standards (SWQS) provision for the protection of waters used for processing or cooling. (N.J.A.C. 7:9B) This is the first designated use assessment for industrial water supplies in a New Jersey Water Quality Inventory Report. Since the SWQS are protective of the most sensitive use, meeting the SWQS for aquatic life and human health should ensure protection of the waterbody for industrial water supply. In addition, water quality needs of industry may vary significantly.

3.6.1 Rivers and Streams Industrial Designated Use Assessment Method

The industrial designated use assessment methodology was derived by comparing those stressors which may effect industrial use of surface water with the SWQSs. For this assessment, pH and total suspended solids (TSS) were used.

EPA Guidance for the Preparation of Water Quality Inventory Reports recommends that states consider the percent of samples exceeding applicable SWQS assess designated use attainment. (EPA, 1997). The SWQS and monitoring program are summarized in Part III, Chapter 3.1; data are summarized in Part III, Section 3.1.3 and Table A3.1.3-4 in the Appendix. Monitoring data collected between 1995-1997 were used for this assessment, thus the assessment is based on monitored data. The assessment method for industrial water supply is shown on Table 3.6.1-1.

Table 3.6.1-1: Industrial Water Supply Assessment Method for Rivers and Streams

Full Support	Less than or equal to 10% of samples for pH or TSS exceed the SWQSs.
Full Support but Threatened	Less than or equal to 10% of samples for pH or TSS exceed the SWQSs but rising concentrations of pH or TSS indicate full support will not be met within the next 2 years.
Partial Support	Greater than 10 % of samples for pH or TSS exceed the SWQSs.
No Support	Termination of use as an industrial water supply.

Notes:
Use 1995-97 data summaries from WQ Indicators Project
Water quality data were compared to applicable NJ Surface Water Quality Standards (N.J.A.C. 7:9B) described in Section 3.1.1.

Spatial Extent of Assessment: This assessment was based on data collected at 76 of 81 ASMN stations. The 5 Delaware River mainstem stations were not included because the Delaware River Basin Commission (DRBC) assesses this waterbody. (DRBC, 2000)

In previous New Jersey Water Quality Inventory Reports, each station was assumed to represent 5 miles of stream. For this assessment, each station was assumed to represent the stream reach

that was monitored. Stream reaches have been defined by USEPA in the Reach File 3 system, which can be used on GIS. Reach File 3 (RF3) was mapped at a moderate 1:100,000 scale. Using RF3, the 76 ASMN stations represent 176.4 of 6420 (2.7%) river miles. The RF3 reach identification number and reach length are provided in Table A3.1.2-1 in the Appendix. Use RF3 was considered an intermediate approach to the more refined spatial assessment that will be provided by the redesigned ASMN.

It is important to note that the monitoring design used to collect these data does not support extrapolating the assessment results to locations or streams that were not monitored. Streams that appeared to have the greatest impacts were prioritized in this network.

3.6.2 Rivers and Streams Industrial Designated Use Assessment Results

Industrial Designated Use Assessment - pH: As discussed in Part III, Section 3.1.3, 54 of the stations (71.1%) sampled for pH exceeded the criteria in less than 10% of the samples. See Figure A3.6.2-1 in the Appendix. Thus the waterbodies associated with these stations were determined to be fully supporting industrial uses. Since the SWQSs are protective of the most sensitive use, meeting the SWQS for aquatic life should ensure protection of the waterbody for industrial water supply. There were 22 stations that exceeded the criteria in more than 10% of the samples and are assessed as partially supporting industrial use. There were no known areas where a water supply was determined to be unsuitable for industrial use.

Table 3.6.2-1 Industrial Water Supply Designated Use Assessment (pH)

Assessment	Stations	River Miles
Full Support	54	114.44
Partial Support	22	61.94
Non-Support	0	0.0
Total	76	176.38

Total suspended solids (TSS): TSS criteria were established in the NJ SWQS to protect aquatic life from excessive sedimentation. As discussed in Part III, Section 3.1.3, relatively little TSS data were available for 1995 to 1997. Results are summarized on Table 3.6.2-2 below.

Table 3.6.2-2 Industrial Water Supply Designated Use Assessment (TSS)

Assessment	Stations	River Miles
Full Support	5	3.46
Partial Support	3	5.74
Non-Support	0	0.0
Total	8	9.20

3.6.3 Source and Cause Assessment

The reader is referred to Part III, Section 3.1.4 for this source and cause assessment.

3.6.4 Maintaining and Improving Industrial Use Assessment

Clarify needed water quality: The pH and TSS assessment provided here represents the Department's first attempt to assess industrial uses. As discussed previously, needs of industrial water users may vary significantly. In addition, the ambient stream monitoring network is not designed to assess water quality at industrial intakes. Industrial users may have additional data regarding water quality and use attainment relevant to their intakes. Comments from industrial users are sought to improve this assessment.

Address identified exceedences of SWQS: As discussed in Part III, Section 3.1.4, waterbodies with exceedences of SWQS criteria are included on the 1998 Impaired Waterbodies List and will remain on future lists until new data show compliance with the applicable criteria. These waterbodies are subject to the provisions and schedule in the TMDL MOA (See Part II, Appendix A2.5-1). As TMDLs are planned, developed and implemented, cause(s) of exceedences will be identified and managed.

Chapter 4 Lake Water Quality Assessment

4.1 Introduction

There are approximately 3,990 lakes, reservoirs and ponds over 2 acres in New Jersey, but of these, only about 60 are natural. The remainder are constructed impoundments. There are 380 public lakes (24,000 acres) and 64 reservoirs. Thus far, 376 lake bathing beaches at 310 lakes have been identified; some lakes have multiple beaches. Uses of New Jersey's lakes, reservoirs and ponds vary and can include potable water supply, water storage, recreational boating, fishing and swimming. These waterbodies also provide habitat for a variety of aquatic life and wildlife.

This chapter focuses on aquatic life and recreational designated use assessments for lakes. This section also discuses eutrophication and its impact on the recreational quality of lakes. Fish consumption advisories for lakes are discussed in Part III, Chapter 7: Public Health and Aquatic Life Concerns. As discussed in Part III, Chapter 3.4: Drinking Water Designated Use Assessment, water supply uses will be assessed in the Source Water Assessment Program.

4.1.1 Lakes Aquatic Life Designated Use Assessment Method

The aquatic life use support assessment for lakes was based upon warm water fishery assessments supplied by the Department's Bureau of Freshwater Fisheries (BFF). This assessment has been improved to provide a direct indicator of aquatic life designated uses. Previous aquatic life assessments for lakes were based on lake trophic status, an indirect indicator of aquatic life uses.

In previous New Jersey Water Quality Inventory Reports, eutrophic lakes were classified as "fully supporting aquatic life designated use, but threatened". However, aquatic plants, which grow in abundance in eutrophic lakes, provide food and habitat to the lake fish community. Many warm-water fish communities can thrive under moderate eutrophic conditions but may be impaired by severe eutrophication when dissolved oxygen levels are severely depressed and/or aquatic vegetation becomes excessively dense. Clean Lakes Program studies of trophic status identified recreational and aesthetic impairments, not impairments to fisheries. Therefore, trophic status assessments are included in Chapter 4.3: Lakes Recreational Designated Use Assessment: Aesthetics.

Assessments of lake fisheries are performed based upon a priority list provided in the Division of Fish and Wildlife's Warmwater Fisheries Management Plan (NJDEP, 1998a) which serves as the primary guidance for warmwater fisheries management for the Department. Lake assessment frequencies vary depending upon the lake in question and its individual management needs.

Fish populations are sampled using methods such as electrofishing (spring or fall), shoreline seining (summer to assess fish reproduction), and/or gillnetting (fall). In addition, basic water chemistry parameters such as dissolved oxygen, pH and nutrients are recorded during the summer months when the water columns are most stratified. Fish population data are then assessed by experienced fishery biologists for the purpose of determining a lake's actual or

potential recreational value as a fishery and recommendations are made to maintain or enhance the resource.

It is important to note that although the Bureau of Freshwater Fisheries is principally concerned with the recreational value of the fisheries they assess, the assessments they provide are based upon the diversity of a wide range of fish species and not just species of recreational value. This is because many sport fish are carnivorous and depend upon an abundant and diverse forage base to support their populations. Species stocked by the Bureau are also identified and addressed in the assessments.

For this 2000 New Jersey Water Quality Inventory Report, assessments were supplied by Bureau of Freshwater Fisheries based upon fish inventories of selected lakes and reservoirs of over 100 acres in size with public access for recreational fishing. This resulted in 10 lakes and reservoirs totaling 9,875 acres being assessed. Assessment dates range from 1993 to 2000. Assessments conducted during or after 1995 are considered "monitored" for this report while those conducted prior to 1995 are considered "evaluated". NJDEP plans to expand the use of fisheries assessments in future Water Quality Inventory Reports. Table 4.1.1-1 describes the aquatic life use assessment method based on Bureau of Freshwater Fisheries lake inventories.

Table 4.1.1-1: Lake Aquatic Life Designated Use Assessment Method

Aquatic Life Assessment	**Fishery Description**
Full Support	Fishery is well balanced, exhibiting good diversity. Consistent recruitment.* No one species dominating the community. No observable factors limiting the fishery.
Full Support but Threatened	Fully supported fishery, however, anticipated changes in surrounding land use, lake water levels or in-lake water quality have the potential to cause future declines in fishery quality.
Partial Support	Fishery present, however, fish diversity not at potential expected for the type of lake in question. Predator to prey populations are not in balance, inconsistent recruitment*.
No Support	Fishery exhibits poor diversity. Fishery dominated by a few tolerant species (carp, goldfish, mudminnows, killifish, etc) and/or general overall number of individuals is low. Poor recruitment* and growth of individuals.
* Recruitment refers to the number of young fish which survive to ultimately become large enough to reproduce and/or become harvestable. For example: reproduction of a number species of fish in a lake may be good but there may be insufficient habitat cover resulting in many of these fish being eaten by their larger counterparts before they grow to sufficient size to either reproduce or be sought after by anglers. In such a scenario, recruitment is regarded as poor.	

4.1.2 Lakes Aquatic Life Designated Use Assessment Results

There were 10 lakes described by Fish and Wildlife totaling 9,875 acres of which 5,950 acres fully support the use, 2,635 acres are threatened, 1,290 acres partially support the use and 0 acres do not support the use. Results are summarized below on Table 4.1.2-1

Table 4.1.2-1: Lakes and Reservoirs Assessment Results Using Fisheries Data

County	Lake Name	Acres	Use Assessment	Latest Assessment Date
Cumberland	Union Lake	898	full support	1994
Hunterdon	Round Valley Reservoir	2,350	full support	1996
Hunterdon	Spruce Run Reservoir	1,290	partial support	1997
Monmouth	Manasquan Reservoir	720	full support	1996
Morris	Lake Hopatcong	2635	threatened	1995/1996
Morris	Budd Lake	376	full support	1997
Passaic	Monksville Reservoir	505	full support	2000
Sussex	Canistear Reservoir	350	full support	1993
Sussex	Lake Aeroflex	101	full support	1995
Warren	Merrill Creek Reservoir	650	full support	2000

The results of designated use assessments provided by the Bureau of Freshwater Fisheries are summarized below on Table 4.1.2-2.

Table 4.1.2-2: Lakes Aquatic Life Designated Use Assessment Summary (in acres)

Use Support Category	Acres
Full support	5,950
Full support but threatened	2,635
Partial support	1,290
No support	0
Total Acres Assessed	**9,875**

4.1.3 Source and Cause Assessment

Spruce Run Reservoir in Hunterdon County was classified as partially supporting aquatic life designated uses. This impairment has been attributed to frequent and significant water withdrawals which cause significant oscillations in water levels. This has eliminated all vegetation within the reservoir, a critical component of fish cover. The lack of adequate cover within the reservoir has affected the recruitment of a number of game species. Recruitment is defined on Table 4.1.2-1. In addition the reservoir receives nutrient laden runoff during storm events from the upstream watershed and exhibits dense algal blooms during the summer months. The Bureau of Freshwater Fisheries has found dissolved oxygen levels from approximately 12 feet down to the lake bottom (70 ft.) are routinely reduced to 0 mg/l DO during the summer months. Spruce Run Reservoir was not studied by the Clean Lakes Program.

Lake Hopatcong was classified as fully supporting aquatic life uses but threatened due to accelerated eutrophication brought about by nonpoint source pollution from the communities

immediately surrounding the lake, especially from septic systems. Lake Hopatcong was also classified as eutrophic by the Clean Lakes Program.

4.1.4 Strategies to Protect and Enhance Aquatic Life Uses in Lakes

Implement management measures for fisheries: Numerous management measures are identified in the Warmwater Fisheries Management Plan such as lake dredging when needed, aquatic vegetation control and angler education.

A Lake Restoration and Management Advisory Task Force ("Lakes Task Force") has been created through an Executive Order by the Governor and is charged with examining the causes of lake eutrophication, and making recommendations regarding the types of measures necessary to restore and properly manage lakes, and ways to finance such work. The task force includes members from the NJDEP, State Treasury, Community Affairs, the New Jersey Environmental Infrastructure Trust and members of the Legislature.

Expand the use of direct measures of aquatic life designated use status: NJDEP plans to make wider use of fishery inventories provided by the Department's Bureau of Freshwater Fisheries. In addition, NJDEP and USEPA Region II are developing rapid bioassessment protocols for lakes. Once the protocols are completed and sufficient data are available, these new data will be integrated into the Aquatic Life Use support status of public lakes for future Water Quality Inventory Reports. The assessments will be conducted using a multi-metric approach similar that which is being developed for rivers and streams, taking into account both finfish and aquatic invertebrate communities.

Additional lake management strategies to control eutrophication are discussed under section 4.3, Lake Recreational Designated Use: Eutrophication and Aesthetics

4.2 Lakes Recreational Designated Use Assessment: Sanitary Quality

Lake bathing beaches provide recreational swimming opportunities to inland communities. Lake bathing beaches are monitored for sanitary quality by county, local and private beach operators with oversight and program coordination from New Jersey Department of Health and Senior Services (NJDHSS). NJDEP's Cooperative Coastal Monitoring Program recently began to compile NJDHSS data so that a more comprehensive picture of the quality of all NJ bathing beaches could be provided. In addition, many of the environmental programs available to maintain and improve lake water quality are operated through NJDEP. Through the Division of Watershed Management, projects needed to protect and improve lake bathing beaches can be cooperatively prioritized and implemented.

The following subgoal and objectives related to lake bathing beach sanitary quality were developed through NEPPS. (NJDEP, 1999).

Subgoal: Protect recreational designated uses in tidal and non-tidal waters.

Objective: Maintain and improve the current number and quality of suitable lake, ocean and bay bathing beaches in NJ

Milestone: By 2000, the recreational lake beach waters will have been assess and water quality improvement projects will have been prioritized.

4.2.1 Lake Recreational Designated Use Assessment Method

The sanitary quality of water at the bathing beach is monitored by the entity responsible for operating the beach, including county and local health agencies and private entities. Some lakes included in this assessment are privately owned and operated, including camps, private schools or lake associations.

NJDHSS regulations govern the collection of these data and beach closures based on elevated levels of fecal coliform (FC). Under these regulations, fecal coliform bacteria are monitored at least weekly during the bathing season (typically Memorial Day to Labor Day). If concentrations exceed 200 FC/ 100 ml sample, the beach sampled again the following day and is closed and remains closed until levels meet the standard. Sanitary surveys are performed to identify and address bacterial pollution sources. As discussed in Chapter 3.3: Rivers and Streams Recreational Designated Use Assessment, levels of fecal coliform bacteria are used to indicate the presence of fecal pollution which may be harmful to human health. Data for this assessment were compiled by NJDEP's Cooperative Coastal Monitoring Program from the NJDHSS. This initial assessment relied on fecal coliform data provided by NJDHSS. Ideally, future assessments will rely on beach closure data as well.

The following assessment method was adapted from USEPA Guidance for Preparation of Water Quality Inventory Reports (EPA, 1997).

Table 4.2.1-1: Lakes Recreational Designated Use Assessment Method

Use Support	Definition
Full	Less than 10% of samples exceed 200 FC/100 ml
Full but Threatened	Less than 10% of samples exceed 200 FC/100 ml but statistically significant trends indicate that greater than 10% of samples will exceed the standard by the next reporting cycle (currently 2 years)
Partial	Greater than 10% but less than 25% of samples exceed 200 FC/100 ml
None	More than 25% of samples exceed 200 FC/100 ml

To date, 376 lake bathing beaches located on 310 lakes have been identified; some lakes have more than 1 beach. Recreational designated use attainment was assessed separately at each beach. Since data were collected within the last 5 years, this assessment is based on monitored results.

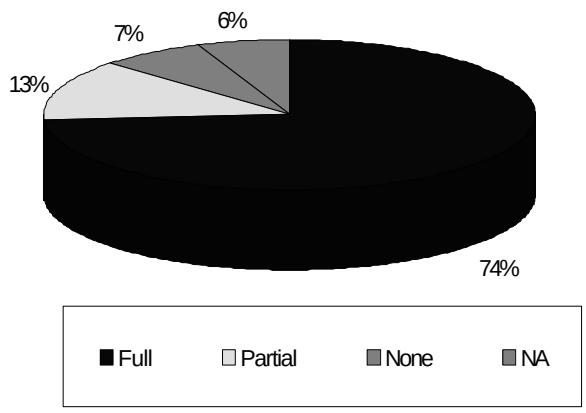
Spatial Extent of Assessment: USEPA Guidance requests that designated use assessments for lakes be reported in lake acres. To date, 167 of 310 lakes (17,473 acres) with bathing beaches have been located on GIS. For mapped beaches, the assessment results are applied to the entire lake or proportionally assigned based on the number of beaches at the lake. The remaining lakes are reported by beach for this report. Efforts are underway to map the remaining beaches. This work is expected to be completed for the 2002 Water Quality Inventory Report.

4.2.2 Lakes Recreational Designated Use Assessment Results

The percent of samples that exceeded 200 FC/ 100ml during 1999 were used to assess recreational designated uses. Results are summarized on Figure 4.2.2-1 below.

As shown on Figure 4.2.2-1, 277 (74%) lake bathing beaches provide excellent recreational swimming opportunities (full support) and 50 (13%) exhibited partial support. Only 27 (7%) exceeded the primary contact standard in more than 25% of samples collected during 1999 (no support). It was not possible to assess recreational designated uses at 22 lakes (6%) because the beach was closed or data were not provided. The rationale for closing lake beaches or not providing data were not readily available. Results for individual lakes are provided in Table A4.2.2-1 and Figure A4.2.2-1 in the Appendix.

Figure 4.2.2-1: Lake Beach Recreational Designated Use Attainment (1999)



For the 167 lakes that have been located on GIS, 11,343 acres (65%) fully support recreational uses, 4571 acres (26%) partially support recreational designated uses; 906 acres (5.1%) do not support recreational uses; and 653 acres (3.7%) were not assessed. As discussed above, efforts are underway to locate the remaining lakes on GIS, facilitating a comprehensive spatial assessment of lake bathing beaches.

4.2.3 Lake Recreational Designated Use Source and Cause Assessment

There were 27 lakes with 44 beaches that were studied in the Clean Lakes Program and identified as eutrophic. These lakes are identified in the Appendix on Table A4.3.1-1: Lakes Trophic Assessments. Of these, 28 beaches (64%) fully supported recreational uses in 1999; 6 beaches (14%) partially supported recreational uses and 10 beaches (23%) did not support recreational uses. Additional information is needed to determine if eutrophic conditions were related to sanitary quality issues at lakes with elevated fecal coliform levels.

In general, sources and causes of lake bathing beach closures are very similar to those affecting rivers and streams. The reader is referred to Part III, Section 3.3.3 for additional information. Additional site specific information regarding sources of fecal coliform pollution at lake bathing beaches is expected to become available through the Watershed Management Program.

4.2.4 Maintaining and Improving Lake Recreational Designated Uses

Continue remediation efforts for eutrophic conditions at lakes with beaches: Through the Clean Lakes Program, remediation efforts for eutrophic conditions are ongoing or have been completed at several lakes with one or more bathing beaches, including Cranberry, Greenwood, Hammonton, Hopatcong, Manahawkin, and Swartswood. Additional information is provided in the Appendix on Table A4.3.3-1: Lake Remediation under the Clean Lakes Program. Through the New Jersey Lakes Bond Act, remediation efforts are ongoing at several lakes with one or more bathing beaches, including Cranberry, Greenwood, Hammonton, Hopatcong, Mohawk, Pine, Round Valley, Swannanoa, Swartswood and Sylvan. Additional information is provided in Appendix A4.3.3-2: FY96 Lakes Bond Act Projects.

Continue and expand cooperative assessments with NJDHSS: The lake bathing beach data for this assessment were provided through the cooperative efforts of the Cooperative Coastal Monitoring Program and the NJDHSS. This initial effort made the lake bathing beach assessment possible. Future cooperative efforts should explore the exchange of lake beach closure data with NJDEP. This dataset would facilitate development of a swimmable index based on beach closure rates for ocean, bay and lake bathing beaches.

Identify and prioritize lake improvement projects: Through watershed management, specific sources of FC pollution at lake bathing beaches will be identified and lakes will be prioritized for improvement projects.

The Governor's Lake Restoration and Management Advisory Task Force ("Lakes Task Force") See section 4.1.5 "Strategies to Protect and Enhance Aquatic Life Uses in Lakes".

Improve spatial assessment: NJDEP and NJDHSS are working cooperatively to locate the remaining 143 lakes on GIS. The results will be used to complete the comprehensive assessment of lake bathing beaches for the next Water Quality Inventory Report.

Develop the lake beach component of the “swimmable index”: NJDEP is beginning development of a “swimmable index” that will integrate beach closure rates for ocean, bay and lake bathing beaches. The index will distinguish beach closures due to water quality issues from precautionary beach closures. Lake beach closure data are needed to improve the index.

4.3 Lake Recreational Designated Use: Aesthetics

Many of the lakes in New Jersey are constructed impoundments which are highly prone to eutrophication. Eutrophication occurs naturally as lakes age, however, this process can be accelerated from excessive inputs of nutrients and suspended sediments from the surrounding watersheds. Eutrophic lakes are characterized by excessive growth of aquatic weeds and algae,

shallow depths as sediments fill the lake in, elevated temperatures and low dissolved oxygen. The excessive algal growth, be it planktonic or rooted, often create aesthetically unpleasant conditions for swimming and difficult conditions for boating. As discussed above, additional information is needed to evaluate the role of eutrophic conditions and sanitary quality at lakes with beaches.

The Clean Lakes Program was designed by USEPA to facilitate identification and remediation of impaired lakes. Public lakes with water quality issues were identified by lake associations, municipalities or other entities; studies were conducted to characterize water quality and as funding was available, remediation projects were conducted. Also during the 1980's and early 1990's, NJDEP collected water quality data on a number of public lakes. Data collection included a suite of indicators such as total phosphorus, Secchi disk transparency and chlorophyll a levels to determine the trophic state of lakes. Much of the impairments brought to the Department's attention through the Clean Lakes Program centered around nuisance algal growth impairing swimming and in some cases boating.

The Clean Lakes Program has assessed a total of 116 public lakes representing 10,462 acres. This represents 31% of public lakes and 44% of public lake acres. Many Clean Lakes assessments had been performed in the 1980's and early 1990's. Since these assessments are more than 5 years old, they are considered to be based on evaluated data.

In the past, lake trophic assessments had been used in Water Quality Inventory Reports to assess lake Aquatic Life Designated Use Support. Beginning in this Report, Aquatic Life Use Support in lakes is based upon warm water fishery assessments supplied by the Department's Bureau of Freshwater Fisheries (BFF) (see section 4.1 above).

4.3.1 Clean Lakes Program Eutrophication Assessment Results

Table A4.3.1-1 in the Appendix provides a list of lakes assessed by the Clean Lakes Program and the assessment results. Of 116 public lakes assessed by the Program (10,462 acres), 4 lakes (206 acres): Lake Atsion, Tuckahoe Lake and Turnmill Lake were assessed as mesotrophic. The remaining 112 lakes (10,256 acres) were assessed as eutrophic. Eutrophic lakes have been included on Impaired Waterbodies Lists.

Subsequently, extensive remediation and a TMDL were completed for Upper Sylvan Lake in Burlington County and this lake (4 acres) is now regarded as mesotrophic. Additional information on this TMDL is provided in the Appendix to Part II, Chapter 3: Water Pollution Control Programs.

A subset of 12 lakes assessed under the Clean Lakes Program specifically for restoration (Phase I assessment) have undergone remediation. The remediation of Manahawkin Lake (45.5 acres) was successful and this lake is now regarded as mesotrophic. For the remaining lakes projects, remediation efforts have addressed some, but not all, of the issues associated with eutrophication. A list of lakes with ongoing Clean Lakes Program projects, impairments, method of remediation and current status are summarized in the Appendix on Table A4.3.3-1. In addition, the New

Jersey Lakes Bond Act provided funds for additional remediation projects which are summarized in the Appendix on Table A4.3.3-2.

4.3.2 Lake Eutrophication Source and Cause Assessment

Much of the Department's information regarding lake eutrophication comes from the Clean Lakes Program. As reported in earlier Water Quality Inventory Reports, lake eutrophication is a widespread issue in New Jersey and is characterized by elevated levels of suspended sediment, nutrient and algal concentrations. Aquatic life may be stressed due to dissolved oxygen fluctuations and in extreme situations, fish kills may occur. Eutrophic conditions generally lower the aesthetic and recreational value of the lake. Although all lakes naturally progress to eutrophic conditions, then become wetlands (especially those created as stream impoundments), this process is being accelerated by excessive inputs of nutrients and suspended sediments from point and nonpoint sources. In addition, an important factor to consider in New Jersey lakes is that most of them are shallow stream impoundments constructed for a variety of purposes including flood and sediment control. These shallow impoundments are highly prone to eutrophication. Through restoration projects, described below in Section 4.3.3, site-specific sources of nutrients and suspended sediment as well as management measures are identified for each lake.

4.3.3 Strategies to Protect and Enhance the Aesthetic Aspects of Swimming and Boating

Implement improvement projects in impaired lakes: New Jersey has traditionally used Clean Lakes Program funds to address eutrophication in lakes. Projects are summarized on Table A4.3.3-1 in the Appendix. More recently, the $5 million Lakes Bond Act has been used to begin additional projects, which are summarized on Table A4.3.3-2 in the Appendix. Nonpoint Source Management Grant (319h) is an additional source of funding for lakes restoration projects

As discussed in Part II, the New Jersey Environmental Infrastructure Trust fund was used to address water quality and sedimentation issues in Colonial Lake in Mercer County. Trust funds are now being used to manage upstream sources of sediment and nutrients. This project was initiated at the municipal level. It is important to note that USEPA no longer funds the Clean Lakes Program, although funds to reinstate this program have been requested from Congress.

Develop TMDLs for impaired lakes: All eutrophic lakes identified by the Clean Lakes Program are included on the 1998 Impaired Waterbodies List. Thus these lakes are subject to the provisions and schedules of the TMDL MOA (See Part II, Appendix A2.5). As TMDLs are developed, nutrient and sediment loads and cycling in the lakes will be assessed and management measures will be prioritized and implemented.

The Governor's Lake Restoration and Management Advisory Task Force ("Lakes Task Force") See section 4.1.5 ”Strategies to Protect and Enhance Aquatic Life Uses in Lakes" located earlier in this subchapter for a description.

Chapter 5 Estuary and Coastal Assessment

Aquatic Life Designated Use Milestone: Maintain and enhance aquatic life designated uses in assessed tidal waters.

5.1 Estuary and Ocean Aquatic Life Assessment

New Jersey's estuaries provide a rich spawning ground for many aquatic species. These species are important for recreational and commercial fishing and shellfishing, as well as important components of the aquatic ecosystem.

Various Programs within the New Jersey Department of Environmental Protection (NJDEP) have oversight for protecting coastal environments (e.g., water quality, fin- and shellfisheries, bathing beaches, land use permitting, etc.); management planning (e.g., Coastal Zone Management, Wastewater) and public policy implementation (e.g., Coastal Areas Facility Review Act). These Programs and descriptions of their activities can be found at NJDEP's Website (www.state.nj.us/dep/). In addition, NJDEP participates in a number of multi-state, estuarine management programs such as the Interstate Environmental Commission (IEC) formerly Insterstate Sanitation Commission, the Delaware River Basin Commission (DRBC) and three National Estuary Programs (i.e., NY/NJ Harbor Estuary and NY Bight Restoration Plan, Delaware Estuary Program and Barnegat Bay Estuary Program).

New Jersey's estuarine waters are assessed in conjunction with two interstate agencies, the Interstate Environmental Commission (IEC) and the Delaware River Basin Commission (DRBC). New Jersey assesses and reports on the estuarine waters within the southern half of Raritan Bay, Sandy Hook Bay and the back-bay waters from the Navesink estuary south to the eastern tip of Cape May (see Figure A5.1-1). The IEC assesses and reports on the waters in the New York/New Jersey Harbor, specifically the northern portion of Raritan Bay, Newark Bay, the Arthur Kill and Kill Van Kull, Upper New York Bay and the Lower Hudson River. The DRBC assesses and reports on the Delaware River and Bay. This New Jersey Water Quality Inventory Report does not include the observations and assessments published by the IEC or DRBC. For information regarding waters overseen by these two interstate agencies, please refer to the corresponding addresses provided in the front of this report.

5.1.1 Estuarine Aquatic Life Assessment Method

Dissolved oxygen (DO) is necessary for almost all forms of aquatic life and monitoring data are readily available. Therefore, DO status was selected as an indicator for this aquatic life designated use assessment. However, because many open water aquatic species are mobile and/ or naturally tolerant of transient low DO occurrences, DO is an indirect indicator of aquatic life designated uses. As discussed in the sections that follow, additional data and assessments are needed to improve this assessment.

NJDEP's Bureau of Marine Monitoring collects quarterly data for DO, salinity, temperature, pH, suspended solids and nutrients at approximately 170 sites in New Jersey's estuarine waters through the Marine and Estuarine Water Quality Monitoring Program (see Figure A5.1.1-1 in the Appendix). This aquatic life assessment is based upon subsurface dissolved oxygen (DO) levels

recorded between 1995 and June 1997. Water column DO levels at or above 4 mg/l were considered acceptable based upon New Jersey's Surface Water Quality Standards (N.J.A.C. 7:9B) within the waters assessed here. This assessment method was based on EPA Guidance for the Preparation of Water Quality Inventory Reports (USEPA, 1997) and is summarized below on Table 5.1.1-1. Because the data used for the Aquatic Life Designated Use assessment are 5 years old or less, the assessment is based on monitored data.

Table 5.1.1-1: Estuary Aquatic Life Use Assessment

Use Support Assessment	Dissolved Oxygen Concentrations
Full Support	DO <4 mg/l in 0 to 10% of the samples
Partial Support	DO <4 mg/l in 11 to 25% of samples
No Support	DO <4 mg/l in >25% of samples

5.1.2 Estuary Aquatic Life Assessment Results

New Jersey's estuaries from southern Raritan Bay south to Cape May had sufficient dissolved oxygen levels to support a healthy biota except within a cluster of shallow estuaries contained within Atlantic and Ocean Counties, beginning in the center of Manahawkin Bay and extending south to Great Egg Harbor Inlet (see Fig. A5.1-1). Of the total 264.3 square miles of estuary assessed here, 203.3 were assessed as fully supporting the Aquatic Life designated use. Of the remaining square miles, 61 partially support the use and 0 do not support the use.

Table 5.1.2-1: Estuary Aquatic Life Assessment Results

Use Support Status	Square Miles	Percent of Assessed Waters
Full Support	203.3	76.8%
Partial Support	61	23.2%
No Support	0	0%
Total	**264.3**	**100%**

Some important considerations associated with this assessment include:

1. Within coastal waters in general, most finfish either tolerate the conditions if they are marginal or avoid the areas altogether if conditions are severe.

2. Data employed to support this indicator are limited. In estuaries for example, there were no more than 7 values per site over a 3 year period, with many sites with less data.

3. In estuaries, the low DO values were typically only slightly below the SWQS criterion of 4 mg/l, and except for a few readings, were rarely below 3 mg/l.

5.1.3 Estuary Aquatic Life Source and Cause Assessment

Factors contributing to low dissolved oxygen concentrations in New Jersey estuaries are discussed in Zimmer and Groppenbacher (1999) and are both natural and anthropogenic.

Estuarine DO levels are characteristically lowest in summer, when water is warm and biological activity is at its highest. Many of the estuaries along the New Jersey coast are shallow waterbodies, often with poor mixing which contributes to the warming of the waters in summer that in turn contribute to low oxygen levels. An additional contributing factor to low DO is input~~s~~ of naturally oxygen depleted waters from adjacent wetlands especially during ebb tides.

Recorded low DO conditions have often been found to coincide with phytoplankton bloom die-off, the resulting decay of which contributes to water column oxygen consumption during the bloom die-off phase. Anthropogenic inputs of nutrients have contributed to elevated nutrient levels that are in turn believed to contribute to periodic phytoplankton blooms.
Anthropogenic inputs include nonpoint sources such as:

- surface runoff from agricultural and developed lands, transported by direct stormwater discharges and tributary inputs;
- direct ground water inputs of nitrogen from historical deposition;
- wet and dry atmospheric deposition of nitrogen oxide emissions, primarily from fossil fuel combusiton (Jaworski, et. al. 1997) which in the Barnegat Bay has been estimated to represent a substantial nitrogen load (USGS, written communication, 8 August 2000); and
- other sources such as large waterfowl populations and sediment resuspension through boat-created turbulence.

In addition, NJDEP recognizes that multi-media approaches to environmental assessment and management are best when dealing with contaminants that may be transported through differing media. Understanding the effects of air deposition and other non-point sources of pollution to coastal waters, including contaminant composition and magnitude of potential load, is critical to scientists and policy makers in formulating watershed-based management strategies and regional solutions to environmental issues. Recent investigations (Jaworski et. al. 1997) have estimated that for ten benchmark watersheds in the United States, including the Hudson and Delaware Basins on either side of New Jersey, the riverine nitrogen fluxes of nitrogen were highly correlated with atmospheric deposition onto their landscapes and also with nitrogen oxide emissions from their airsheds. More locally, a study of Barnegat Bay in New Jersey, a typical shallow Atlantic coast embayment, indicated that over 75% of the nitrogen input to the bay is from atmospheric deposition (Seitzinger and Sanders 1999).

To address these multi-media concerns, NJDEP has established the statewide New Jersey Atmospheric Deposition Network (NJADN) which samples gaseous, particulate, and precipitation concentrations of a number of contaminants at nine sites throughout the State. The NJADN, through the collection of data that address wet and dry deposition and air-water exchange of atmospheric pollutants, will provide estimates of direct loadings to surface waters. Such data will be especially important for aquatic systems that have large surface areas relative to watershed areas, such as coastal areas. Preliminary findings of the NJADN are available for a number of pollutants. Findings for nitrate confirm earlier estimates that air deposition of nitrogen may be significant for some watersheds. The annual wet deposition of nitrate throughout the State, as measured by the NJADN, ranged from 22 to 30 mmol/m^2/yr (Eisenreich & Reinfelder, 2001). With the assumption that nitrate represents roughly half of the total

dissolved nitrogen in rain (with the remainder either ammonium or dissolved organic nitrogen), average total nitrogen fluxes to terrestrial areas and coastal waters of the State are approximately 0.7 gram/m^2/yr.

5.1.4 Ocean Waters Aquatic Life Assessment Methods

Aquatic life assessment for ocean waters in New Jersey is based upon water column dissolved oxygen (DO) levels recorded by the USEPA helicopter during June through September, 1995 through 1998. (USEPA, 1999). A series of 10 transects extend east along the New Jersey coastline from Sandy Hook south to Cape May with samples taken at 1, 3, 5, 7, and 9 mile points along each transect. Samples are collected eight to ten times during the critical summer period. At each site, two samples are collected, one at one meter below the surface and one at one meter above the ocean floor. Ocean depths ranged from 20 to 75 meters.

For the purposes of this assessment only data from the 1 and 3 mile points were utilized (both surface and bottom) in order to limit the assessment to waters within New Jersey's three mile jurisdiction (Fig. A5.1). Because the data supporting the Aquatic Life Designated use assessment here are 5 years old or less, they are regarded as monitored.

Water column DO levels at or above 5 mg/l were considered acceptable based upon New Jersey Surface Water Quality Standards (N.J.A.C. 7:9B) within the waters assessed here. Sampling sites assessed as fully supporting the Aquatic Life Use exhibited acceptable DO in zero to ten percent of the data (top and bottom assessed together). Sites assessed as fully supporting but threatened exhibited unacceptable DO levels in 11 percent of samples or greater (see table 5.1.4-1 below).

Table 5.1.4-1: Ocean Water Aquatic Life Use Assessment

Use Support Assessment*	Dissolved Oxygen
Full Support	DO <5 mg/l in 0 to 10% of the samples
Full Support But Threatened (see note)	DO <5 mg/l in > 11% of samples
Note: DO concentrations are an indirect indicator of aquatic life use attainment. As discussed in Section 5.1.5 below, additional data are needed to improve this assessment. As additional data are collected and assessed, the assessment method and results will be adjusted to reflect the new information.	

Spatial Extent of Assessment: A total of 446 square statute miles of ocean were assessed based on data collected at 19 sites. Each site was assumed to represent 23.5 square statute miles (1/19 of the total area).

5.1.5 Ocean Water Aquatic Life Assessment Results

Of 446 square (statute*) miles assessed (Sandy Hook south to Cape May and out 3 nautical** miles) 21 percent (94 sq. statute mi.) fully support the Aquatic Life Use and the remaining 79

* Statute mile equals 5280 feet; a nautical mile is 6080 feet.

percent (352 sq. statute mi.) are threatened. The areas of full support are centered approximately one mile off the coast around Sandy Hook, Atlantic City, Corson Inlet and Hereford Inlet.

Some important considerations associated with these assessment results include:
Low DO occurrences were transient: USEPA personnel indicated that based on experience, the regions exhibiting low DO are transient, forming during the summer months and disappearing during the fall turnover and not forming again until the following summer when the waters re-stratify (Randy Braun, personal communication).

Low DO occurred on the ocean bottom: DO readings collected at one meter below the surface indicate acceptable DO and almost all exceedences of criteria were recorded on the ocean bottom (one meter off the bottom). Additional data within the water column are needed to characterize the volume of the low DO cells.

Lack of annual data: USEPA data used for this assessment were collected during the most stressful period of the year (June through August) when DO levels are lowest, and as such, are not gathered to specifically assess the attainment of aquatic life designated uses year-round.

Lack of biological data: DO concentrations provide an indirect indicator of aquatic life designated use attainment. In open waters, fish can avoid areas with low DO, and many crustaceans are naturally tolerant of temporary low DO conditions. Therefore, the significance of temporary low DO conditions to aquatic life uses is unclear at this time. Clearly, biological data such as recorded fish kills or assessments of invertebrate populations would significantly enhance this assessment. As additional data are compiled, the assessment methods and results will be adjusted to reflect the new information.

5.1.6 Coastal Aquatic Life Source and Cause Assessment

Occurrences of low DO in the ocean has been attributed to a combination of natural processes and anthropogenic inputs of nutrients. Ocean waters naturally stratify as they warm in the summer. As phytoplankton bloom and die during the summer, natural biological activity decomposes the algae which in turn reduces DO levels near the ocean floor. The rate, timing and extent of phytoplankton cycles may be worsened by nutrient inputs from near shore waters.

USEPA (1999) attributed the low DO in the near shore waters to the oxygen demand created by river inputs, offshore sewerage treatment plant inputs (there are 15 outfalls in the New Jersey coastal waters, see Figure A5.2.3-2), stormwater runoff and the influence of the plume from the Hudson/Raritan River estuary system. Zimmer and Groppenbacher (1999) also mention the presence of ocean sanitary discharges as a potential source contributing nutrients to offshore waters. Atmospheric contributions to nutrient enrichment occur in the ocean but, in contrast to estuaries, their relative significance appears to be minor when contrasted to other inputs (NY-NJ Harbor Estuary Program, 1996).

5.1.7 Maintaining and Improving Aquatic Life in Coastal Waters

Improve the basis for aquatic life assessments: Additional biological datasets will be explored and, as appropriate, integrated into future assessments of aquatic life in coastal waters. Major

datasets include: fish and shellfish population data collected by the Division of Fish and Wildlife and other entities; ocean biological monitoring performed in the vicinity of the 15 ocean STP outfalls through NJPDES permits; data regarding fish kills and chlorophyll a data collected via satellite. Additional assessments are also expected to become available through publication of the Barnegat Bay Estuary Program's Characterization and Assessment.

Develop a "fishable index": NJDEP is developing a fishable index that relates to the Clean Water Act's "Fishable Goal" that considers fish and shellfish population and consumption issues. The improved basis for aquatic life assessments is expected to provide data needed to support development of the fishable index. Progress on development of the fishable index will be reported in the next Water Quality Inventory Report.

Continue to monitor and assess air deposition of nutrients to coastal waters: NJDEP is operating an Air Deposition Monitoring Network that includes nutrient data collection. This network is expected to provide important data related to nutrient fluxes to estuarine and ocean waters from air deposition. These nutrient fluxes, in addition to land based sources, may play an important role in algal blooms in these waters that contribute to episodes of low DO.

Manage nutrient loads to coastal waters: As appropriate, based on the assessments above, additional measures to manage nutrient loads to coastal waters may be needed. It is important to observe that pollution sources influencing ocean impairment are interstate in nature and their remediation is also. Management measures within the waters discussed here must be the responsibility of New Jersey, New York City and New York State. A nutrient Total Maximum Daily Load (TMDL) analysis is being planned through the New York-New Jersey Harbor Estuary Program.

5.2 Estuarine and Coastal Recreational Designated Use Assessment

Subgoal 2. Protect recreational designated uses in tidal and non-tidal waters.

Milestones/Objectives: Maintain and improve the current number and quality of suitable lake, ocean and bay bathing beaches in NJ.

Milestone: By 2005, 100% of New Jersey's coastal recreational beach waters will be safe for swimming

New Jersey's coastal beaches and waterways are very intensely used for recreational purposes. This resource includes 138 bay monitoring stations covering about 4 miles and 179 ocean stations covering 127 miles. In addition, 264.3 square statute miles of tidal estuarine rivers and shallow back bays form an inner-coastal estuarine network (Fig. A5.2.2-1). New Jersey's ocean jurisdiction extends to 3 nautical miles off-shore, 446 square statute miles. Ocean and bay resources are widely used for swimming, boating, commercial and recreational fishing and shellfish harvest. Thus, there are ample opportunities for direct contact with these waters and high sanitary quality is very important for protection of public health, economics and enjoyment of this valuable resource.

5.2.1 Estuarine and Coastal Recreational Designated Use Assessment Method

Recreational designated use attainment was assessed using several datasets:

- Cooperative Coastal Monitoring Program beach closure data from over 6000 samples collected each between 1997 and 1999 were used to assess recreational uses at designated ocean and bay bathing beaches. Data are managed in an in-house database. Results have been reported in New Jersey's Environmental Indicator Technical Report (NJDEP, 2000b. DRAFT)

- Marine and Coastal Water Quality Monitoring Program fecal coliform data from over 600 samples collected between 1995 and 1997, inclusive, were used to assess recreational use attainment in tidal rivers and estuaries. Data are managed in USEPA's STORET database. Results were published in "Report on Marine and Coastal Water Quality, 1993-97" (NJDEP, October, 1999). This report is available from the NJDEP website: www.state.nj.us/dep.

- USEPA Ocean Monitoring included collection of fecal coliform data from 44 stations, sampled 7-14 times per year; 452 samples were collected in 1997 and 547 samples were collected in 1998. (USEPA, 1999). These data and an assessment of ocean pollution sources were used to assess recreational use attainment in the ocean.

National Shellfish Sanitation Program data provide another dataset that could be used to assess recreational designated use attainment. Integration of this very large dataset will be explored for the 2002 New Jersey Water Quality Inventory Report.

Table 5.2.1-1: Primary Contact Assessment Method for Ocean and Bay Beaches	
Full Support	Less than or equal to 10% of 100 beach days are closed per year
Full Support but Threatened	Less than or equal to 10% of 100 beach days are closed per year but rising levels of bacterial indicator(s) indicate full support will not be met next year.
Partial Support	Between 11% and 25% of 100 beach days are closed per year
No Support	Greater than 25% of 100 beach days are closed per year

Notes:
Water Quality Standard: Compared to NJ DHSS primary contact standard. The NJDHSS Primary Contact Standard requires that single samples contain less than or equal to 200 FC/100 ml. Resampling is required if a sample exceeds 200 FC/100 ml, and beaches are closed if the resample also exceeds the standard. Some beaches may also be closed on a precautionary basis if it is likely that the standard will be exceeded. Secondary contact uses are considered to be met if NJ DHSS for primary contact is met.
Data Source: Cooperative Coastal Monitoring Program Ocean and Bay Beach Closure data reported as an environmental indicator
Spatial Extent of Assessment: 138 back bay beaches estimated to be 150 feet long (beachfront) x 100 feet wide (3.9 square statute miles); 127 miles of ocean beaches estimated to be 150 feet wide .

Table 5.2.1-2: Recreational Designated Use Assessment Method for Ocean Waters	
Full Support	The FC geometric average was greater than 50 MPN/100ml in less than 10% of stations used to assess the waterbody
Full Support but Threatened	FC levels meet full support but statistically significant adverse trends indicate full support will not be attained in 2 years.
Partial Support	The FC geometric average was greater than 50 MPN/100ml in 11-25% of stations used to assess the waterbody
No Support	The FC geometric average was greater than 50 MPN/100 ml in more than 25% of stations used to assess the waterbody
Notes: **Water Quality Standard:** NJ Surface Water Quality Standard for SC Waters (N.J.A.C. 7:9B); Secondary contact uses are considered to be met if SWQS for primary contact is met. **Data Sources:** Cooperative Coastal Monitoring Program FC data from 1998 and 1999; USEPA Ocean Monitoring done by helicopter; FC data for 1998 and 1999 were assessed; best professional judgement of pollution sources in NJ off-shore ocean waters. **Spatial extent of assessment:** Ocean shoreline to 3 miles off-shore (446 square statute miles)	

Table 5.2.1-3: Recreational Use Assessment Method for Estuarine Waters	
Full Support	The FC geometric average was less than 200 MPN/100ml and less than 10 percent of individual samples exceeded 400 MPN/100 ml.
Full Support but Threatened	FC levels meet full support but statistically significant adverse trends indicate full support will not be attained in 2 years.
Partial Support	The FC geometric average was less than 200 MPN/ 100 ml, but more than 10 percent of individual samples exceeded 400 MPN/100 ml.
No Support	The FC geometric average exceeded 200 MPN/100 ml and more than 10 percent of individual samples exceeded 400 MPN/ 100 ml.
Notes: **Water Quality Standard:** NJ Surface Water Quality Standard for SE Waters (N.J.A.C. 7:9B) Secondary contact uses are considered to be met if SWQS for primary contact is met. **Data Sources:** Marine and Coastal Water Quality FC data collected between 1995 and 1997. Data were grouped by waterbody to have at least 10 samples per waterbody assessment. **Spatial Extent of Assessment:** Tidal rivers and back bays from Raritan Bay to the tip of Cape May and Maurice River and Cove. (269.15 square statute miles) Raritan Bay was included because recreational uses were not assessed in the Interstate Sanitation Commission's 2000 Water Quality Inventory Report; Delaware Bay was not included because recreational uses were assessed in the Delaware River Basin Commission's 2000 Water Quality Inventory Report.	

The beach closure environmental indicator provides information that is important to citizens, local officials and environmental managers. The beach closure indicator also provides information regarding local pollution sources that is needed to manage intensely used beach resources.

5.2.2 Estuarine and Coastal Recreational Designated Use Assessment Results

Estuarine Waters

As shown on Figure 5.2.2-1 and Table A5.2.2-1a in the Appendix, recreational designated uses were fully met in all estuarine waters from the tip of Sandy Hook to the tip of Cape May. Recreational designated uses were partially met in the Maurice River and Cove. Thus of 269.15 square statute miles assessed, 98.2% (264.03 sq. miles) fully met recreational uses and 1.8% (4.8 sq. miles)partially met recreational uses between 1995 and 1997.

As discussed in the Report on Marine and Coastal Water Quality, 1993-1997, levels of FC above background indicate the presence of FC sources in several waterbodies. (Zimmer and Groppenbacher, 1999). Additional work is needed to assess trends in FC concentrations and to evaluate potential threats to designated use attainment in these waterbodies.

Table 5.2.2-1: Estuarine Waterbodies Affected by FC Pollution Sources		
• **Monmouth County**		
Navesink River	Shark River	Manasquan River and Inlet
• **Barnegat Bay and Tributaries**		
Metedeconk River	Toms River	Forked River
Silver Bay	Waretown Creek	Westecunk Creek
Mullica River		
• **Atlantic and Cape May County Back Bays**		
Absecon Creek	Great Egg Harbor River	Middle River
Beach Thoroughfare	Inside Thoroughfare	Lakes Bay
Jarvis Sound	Cape May Canal	
• **Delaware Bay**		
Maurice River and Cove	Nautuxent Cove	

Ocean Waters

As shown on Figure 5.2.2-1 and Table A5.2.2-1b in the Appendix, recreational designated uses were fully met in all ocean waters. A review of pollution sources did not identify any significant threats to sanitary quality in ocean waters. Thus of 446 square statute miles assessed, 100% fully met recreational designated uses between 1998 and 1999.

Bathing Beaches

As shown in the Bathing Beach Environmental Indicator Report provided in Appendix A5.2.2-2, recreational designated uses were fully met at all ocean and bay bathing beaches for 1998 and 1999.

5.2.3 Estuarine and Coastal Recreational Designated Use Source and Cause Assessment

Although recreational designated uses were largely met in NJ estuarine and ocean waters, localized problems occur. The following provides a qualitative assessment of the sources fecal coliform where levels are above background levels.

Sources of FC that may affect NJ estuarine and ocean waters include:

- Municipal Stormwater and Runoff – there are over 7000 storm drains that discharge to river and bay estuarine waters. Stormdrains and overland runoff can be a source of FC pollution from pets and other wildlife. More stormdrains are installed each year as coastal areas are developed; runoff increases as impervious areas increase. Figure A5.2.3-1 shows the density of storm drains in the Asbury Park vicinity. Through NJs Sewage Infrastructure Improvement Act Program, cross-connections and inter-connections with sanitary sewer lines have been investigated and largely corrected. As

- Wildlife – congregations of seagulls are a suspected source of FC pollution in some areas.

- Sanitary discharges from boats – although boaters are encouraged to use pump-out stations and No Discharge Zones have been established in some areas, some sanitary discharge from boats probably still occurs.

- Municipal Sewage Treatment Plants – There are 15 municipal STPs that discharge to the ocean in NJ (see Figure 5.2.3-2). Improvements in estuarine water quality occurred as coastal STPs were regionalized and upgraded in the 1980's. Although compliance with FC limits is generally very good, localized problems still occur. For example, sewer line blockage closed beaches in Atlantic City 6 times in 1999.

- Transport from Non-tidal Rivers - The sanitary quality of non-tidal rivers is poor, and recreational designated uses are largely not met in these rivers. Sources of FC pollution to non-tidal rivers include municipal stormwater and runoff, combined sewer overflows, sanitary sewer overflows, and wildlife (primarily geese).

- As discussed in the Designated Use Assessments for Rivers and Streams (Part III, Chapter 3, Section 3.3), sanitary quality was monitored in the Ambient Stream Monitoring Network in the following rivers that flow to estuarine waters: Manasquan, Toms, Mullica, Great Egg, Maurice, Cohansey and Salem. All stations are above the head of tide. The Toms, Mullica and Maurice met SWQS for FC at the downstream sampling stations between 1995 and 1997. Exceedences rates ranged from 15% to 41% in the remaining rivers. These data must be interpreted with caution however, because sampling programs were not conducted concurrently. Additional effort is needed to better evaluate FC inputs from non-tidal rivers to estuarine rivers and bays.

- Transport from Lakes – Field investigations have revealed that lake outlets have lead to bathing beach closures.

5.2.4 Maintaining and Improving Recreational Designated Use Attainment in Coastal Waters

- The Department's Bathing Beach Action Plan to address beach pollution issues is provided as Appendix A5.2.3-1**.**

- The Department will continue to perform aerial surveillance of nearshore coastal waters which enables the routine evaluation of coastal water quality and the assessment of the nature and extent of ocean pollution. Six flights per week, excluding Wednesdays, include Raritan Bay, the Lower New York Bay, and the Atlantic coast from Sandy Hook to Barnegat Inlet. Flights on Thursdays and Sundays are extended to include the area from Barnegat Inlet to Cape May Point.

- As part of the New York-New Jersey Harbor Estuary Program Floatables Action Plan, flight activities are coordinated with the United States Environmental Protection Agency (USEPA) and the United States Army Corps of Engineers' effort to capture floating solid waste and debris, also known as floatables, with water-skimming vessels. Sources of floatables that have affected the State's coastal shores include stormwater outfalls, combined sewer overflows, operational landfills, and illegal dump sites. Surveillance flights continue to record a decrease in the quantity of floatables in the coastal waterways compared to the years prior to 1990.

- In order to address this issue, NJDEP's Water Compliance and Enforcement Element will shift emphasis of weekly summer inspections to include sewage collection systems as well as STP facilities.

- Through the development and implementation of TMDLs for FC pollution in rivers that flow to estuaries, reduction of FC from freshwaters is expected. This reduction is expected to have a positive influence on FC concentrations in coastal waters

Chapter 6 . Wetlands Assessment

6.1 Development of Wetland Water Quality Standards

In New Jersey the chemical, physical, and biological integrity of wetlands are protected under both federal and state laws. Federal protection is provided under sections 303, 401, and 404 of the Federal Clean Water Act. Section 401 is designed to allow the State to control any discharges to its waters, which may result from the issuance of a federal permit or license, through a certification process. Section 404 addresses and regulates the discharge of dredge and/or fill material into wetlands and other waters of the state. In 1994, New Jersey began implementing its State program in place of the Section 404 program after being granted the authority by the EPA pursuant to Section 404(g). Section 303 provides protection through the antidegradation provisions of the Surface Water Quality Standards. The State includes wetlands in the definition of "surface waters". Like many States, New Jersey is anticipating guidance from USEPA to develop wetlands criteria and guidance for incorporation into State rules and regulations.

Several New Jersey statutes provide various levels of protection to wetlands including the New Jersey Water Quality Planning Act (N.J.S.A. 588:11A-1), the Flood Hazard Area Control Act (N.J.S.A. 58:16A-50 et seq.) and the New Jersey Water Pollution Control Act (N.J.S.A. 58:10A-1). Specific protection is provided for New Jersey tidal wetlands through the Wetlands Act of 1970. In addition, since July 1,1988, the State has protected its "inland" wetlands through the Freshwater Wetlands Protection Act (FWPA) (N.J.S.A. 13:9B-1 et seq.). Prior to enactment of the FWPA, several different state laws afforded various levels of protection to "inland" wetlands. One of the goals of the Act was to consolidate the protection of wetlands into one program. It should be noted, however, that the FWPA does not affect wetlands previously regulated under the Wetlands Act of 1970. In addition, the FWPA exempted areas under the jurisdiction of the Hackensack Meadowlands Development Commission and therefore, activities in this area do not require a State freshwater wetlands permit nor are they subject to transition area requirements. In the areas under the regulation of the Pinelands Commission, freshwater wetland requirements are implemented, but applicants must also comply with the Pinelands Comprehensive Management Plan.

6.2 Integrity of Wetland Resources

Currently, NJDEP is in the midst of several research studies to monitor the biological, physical and chemical integrity of wetlands. Brief descriptions of these projects are provided below. Although all of these research projects are collaborative efforts, they are organized according to NJDEP Lead Program.

NJDEP Office of Natural Lands Management (ONLM) Wetlands Research

GAP Analysis. The NJDEP Office of Natural Lands Management (ONLM) classifies, maps and assesses the status of natural communities (both wetland and upland) of the state. This work is proceeding on a broad scale through multi-agency funding for the **Mid-Atlantic Gap Analysis Project**. Through this project, all of the vegetation of the state is being classified to the U.S. National Vegetation Classification, and mapping is being done at a scale of 1:100,000. This work is facilitating the development of conservation status ranks of vegetation communities and the

identification of communities that are imperiled or rare and of conservation concern at the state or global level.

ONLM Wetlands of Concern Research. Funded by the EPA wetland protection development grant program (Section 104.B.3), NJDEP Office of Natural Lands Management has initiated several projects aimed at developing monitoring programs for wetlands that are of conservation concern. These competitive grants have funded work to classify wetland vegetation communities, evaluate wetland quality for biodiversity conservation, and establish baseline monitoring for several wetland types including calcareous sinkhole ponds, pitch pine lowlands, pine barren riverside savannas, and non-tidal floodplain forests. These particular wetland types each harbor significant numbers of species that are endangered, threatened or rare in the state. This work will continue to focus on additional significant wetlands types as funding allows.

- For ***pitch pine lowland forest* wetland communities**, in addition to classifying the vegetation of the different variations of the community, the fire history regime is being characterized to increase our understanding of the role of fire in maintaining the vegetation of the community types.

- For ***calcareous sinkhole pond* communities**, in addition to classifying vegetation, much work has been done to characterize the relative contribution of groundwater vs. overland runoff to the wetlands, monitoring water dynamics over the course of a year. Benthic macroinvertebrates have been sampled, providing a glimpse of how these ephemeral palustrine communities differ from the riparian benthic communities that are regularly surveyed in the state.

- For ***pine barren riverside savanna* communities**, in addition to classifying present day vegetation, sediment and peat cores have been analyzed to characterize the setting of the communities in the landscape as well as vegetation history (pollen) and fire history (charcoal). Groundwater monitoring wells have also been installed in several reference wetlands. What has emerged is a view of wetland communities that have been shaped and influenced by stream valley dynamics, groundwater flow, stream flooding, and fire over the past 8000 – 9000 years.

- For ***non-tidal floodplain forest* wetlands**, work has begun on vegetation classification and identification of reference wetland sites. Once reference sites are selected, additional environmental data including existing surface water monitoring data from adjacent streams will be reviewed to characterize the environmental setting of the reference sites and to develop monitoring plans for one high quality and one degraded floodplain forest per watershed management area.

New Jersey Rare Wetlands Plant Species Trends. Through funding from NJDEP's Division of Science, Research and Technology, the Office of Natural Lands Management has also been reviewing the Natural Heritage Database to assess trends and develop monitoring plans for Endangered Plant Species. More than 50% of the endangered plant species in New Jersey use

wetland habitats and this work can be partitioned to focus on the wetland species, thereby providing an assessment of an important natural resource of our wetlands.

NJDEP Land Use Regulation Program Research

Hydrogeomorphic Assessment (HGM). NJDEP and Rutgers University scientists are conducting an EPA-funded study to assess the feasibility of using Hydrogeomorphic Wetlands Assessment methods in New Jersey. Thirteen reference wetland sites are being field studied in-depth to develop an HGM model for riverine wetlands in New Jersey's glacial lake basin.

NJDEP Division of Science, Research and Technology Research

Developing Indicators of Wetland Quantity and Quality. NJDEP scientists within both the Division of Science, Research and Technology and the Land Use Regulation Program are working with NJDEP consultants to field assess wetland mitigation sites in New Jersey. The research goals of this State-supported project include indicators of mitigation acreage achieved (quantity), as well as potential wetlands quality indicators through a Qualitative Rapid Assessment Tool that is predictive in nature.

Regional Geographic Initiative: Development of Wetlands Quality and Function Assessment Tools and Demonstration in Two New Jersey Watersheds. Rutgers University scientists working on the HGM project (cited previously) have teamed with the Division of Science, Research and Technology and Land Use Regulation Program to conduct a comprehensive literature review of wetland functional assessment tools and apply a subset of the most promising tools at the HGM reference wetlands. The results of this EPA-supported work will help NJ understand the utility of various functional assessment tools for some New Jersey wetlands.

Testing a Wetlands Mitigation Rapid Assessment Tool At Mitigation and Reference Wetlands in New Jersey. The Rapid Assessment Tool under development through the *Wetlands Quantity and Quality Indicator* project cited previously will be field-tested at the HGM reference wetlands sites by Rutgers University scientists. This State-supported research will tie the various functional assessment studies together by comparing the application of these different tools at the same sites. The research will also provide a comparison between naturally occurring wetlands sites and mitigation sites. Finally, this work will provide additional data about the consistency in application of a rapid assessment tool by different evaluators.

Wetlands Metal Sequestration and Citizen Knowledge. Scientists from NJDEP, Princeton University, and the Stony Brook-Millstone Watershed Association are conducting an EPA-NSF funded study to link an ecological model of metal behavior in wetland soils, as affected by plant species composition, with a sociological study of citizen perceptions of the function and value of wetlands. This study will explore how such perceptions may change with the benefit of information from the wetlands metals research.

Endangered and Nongame Species Program (ENSP) Research

Landscape Project. NJDEP's Endangered and Nongame Species Program (ENSP) in collaboration with multiple partners, has developed a landscape level approach to protect rare

species and critical wildlife habitat. Priority habitats for rare species by NJ Landscape Region for wetlands, forest, and grassland species are being mapped using an extensive data base of species locations, land use classification data, and scientific literature values on species ranges. Internet-based and hardcopy mapping products will be provided at the state, county and municipal levels to provide users with information for planning and regulatory applications.

Herpetofauna Projects. NJDEP's ENSP has three citizen-science based herpetofauna conservation projects to identify wetlands-associated species. Herpetofauna serve as surrogates for water quality. Through peer-review journal publications, it is quite clear that most amphibians and some reptiles are excellent bio-indicators for water quality.

- The ***New Jersey Herptile Atlas***, which began in 1994, is a ten-year project aimed at determining amphibian and reptile distribution and population statewide through volunteer surveys. The Atlas is in the process of collecting point location data for all species.

- The ***Calling Amphibian Monitoring Program*** works with volunteers to survey 24 transects statewide in order to perform frog and toad population trend analysis. All survey points are geo-referenced.

- The ***Vernal Pool Protection Project***, anticipated to begin September 2000, will have volunteers confirm locations of vernal ponds and survey these locations for herpetofauna.

See www.dep.state.nj.us/dep/fgw/ensphome.htm for more information on these ENSP initiatives.

6.3 Extent of Wetland Resources

Since 1995, NJDEP has participated in the National Environmental Performance Partnership System (NEPPS) to institute Results-Based Management Department-wide. Measures of environmental progress, using the stressor-condition-response model of indicators are a key aspect of the NEPPS process. NJDEP's 1998 Strategic Plan set forth a milestone for wetlands:

Milestone: By 2005, there will be a net increase in wetland acreage and quality.

Following the stressor-condition-response model of environmental indicators, NJDEP has developed stressor and condition indicators for wetlands in New Jersey. These measures, identified by stakeholders as important measures of wetland stressors and conditions, are beginning to provide a consistent set of status and trend data for NJ wetlands. Although NJDEP has not yet developed the response indicator data in time for the 305B report, NJDEP expects to include response indicators (such as number of acres of wetlands preserved), as the third component to the stressor-condition-response indicators for wetlands.

Stressor Indicator: NJDEP Permitted Wetlands Losses

Permitted wetlands disturbances in relation to wetland mitigation required is an indirect measure of the net change in impacted wetlands acreage in New Jersey. From July 1, 1988 to June 30, 1999, 1,638.12 acres of NJ freshwater wetlands were permitted to be disturbed, while a total of

920.12 acres of compensatory mitigation were required, resulting in an estimated permitted net loss of 718 acres of freshwater wetlands over this eleven-year period. Assuming the 1986 freshwater wetland baseline of 739,160 acres (NJDEP Bureau of Geographic Information and Analysis), the permit data indicate approximately 0.22% of NJ freshwater wetlands have been permitted for disturbance resulting in a permit-estimated net loss of 0.09% of freshwater wetlands over this eleven year period.

From 1992 to 1998, an estimated 204.18 acres of NJ coastal wetlands were permitted to be disturbed. Required mitigation for this disturbance consisted of approximately 17.5 acres of creation and 8,849 acres of enhancement (return of natural tidal flow to former salt hay farms). While there has been a net loss of coastal wetlands, there is projected to be an increase in the function and value of approximately 8,900 acres of coastal wetlands where enhancement and restoration projects are underway.

Data on the impacts to wetlands as a result of exemptions specified in the New Jersey Freshwater Wetlands Protection Act are not included in these data. Regulatory authority for wetlands permits within the Hackensack Meadowlands is under the jurisdiction of the U.S. Army Corps of Engineers and therefore, data for permitted wetlands activities within the Hackensack Meadowlands are not accounted for. While New Jersey does retain authority for wetlands impacts under Section 401 of the Clean Water Act, in practice NJDEP defers to the HMDC and their consistency finding with New Jersey's Coastal Zone Management Plan. NJDEP will work with HMDC to include these data in the next iteration of indicator reporting. Other exemptions not reported include: ongoing farming activities such as construction or maintenance of farm ponds or irrigation ditches and maintenance of farm or forest roads; projects for which preliminary site plan or subdivision applications received preliminary approvals prior to the effective date of the Act (7/1/88); projects for which preliminary site plan or subdivision applications were submitted prior to June 8, 1987 (at which time Governor Kean issued a moratorium on construction in wetlands until FWWPA signed); and permit applications that were approved by the Army Corps of Engineers prior to the effective date of the Act.

See Chapter 6 Appendix for more complete information on this stressor indicator.

Condition Indicator: Acres of Freshwater and Tidal Wetlands in New Jersey.

NJDEP maintains a digital data set of land use/land cover data using a modified Anderson (Anderson et al. 1976) classification system based upon 1:24,000 and 1:12,000 scale aerial photography from two points in time: 1986 and 1995/97. The minimum mapping unit for wetlands is 1 acre. Thousands of ground-truth points are associated with these data sets. The 1995/97 data set also includes an impervious surface cover data layer at 5% imperviousness intervals.

Freshwater wetlands were delineated at 1:12,000 in both 1986 and 1995/97 to a one-acre minimum mapping unit. Coastal wetlands were delineated at 1:24,000 in 1986 and 1:12,000 in 1995/97. Data for 1986 are currently available on the Internet for all of New Jersey. Statewide data for 1995/97 are expected in Fall 2000; however, NJDEP is releasing data on a watershed

management area basis in DRAFT form as they become available. Once all data are received, quality-assured, and edge-matched, NJDEP will release a FINAL statewide coverage. See www.state.nj.us/dep/gis for the 1986 and 1995/97 NJDEP land use/land cover data and complete metadata.

Since NJDEP's land use/land cover data are more precise than previously available data sets, NJDEP is reporting on statewide wetlands acres based on the 1986 coverage. NJDEP is also reporting on net loss of wetlands acres by Anderson classification system for 12 out of 20 NJ Watershed Management Areas between the period 1986-1995/97. NJDEP will be able to provide statewide net loss acreages for the entire State after all 1995/97 data are received (expected Fall 2000). NJDEP is also expecting to update these data into the future to track land use/land cover change over time.

Based upon the 1986 Land Use/Land Cover data set, NJDEP estimates there are 948,429 acres of wetlands in New Jersey broken out as: 739,160 acres of freshwater wetlands and 209,269 acres of tidal wetlands. NJDEP estimates that wetlands comprise approximately 19% of the total NJ land base of 4,984,338 acres.

1986 New Jersey Wetlands (Freshwater and Tidal) By County

County	Land Area (sq. miles)	Wetland Area based on 1986 LULC (Acres)	% of County is Wetlands based on 1986 LULC
Atlantic	569	120974	33.2%
Bergen	234	11891	7.9%
Burlington	819	137193	26.2%
Camden	221	19941	14.1%
Cape May	267	81511	47.7%
Cumberland	500	93956	29.4%
Essex	130	6493	7.8%
Gloucester	329	32219	15.3%
Hudson	47	2792	9.3%
Hunterdon	423	19918	7.4%
Mercer	228	20925	14.3%
Middlesex	312	39994	20.0%
Monmouth	476	63546	20.9%
Morris	468	43148	14.4%
Ocean	642	100799	24.5%
Passaic	192	9020	7.3%
Salem	365	56638	24.2%
Somerset	307	24939	12.7%

County	Land Area (sq. miles)	Wetland Area based on 1986 LULC (Acres)	% of County is Wetlands based on 1986 LULC
Sussex	527	41585	12.3%
Union	103	3342	5.1%
Warren	362	17605	7.6%
Total	**7521**	**948429**	**19.7%**

Draft Wetlands Change By Anderson Type, 1986-1995 For 12 Of 20 NJ Watershed Management Areas					
Anderson Label	**Anderson Code**	**Acres 1986**	**Acres 1995**	**Acreage Loss/Gain**	**Percent Change**
Agricultural Wetlands (Modified)	2140	38142	33430	-4711	-12.4%
Atlantic White Cedar Swamp	6221	11175	10878	-297	-2.7%
Coniferous Scrub/Shrub Wetlands	6232	3230	3183	-47	-1.5%
Coniferous Wooded Wetlands	6220	17949	17450	-499	-2.8%
Deciduous Scrub/Shrub Wetlands	6231	30442	27376	-3067	-10.1%
Deciduous Wooded Wetlands	6210	193813	186821	-6993	-3.6%
Disturbed Wetlands (Modified)	7430	5966	9707	3741	62.7%
Former Agricultural Wetland-Becoming Shrubby, Not Built-Up)	2150	2	3170	3168	195571.3%
Freshwater Tidal Marshes	6120	1368	1339	-29	-2.1%
Herbaceous Wetlands	6240	28120	25035	-3085	-11.0%
Managed Wetland In Built-Up Maintained Rec Area	1850	1807	2309	502	27.8%
Managed Wetland In Maintained Lawn Greenspace	1750	3218	3981	763	23.7%
Managed Wetlands (Modified)	8000	442	0	-442	-100.0%
Mixed Brush And Bog Wetlands, Coniferous Dominate	6234	3140	3266	126	4.0%
Mixed Forested Wetlands (Coniferous Dom.)	6252	19965	19529	-436	-2.2%
Mixed Forested Wetlands (Deciduous Dom.)	6251	24461	23927	-534	-2.2%
Mixed Scrub/Shrub Wetlands (Deciduous Dom.)	6233	3952	3930	-23	-0.6%
Saline Marshes	6110	32520	32341	-179	-0.6%
Vegetated Dune Communities	6130	1909	2054	145	7.6%
Wetland Rights-Of-Way (Modified)	1461	2420	2460	39	1.6%
Severe Burned Wetlands	6500	0	429	429	100.0%
Total		**424042**	**412612**	**-11430**	**-2.7%**

6.4 Additional Wetlands Protection Activities

Preservation

The State of New Jersey has a long history of preservation of open space, including important wetlands habitat. NJDEP implements land preservation through its Green Acres Program.

The preservation of wetlands as a natural resource is a policy of the Green Acres Program. The program is predicated on the preservation of open space for public conservation and recreation purposes. These purposes include both freshwater and coastal wetlands and wetland systems such as stream corridors, aquifer recharge areas and floodplains. Green Acres has provided funding for direct acquisition by the State of wetlands along the Delaware Bayshore, in the Highlands and Pinelands regions of New Jersey. The local government and nonprofit funding programs also provide funding for wetlands preservation.

The Green Acres project ranking system considers wetlands features as an element of the natural resources of the proposed project. The water quality protection element of wetlands along with the protection of headwaters and stream corridors is an important feature of Green Acres acquisition projects.

In addition to acquisition programs, Green Acres also has a tax exemption program for nonprofit conservation organizations. This program provides for property tax exemption for lands owned by nonprofits that have conservation and recreation value and provide for public access and use. Many freshwater wetland systems, such as Troy Meadows are enrolled in the program.

In 1998, New Jersey voters approved a constitutional dedication of $98 million of annual funds for ten years and over $1 billion in bond financing to support open space preservation. Passage of the Garden State Preservation Trust Act in June 1999, established this stable source of funding.
For more information see: *www.state.nj.us/dep/greenacres/challenge.htm*

Mitigation

NJDEP requires compensatory mitigation for activities in wetlands that involve investigation, cleanup, or removal of hazardous materials, as well as activities requiring Individual Permits (activities that exceed the requirements of General Permits). Mitigation of wetlands can be achieved through wetland creation, restoration and/or wetland enhancement. NJDEP is establishing performance standards for various types of wetland mitigation to inform applicants of success criteria they need to meet.

Other forms of mitigation include: upland preservation to benefit a freshwater wetland ecosystem; purchase of mitigation credits from a wetland banker who has performed wetland creation, restoration, and/or enhancement; or monetary contribution to the Wetland Mitigation Fund for wetland creation or land donation by the Freshwater Wetland Mitigation Council.

The Freshwater Wetlands Mitigation Council has awarded over $600,000 from the Wetland Mitigation Fund towards the enhancement, restoration and creation of wetlands throughout New Jersey.

NJDEP's Office of Natural Resource Damages has facilitated wetlands enhancement, creation, restoration and preservation efforts near natural resource damage sites.

The US Fish & Widlife Service has been working with landowners to restore 482 acre of salt marsh to benefit waterfowl in New Jersey. This program has also helped revegetate three miles of riparian corridors. Also, the Army Corps of Engineers is working on plans to help restore the stream banks of the Cooper River in Camden County.

Conservation Resource Enhancement Program

The Conservation Resource Enhancement Program is a joint federal and state land conservation program designed to address state and nationally-significant water quality, soil erosion, and wildlife habitat issues related to agricultural land use. NJDEP and the NJ Department of Agriculture are anticipating a cooperative program with the federal government to purchase easements or rental contracts on up to 30,000 acres of riparian buffers on agricultural lands. These lands are expected to include wetlands and implementation of the program is expected to contribute to NJ's goal of achieving a net gain in wetlands acreage and quality.

Proposed Rules

NJDEP has recently issued Proposed readoption of freshwater wetlands rules to help achieve wetlands goals for increased wetland acreage and quality by 2005. Included in the proposal are vernal pool protection and additional buffers adjacent to wetland transitional areas for residential development. In addition, NJDEP is proposing that mitigation not only occur within the same watershed so that it is as close to the site of impact as feasible, but also hoping to foster consolidation of smaller mitigation projects into one larger site to increase wetland acreage, function, and value. For more information on the proposed rules: *www.state.nj.us/dep/landuse.*

NJDEP has recently issued Proposed Water Quality and Watershed Management Rules to enable water quality management planning efforts on a watershed basis. These proposed rules, if adopted, will provide increased protection of wetlands as environmentally sensitive areas; through stormwater nonpoint source requirements; and through maintenance of baseflow in streams. For more information see *www.state.nj.us/dep/watershedmgt.*

Chapter 7: Public Health and Aquatic Life Concerns

Objective: Evaluate fish tissue contamination, update advisories and provide public education.

Indicator Development*: Report on priority setting and data development needs for fish consumption advisories.
** NEPPS indicator provides overview of priorities/ data development needs related to fish consumption advisories.*

7.1 Fish Consumption Designated Use Assessment

As far back as 1976 NJDEP instituted a comprehensive program to survey possible contamination of fish and shellfish in New Jersey waters. Although some contaminated fish and shellfish species in certain drainages have been identified (See Tables 7.1.2a,b below) most fish species and waterways in New Jersey do not have fish consumption advisories. Original efforts (Belton 1982) evaluated a broad spectrum of fish including species of recreational and commercial importance as well as species used as ecological indicators. Sampling locations included all major drainage basins, locations containing known or suspected sources of PCB contamination or locations important to recreational and commercial fisheries. These initial results showed PCB contamination to be present only in certain species of fish with fatty edible tissue (e.g., striped bass, bluefish, American eel) whereas other important recreational and commercial foodfish were not contaminated (e.g., summer and winter flounder, weakfish, smallmouth and largemouth bass, perch, carp, etc.). Saltwater and migratory species (e.g., eel) tended to have higher concentrations than freshwater species. In addition, most waterways of the state did not have contaminated fish whereas certain geographical areas with a few species showed levels of concern ostensibly due to localized sources. Subsequent monitoring activities were then targeted at these species and drainages.

This comprehensive approach followed by intensive localized monitoring was used again in the late 1980s when Dioxins in fish became an environmental and health concern (Belton 1985) as well as again in the 1990s when mercury in finfish was discovered and heath advisories posted (NJDEP 1994). In general, concentrations of various persistent chemical *contaminants are* often highest in animals at the top of the food chain (e.g., apex fish and wildlife species), and fish from a number of sites around the state have been shown to contain contaminant concentrations above both federal and/or state thresholds. Identification of these findings prompted the NJDEP and the Department of Health and Senior Services to issue health advisories on the consumption of several species of fish from throughout the state targeted as specific waterways. Some species which are migratory (e.g., American ell) which will pick up PCBs downstream in urban areas and then migrate upstream were given “Statewide” consumption advisories (i.e., even though fish were only analyzed from the estuaries) to conservatively protect fishermen/consumers upstream even though the contamination did not necessarily reflect local sources or conditions of water quality. These advisories are routinely listed at the NJDEP Website (i.e., *www.state.nj.us/dep/fgw*) and in the New Jersey Fish and Wildlife Digests (NJDEP 2000a and NJDEP 2000b).

From the perspective of “fishable waters” some of these waterways, listed for advisories, may have fish perfectly suitable for recreational purposes (i.e. based on Fish and Game Rules: (NJDEP 2000a and b) and/or safe to eat (i.e., based on health advisory information: NJDEP 2000a and b) or contaminated but subject to common catch-and-release programs. Tolerant species such as carp may live in degraded waters at safe levels of contamination and therefore satisfy both public health and aquatic life concerns. Individual Use Support Summaries for waterways affected by fish consumption advisories are listed in Part I-Executive Summary of this document and in Tables 7.1-2a,b below.

7.1.1 Fish Consumption Designated Use Assessment Method

We must recognize that using fish consumption advisories as indicators of local water quality is somewhat problematic. That is, assigning a waterway where contaminated fish may have been caught (using a sampling/assessment methodology designed to evaluate impacts to consumers) may not be directly correlated with water quality degradation in a specific stream reach. IN addition, finfish, within certain limitations, are extremely mobile making associations with sources and causes often tenuous. Also, differing specie physiology and contaminant properties (e.g. only fatty muscle accumulates organochlorides) may result in only certain fish within a waterway presenting public health concerns whereas other fish are completely safe to eat.

Much of the data used to establish the fish consumption advisories in New Jersey are over five years old. Specifically, all PCB/dioxin/pesticide based advisories are from the mid-1980s. Recognizing that this data is old and that the sources of the bioaccumulated contaminants have been subjected to regulatory source reduction over the ensuing years, NJDEP views these advisories as based on *evaluated data* thereby listing the affected waterways uses as “threatened” (at least until additional data is collected - see below). Fish consumption advisories based on *monitored data* (data collected within the last five years) in New Jersey is limited to mercury contamination and NJDEP views these data to establish “not supporting” or “partially supporting” uses (See Table 7.1-2). It should be noted however that the primary source of mercury contamination is atmospheric deposition associated with coal fired power plant emissions. Source reduction strategies targeted at these are multi-media in nature. The funding to address these data gaps and routinely update advisories as needed has not been available for several years. A continuous stable source of funding to maintain the State’s monitoring of fish and waterways impacted by consumption advisories should be established. In fiscal year FY 1998 a one-time special NJ appropriation was established for NJDEP to study chemical contamination in the State's fisheries allowing both data sets to be selectively re-assessed via new monitoring in FY1999 and FY2000.

Table 7.1-1: Fish Consumption Use Assessment Criteria	
EPA Designated Use Support	**Criteria**
Full Support	No fish restrictions or bans in effect (1) OR monitoring of fish tissue may show contaminants present but not exceeding levels of concern.
Full Support but Threatened	Monitoring of fish tissue reveals contaminant levels with trends towards or away from levels of concern OR data more than five years old (2).
Partial Support	"Restricted Consumption" of fish in effect (restricted consumption defined as limits on the number of meals or size of meals consumed per unit time for one or more fish species); or a fishing ban is in effect for a sub-population that could be at potentially greater risk for one or more fish species.
No Support	"No consumption", or fishing ban in effect for general population for one or more fish species; or commercial fishing ban in effect.
(1) Note: Consumption Standards: Fishing advisories are measured against USFDA Tolerances for contaminated food as well as NJ risk assessments performed by Toxic in Biota Committee a joint effort between the NJDEP and the NJ Department of Health and Senior Services. (2) Data Sources: Much of the PCB/dioxin/pesticide data are old (1980s). Much of the mercury data is more recent (1990s). Both data sets are being selectively re-assessed via new monitoring. Spatial Extent: Statewide (select species), regional (Pinelands) or site specific (individual lakes).	

7.1.2 Fish Consumption Designated Use Assessment

NJDEP participates in an Interagency Toxics in Biota Committee (TIBC) that focuses on toxic contamination in fish tissue that may be of concern to human health. As funds are available, NJDEP's Division of Science, Research and Technology conducts research projects to evaluate levels of contaminants in fish, shellfish and crustacea. As needed, fish consumption advisories are developed through the TIBC to protect human health.

In the mid-1980's, the NJDEP found elevated levels of PCBs, dioxins and pesticides (primarily chlordane) in finfish, lobsters, eels and crabs collected from New York-New Jersey interstate waters and from the Delaware River Estuary. In order to protect human health, commercial fishing bans and recreational fishing advisories have been issued by the State for affected species and waterways. Through a special appropriation from Governor Whitman, a study is being conducted to collect current data and update these advisories as appropriate.

More recently, New Jersey became one of 33 states that have enacted fish consumption advisories in response to mercury contamination. These consumption advisories have been issued for species consumed by recreational anglers (chain pickerel and largemouth bass), not commercially available species. Drinking water supplied from the affected waters has been tested and shown to be safe because the mercury resides primarily in sediments and aquatic life.

New Jersey shares mid-river jurisdictional waters with New York in the northern watersheds and Delaware/Pennsylvania in the south. Extensive cooperation and peer-review between states occurs in data analysis and in the formulation of each state's fish consumption advisories. These primarily affect national estuarine areas (NY-NJ Harbor Estuary and Delaware Estuary). For

example, in the Delaware Estuary NJDEP, after reviewing the risk-based consumption advisories developed by Delaware's DNREC, amended its own Fish and Game guidance (NJDEP 2000aand b) for Delaware Bay waters to reflect the same guidance for Delaware anglers.

This year NJDEP is cooperating with a DRBC study describing the existing approaches to developing fish consumption advisories in the Delaware Estuary, the available data on contaminant levels in estuary fish, trends for specific contaminant and species, and opportunities for developing a unified program for the Delaware Estuary (i.e., summary report available 9/00).

In marine waters NJDEP as been instrumental in developing Coastwide fish-consumption advisories for bluefish an important recreational/commercial species, which is migratory from Florida to Maine. In 1986, after announcing NJ consumption advisories, NJDEP in conjunction with all the Atlantic States Environmental and Health Departments organized, designed and successfully sought federal funding for a Coastwide bluefish study. The study performed by NOAA and EPA showed that contaminated bluefish posed the same consumer risk no matter where they were caught in any Atlantic State jurisdictional. Individual states followed with regulatory risk analyses and consumption advisories consistent with New Jersey's

Application of the results of these studies to designated use attainment must be done with caution due to the following issues:

- Fish tissue monitoring is complex and expensive, hence, studies are often conducted only where fish tissue contamination issues is suspected and commercial or recreational fishing occurs. Therefore, a statewide overview of the magnitude and severity of this problem is not discernable from the data set.
- Fish are mobile animals and may have become contaminated in New Jersey waters or elsewhere.
- Pollution sources may be local (e.g., chlordane) or primarily transported from other states (e.g., mercury).
- Fish consumption advisories include provisions to protect sensitive populations (e.g., pregnant women, nursing mothers, small children).
- Several fish advisories are based on data that are more than 10 years old. A study is underway to collect current data to update and revise these advisories as appropriate.

Fish consumption advisories that apply to New Jersey waters are summarized in the following Tables 7.1-2a and 7.1-2b.

Table 7.1-2a: Fish and Crab Advisories Based On PCBs, Dioxin or Chlordane Contamination

LOCATION/ SPECIES	POLLUTANT	ADVISORY/PROHIBITION	
		General Population	High Risk Individual[1]
NEW JERSEY-STATEWIDE Note: local advisories may be more specific for the same species.			
American eel	PCBs	do not eat more than once a week	do not eat
Bluefish (over 6 lbs.)	PCBs	do not eat more than once a week	do not eat
Striped bass*	PCBs	consumption advisories vary by area; see below	consumption advisories vary by area; see below
American lobsters	PCBs	do not eat green glands (hepatopancreas)	do not eat green glands
NEWARK BAY COMPLEX Newark Bay, Hackensack River downstream of Oradell Dam, Arthur Kill, Kill Van Kull, tidal portions of all rivers and streams that feed into these water bodies.			
Striped bass*	PCBs/Dioxin	do not eat	do not eat
American eel	PCBs	do not eat more than once a week	do not eat
Blue crab*	PCBs/Dioxin	do not eat or harvest[2]	do not eat or harvest[2]
Bluefish (over 6 lbs.), white perch, white cat fish	PCBs	do not eat more than once a week	do not eat
NEWARK BAY COMPLEX Passaic River downstream of Dundee Dam and streams that feed into this section of the river.			
all fish and shellfish*	Dioxin	do not eat	do not eat
blue crab *	PCBs/Dioxin	do not eat or harvest[2]	do not eat or harvest[2]

LOCATION/ SPECIES	POLLUTANT	ADVISORY/PROHIBITION	
		General Population	High Risk Individual[1]
HUDSON RIVER Hudson River includes the river downstream of NY-NJ border (about 4 miles above Alpine, NJ			
American eel *	PCBs	Do not eat more than once a week	Do not eat
Striped bass *	PCBs	Do not eat more than once a week	Do not eat
Bluefish (over 6lbs.) white perch and white catfish	PCB	Do not eat more than once a week	Do not eat
Blue crab	PCBs/Dioxin	Do not eat green gland (hepatopancreas)[3]	Do not eat green gland [3]
RARITAN BAY COMPLEX This complex includes the New Jersey portions of Sandy Hook and Raritan bays, the tidal portions of the Raritan River (downstream of the Rte. 1 bridge in New Brunswick) and the tidal portions of all rivers and streams that feed into these water bodies.			
Striped bass *	PCBs	Do not eat more than once a week	Do not eat
Bluefish (over 6 lbs.), white perch and white catfish	PCBs	Do not eat more than once a week	Do not eat
Blue crab	PCBs/Dioxin	Do not eat green gland (hepatopancreas)[3]	Do not eat green gland (hepatopancreas)[3]
NORTHERN COASTAL WATERS This area includes all coastal waters from Raritan bay south to the Barnegat Inlet.			
Striped bass *	PCBs	Do not eat more than once a week	Do not eat
CAMDEN AREA This area includes Strawbridge Lake, Pennsauken Creek (north and south branches), Cooper river and its drainage, Cooper River Lake, Stewart Lake and Newton Lake.			
All fish, shellfish and crustaceans *	Chlordane	Do not eat	Do not eat

LOCATION/ SPECIES	POLLUTANT	ADVISORY/PROHIBITION	
		General Population	High Risk Individual[1]
LOWER DELAWARE RIVER & BAY Delaware River from Yardley, PA to the PA/DE border			
American eel	PCBs, Chlordane	Do not eat	Do not eat
LOWER DELAWARE RIVER & BAY Delaware River from Yardley, PA (across from Ewing Twp., NJ) south to the Chesapeake and Delaware Canal			
Channel catfish * White catfish White perch	PCBs, Chlordane	Do not eat Do not eat Do not eat	Do not eat Do not eat Do not eat
LOWER DELAWARE RIVER & BAY Lower Delaware River includes the river between the PA Turnpike Bridge (I-276 bridge) in Burlington Twp. (Burlington County) and Birch Creek in Logan Twp. (Gloucester County about 2 miles below Commodore Barry Bridge			
Channel catfish *	PCBs, Chlordane	Do not eat	Do not eat
Lower Delaware River & Bay Delaware River from the DE/PA border south to the Delaware and Chesapeake Canal			
Striped bass *	PCBs	Do not eat	Do not eat
Lower Delaware River & Bay Delaware River from the Chesapeake and Delaware Canal (across from Salem, NJ) south to mouth of the Delaware Bay			
Striped bass * Channel catfish White catfish	PCBs	Do not eat more than five 8-ounce meals per year	Do not eat more than 3 4- ounce meals per year

* Selling any of these species from designed water bodies is prohibited in New Jersey.
[1] High-risk individuals include infants, children under the age of 15, pregnant women, nursing mothers and women of childbearing age. They are advised not to eat any such fish or crabs taken from the designated regions since these contaminants have a greater impact on the developing young.
[2] No harvest means no taking or attempting to take any blue crabs from these waters.
[3] Interim recommendation based on research showing elevated levels of chemical contaminants in the blue crab hepatopancreas also called the green gland.

Table 7.1-2b: Consumption Advisories for Mercury for Largemouth Bass and Chain Pickerel from New Jersey Freshwaters

Location	Species	Advisory + General Population	Advisory + High-Risk Individual*
New Jersey Statewide			
For all freshwater bodies (except those listed below)	Bass and pickerel	do not eat more than once a week	do not eat more than once a month
Pinelands Area			
For all water bodies (except those listed below)	Bass and pickerel	do not eat more than once a month	do not eat
Site-Specific Pinelands			
Lake Lenape	Bass Pickerel	do not eat more than once a week do not eat more than once a week	Do not eat do not eat more than once a month
Mirror Lake	Bass Pickerel	No restrictions No restrictions	do not eat more than once a month do not eat more than once a week
Stafford Forge	Bass Pickerel	do not eat more than once a month do not eat more than once a week	Do not eat Do not eat
Wading River	Bass Pickerel	do not eat more than once a month do not eat more than once a week	Do not eat Do not eat
Site-Specific Statewide			
Assunpink Creek	Bass Pickerel	No restrictions Do not eat more than once a week	Do not eat more than once a week Do not eat more than once a month
Atlantic City Reservoir - No Fishing Allowed	Bass Pickerel	Do not eat Do not eat	Do not eat Do not eat
Big Timber Creek	Bass Pickerel	No restrictions do not eat more than once a week	do not eat more than once a week do not eat more than once a month
Canistear Reservoir	Bass Pickerel	do not eat more than once a week do not eat more than once a week	Do not eat Do not eat more than once a month
Clinton Reservoir	Bass Pickerel	do not eat more than once a week do not eat more than once a week	do not eat do not eat more than once a month
Cranberry Lake	Bass Pickerel	do not eat more than once a week No restrictions	do not eat more than once a month do not eat more than once a month

Location	Species	Advisory + General Population	Advisory + High-Risk Individual*
Crosswicks Creek	Bass Pickerel	No restrictions do not eat more than once a week	do not eat more than once a week do not eat more than once a month
Crystal Lake (Burlington County)	Bass Pickerel	No restrictions Do not eat more than once a week	do not eat more than once a week do not eat more than once a month
Delaware River (Easton to Trenton)	Bass Pickerel	No restrictions Do not eat more than once a week	do not eat more than once a month do not eat more than once a month
Delaware River (Trenton to Camden)	Bass Pickerel	No restrictions do not eat more than once a week	do not eat more than once a week do not eat more than once a month
Lake Carasaljo	Bass Pickerel	do not eat more than once a week No restrictions	Do not eat do not eat more than once a month
Lake Hopatcong	Bass Pickerel	No restrictions No restrictions	do not eat more than once a month do not eat more than once a month
Manasquan Reservoir	Bass Pickerel	do not eat more than once a month do not eat more than once a week	Do not eat do not eat more than once a month
Merrill Creek Reservoir	Bass Pickerel	do not eat more than once a week do not eat more than once a week	Do not eat do not eat more than once a month
Monksville Reservoir	Bass Pickerel	do not eat more than once a week do not eat more than once a week	Do not eat Do not eat more than once a month
Rockaway River	Bass Pickerel	do not eat more than once a week No restrictions	Do not eat more than once a month Do not eat more than once a month
Round Valley Reservoir	Bass Pickerel	No restrictions do not eat more than once a week	do not eat more than once a month do not eat more than once a month
Shadow Lake	Bass Pickerel	No restrictions do not eat more than once a week	do not eat more than once a week do not eat more than once a month
Spruce Run Reservoir	Bass Pickerel	No restrictions do not eat more than once a week	do not eat more than once a month do not eat more than once a month

Location	Species	Advisory + General Population	Advisory + High-Risk Individual*
Swartswood Lake	Bass Pickerel	Do not eat more than once a week No restrictions	do not eat more than once a month do not eat more than once a week
Union Lake	Bass Pickerel	do not eat more than once a month do not eat more than once a month	Do not eat Do not eat
Wanaque Reservoir	Bass Pickerel	do not eat more than once a week do not eat more than once a week	Do not eat Do not eat
Wilson Lake	Bass Pickerel	do not eat more than once a week do not eat more than once a week	Do not eat more than once a month Do not eat
Woodstown Memorial Lake	Bass Pickerel	No restrictions do not eat more than once a week	do not eat more than once a month do not eat more than once a month
Notes: + One meal is defined as an eight-ounce serving. * High risk individuals are pregnant women, women planning pregnancy within one year, nursing mothers and children under five years old.			

The Bound Brook and New Market Lake became contaminated from releases of the Cornell Dublier Electronics Superfund Site, located about one-mile upstream of the lake, resulting in contaminated sediments and fish. In 1997, the Department issued a ban on consumption of any fish from the Bound Brook and New Market Lake. The ongoing remediation of this site is being managed by the USEPA.

7.1.3 Data Development Needs

As stated above, State issued advisories relative to PCB's and chlorinated pesticides are based on data that are over five years old and fish tissue contamination data have not been collected from all waterbodies or species that are consumed by New Jersey recreational and commercial anglers. Funding to address these data gaps and routinely update advisories as needed has not been available for several years. In FY 1999 and FY 2000 a one-time special NJ investigation of chemical contamination in State's fisheries will be performed including those marine and estuarine fish and shellfish and freshwater fish under current fish consumption advisories. The results of this study will be used to repeal or amend existing advisories or if necessary develop new advisories. In addition, the data generated will also assist the DEP to evaluate trends in contaminant concentrations of these selected species. The outcome of this study will facilitate the development of NEPPS milestones and indicators relative to fish consumption. In concordance with this status and trends monitoring a stable source of funding should be identified to support this important public health and aquatic life indicator.

7.1.3.1 Risk Assessment Needs

Development of a more comprehensive health assessment of contaminants in fish species that are consumed by New Jersey anglers is a significant risk assessment need. Recent data from EPA on new risk factors for some chemicals of concern as well as the use of Toxic Equivalent Factor (TEQ) approaches towards assessing cumulative risk from more congeners of PCBs and dioxins may be indicated.

7.1.3.2 Understanding Factors that Influence Bioaccumulation

Several environmental factors influence patterns of chemical bioaccumulation, including the age, lipid content and species of fish and a variety of water quality parameters (e.g., pH, dissolved organic carbon, calcium, etc.). Improved understanding of how these factors interplay will enhance our ability to predict spatial patterns of contamination, and thus the development of appropriate advisories and contaminant management measures.

7.1.3.3 Identifying Sources of Chemical Contamination

The results of ongoing studies will be used to evaluate the basis for existing fish consumption advisories, evaluate risks associated with contamination, and identify sources of toxic contamination. Efforts to address significant data gaps will be conducted, as resources become available. There are numerous suspected sources of toxic chemicals that bioaccumulate in fish and shellfish, including historical and current sediment contamination, air deposition, combined sewer overflows, municipal stormwater, agricultural -runoff and various point source discharges. In order to reduce contamination in fisheries and therefore reduce the need for consumption advisories, levels environmental contamination must be reduced. Identification of specific sources of toxic contamination and data regarding the relative contribution of each source is the first step toward appropriate management.

Before and after fish advisories are put in place NJDEP continuously looks for localized or downstream sources of contamination. In both the Delaware Estuary and the Harbor Estuary Programs NJDEP is currently developing Pilot Studies for Source Trackdown using GIS-based data searches (Belton and DeFina 2000) and bald eagles (Niles et al. 2000) as bioindicators of PCB contamination. In other waters NJDEP also participates in the trackdown of un-permitted discharges of contaminants in conjunction with the Department's land use regulation program (e.g. CSO Sampling workplans, enforcement follow-up, etc.).

Air deposition is a likely source for significant loads of some bioaccumulative contaminants (e.g., mercury, PCBs, etc.). To investigate and track these sources NJDEP has established the New Jersey Atmospheric Deposition Network (NJADN) through Rutgers University to monitor nine stations statewide for air toxics. These data will support evaluation of multi-media transport mechanisms useful in understanding certain sources of bioaccumulation (e.g., a major sources of mercury causing NJ fish advisories are coal fired power plants in the Ohio River valley). To address these sources NJDEP is participating in litigation to reduce stack emissions of metals from these out-of-state power plants. NJDEP also organized an *Air-Water Deposition Workshop* held in April of FY 2000 to review existing air-water data and to address how these data can be used to develop air-water science-based management strategies (report due out in Fall 2000). It was noted that water-based TMDLs supply a mechanism to limit permitted sources to

waterbodies and that the Clean Air Act's "Great Waters Program" allow agencies to seek regulatory action against air emission sources through stack permit/controls if links are found between the two media. In addition NJDEP is participating in multi-state TMDL modeling efforts (i.e., DelEP and HEP) to link hydrological transport models with air, water, and sediment data inputs and subsequent with outputs to a food chain transport model (i.e., bioaccumulation).

7.1.4 Maintaining and Improving Aquatic Life and Addressing Public Health Concerns

Improve the basis for fish consumption advisories: New bioaccumulation data sets will be developed based on recent sampling events to evaluate the status of existing advisories. Additional studies of fish and shellfish population data, water/sediment chemistry will be collected and collated to evaluate/improve sampling study designs, update advisories and provide public education:

Develop a "fishable index": NJDEP is developing a fishable index that considers fish and shellfish population and consumption issues. From the perspective of "fishable waters" some of these waterways, listed for advisories, may have fish perfectly suitable for recreational purposes and/or safe to eat or contaminated but subject to common catch-and-release programs. Development of a fishable index will consider all of these uses and will be reported in the next Water Quality Inventory Report.

Continue to monitor for sources: NJDEP is currently developing Pilot Studies for Source Trackdown using GIS-based data searches and bald eagles and bioindicators for bioaccumulated contaminants. NJDEP will also participate in the trackdown of un-permitted discharges of contaminants in conjunction with the Department's land use regulation program (e.g. CSO Sampling workplans, enforcement follow-up, etc.).

Monitor and assess air deposition sources: Air deposition is a likely source for significant loads of some bioaccumulative contaminants (e.g., mercury, PCBs, etc.). To investigate and track these sources NJDEP has established the New Jersey Atmospheric Deposition Network (NJADN) to evaluate air data to support evaluation of multi-media transport mechanisms useful in understanding certain sources of bioaccumulation. . In addition NJDEP is participating in multi-state TMDL modeling efforts (i.e., DelEP and HEP) to link hydrological transport models with air, water, and sediment data inputs and subsequent with outputs to a food chain transport model (i.e., bioaccumulation).

Stable sources of funding: Funding to address data gaps and routinely update fish consumption advisories has not been available for several years. In fiscal year FY 1998 a one-time special NJ appropriation was established for NJDEP allowing a selective reassessment via new monitoring in FY1999 and FY2000. A continuous stable source of funding to maintain the State's monitoring of fish and waterways impacted by consumption advisories should be established.

7.2 Shellfish Consumption Designated Use Assessment

Shellfish Consumption Designated Use Milestone: By 2005, 90% of New Jersey's classified waters will provide shellfish that are safe to harvest.

The National Shellfish Sanitation Program (NSSP) collects data on the levels of total coliform in shellfish and waters that are harvested for shellfish. These data were used to develop the shellfish consumption portion of the fish and shellfish consumption designated use assessment and will be reported as an environmental indicator in the future. This network has not changed since the 1996 Water Quality Inventory Report. The total coliform standard has always been recognized by the NSSP and the Interstate Shellfish Sanitation Conference as a safe and effective means of classifying shellfish waters.

7.2.1 Shellfish Consumption Designated Use Assessment Method

The Department monitors the sanitary quality of estuarine and ocean waters by observing measurements of coliform bacterial concentrations (indicators of the presence of pathogens) in the water column and uses the results to classify bay, estuarine and ocean waters for shellfish harvesting. The data are analyzed for compliance with federal standards. In addition, shoreline surveys and hydrographic tracing are performed to identify pollution sources. Monitoring is focused on areas with the potential for a harvestable shellfish resource.

Waters in compliance with standards are open for shellfish harvest (*Approved* areas). Waters partially in compliance may be open seasonally or opened under special conditions (i.e., the shellfish are relayed to regions with good quality water and harvested after 30 days, to allow for purging of harmful pathogens). These areas are designated *Special Restricted* areas. Waters with significantly elevated bacterial levels are permanently closed to shellfish harvest (*Prohibited* areas). The total coliform criteria for each classification are listed in Table 7.2.1-1. (See figure A7.2.2-1 for shellfish classification areas.) Areas around known pollution sources, such as sewage outfalls and marinas, are automatically closed and classified as *Prohibited.* These areas may not be closed due to existing water quality but rather are a preventive measure to protect human health. If an emergency such as a bypass or break in a pipe occurs, these *Prohibited* areas provide for adequate protection of public health. Those areas assessed as "Approved" are reported as Fully Supporting the designated use while "Specially Restricted" or "Seasonally Approved" waters are reported as Partial Support and "Prohibited" areas are reported as No Support (Table 7.2.2-1).

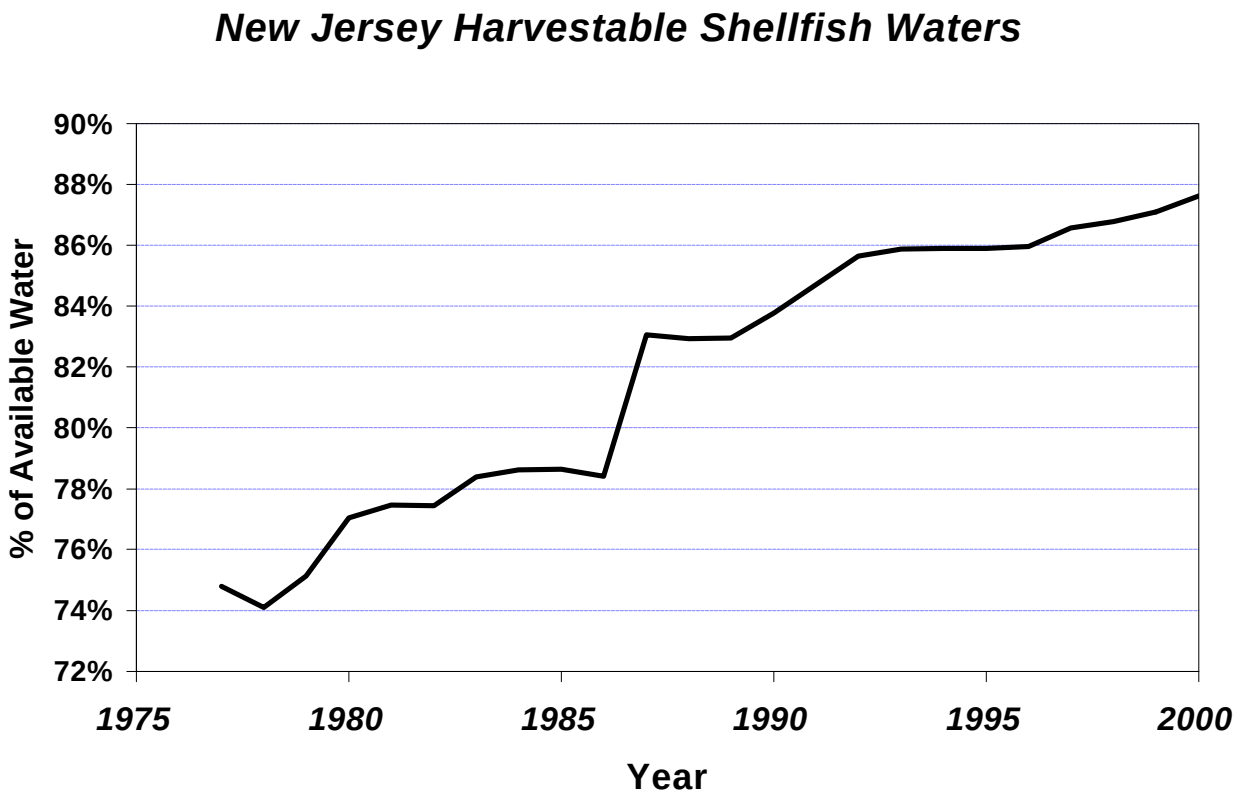
Table 7.2.1-1 Shellfish Consumption Assessment for bays, estuaries and open ocean waters		
305(b)	**NSSP**	**Criteria**
Full Support	**Approved**	Geometric mean MPN less than or equal to 70 per 100mL and the estimated 90th percentile does not exceed an MPN of 330 per 100mL
Partial Support	**Specially Restricted or Seasonal**	Geometric mean MPN greater than 70 but less than or equal to 700 per 100mL and the estimated 90th percentile does not exceed an MPN of 3,300 per 100mL
No Support	**Prohibited**	Geometric mean MPN exceeding 700 per 100mL and the estimated 90th percentile greater than an MPN of 3,300 per 100mL
Notes: *Approved* waters are harvestable without restriction. *Seasonal* waters that are open seasonally typically opened in the winter. *Specially Restricted* requires relay or depuration prior to harvest. *Prohibited* waters that are closed to the harvesting of shellfish.		

7.2.2 Shellfish Consumption Designated Use Assessment Results

Currently, about 2,500 stations are used to monitor 1,053 square miles of waters classified for shellfish harvest in the Shellfish Sanitation Program. These stations are sampled between five and twelve times each year for total coliform and fecal coliform bacteria.

New Jersey has been a national leader in maintaining and enhancing waters available for shellfish harvest. The shellfish waters that support harvesting have increased from 75% in 1977 to 86% in 1996, to 87% in 1998 and 88% in 2000. (See figure 7.2.2-2).

Figure 7.2.2-2



Bay and estuary waters- Approximately 456 square miles (74%) of bay and estuary waters have the sanitary quality sufficient to fully support open shellfish harvesting, while 115 square miles (19%) partially support this use through seasonal harvesting or harvesting following relay or depuration. The shellfish harvesting in the remaining 43 square miles (7%) is prohibited. These waters do not have the sanitary quality required to support harvesting or are closed to harvesting as a precautionary measure in the vicinity of sewer outfalls or marinas and are identified as No Support.

Ocean- In the ocean waters, 352 square miles (78%) fully support shellfish harvesting while 87 square miles (20%) do not support the use. As explained above, the 87 square miles includes areas around sewage outfalls where water quality is sufficient to support shellfish harvesting but are closed as a precautionary measure.

Waters that fully and partially support shellfish harvest are considered safe for harvest. Shellfish taken from these waters may be consumed with or with out additional safety measures. These areas account for 923 sq. miles (808 full support and 115 partial support) or 88% of the total area assessed.

Waters that fully and partially support shellfish harvest are considered safe for harvest. Shellfish taken from these waters may be consumed with or with out additional safety measures. These areas account for 923 sq. miles (808 full support and 115 partial support) or 88% of the total area assessed. Based on 2000 data, 923 square miles (88%) of New Jersey's classified ocean, estuarine and bay waters provide shellfish that are safe to harvest, and 130 square miles (12%) do not support shellfish harvest. Results for 2000 are presented in Table 7.2.2-1.

Table 7.2.2-1: Shellfish Consumption Designated Use Attainment (in square miles, % of total)[1]

	Full Support	**Partial Support**	**No Support**	**Total Assessed**
Bay and Estuary	456 (74%)	115 (19%)	43 (7%)	614
Ocean	352 (80%)	0 (0%)	87 (20%)	439
Total	**808 (77%)**	**115 (11%)**	**130 (12%)**	**1053**

Notes: This assessment includes waters of NJ, which are also assessed and reported to USEPA by DRBC and ISC. NJ will work with RTI to identify waters, which are assessed by multiple entities to eliminate double counting these waters in the national 305(b) Report.
[1]Data are reported in square statute miles and as a percent of the total area assessed.
Full Support (Approved): waters are harvestable without restriction.
Partial Support (Specially Restricted/Seasonal): waters that are open seasonally or require relay and depuration prior to harvest.
No Support (Prohibited): waters that are closed to shellfish harvesting. Areas around known pollution sources, such as sewage outfalls and marinas, are automatically classified as no support.

7.2.3 Shellfish Consumption Source and Cause Assessment

As part of *The 1995 National Shellfish Register* (NOAA 1997) NJDEP's Bureau of Marine Water Monitoring supplied information to NOAA on individual shellfish growing areas within State jurisdictional waters. They were also asked to identify the presence of twelve different sources of pollution including agricultural feedlots and Marinas grouped into three broader categories: point, nonpoint and upstream sources. In estuarine waters, marinas, boating, urban runoff and stormwater were identified as major contributing factors impacting on shellfish. In Offshore/Ocean waters, direct discharges from ocean outfalls may present localized impacts and nonpoint source urban runoff continues to have a negative impact. See Table A7.2.3-1 for a summary of these results.

There has been a trend toward general improvement in water quality in the estuaries since the domestic waste discharges were relocated to offshore areas. In addition, many previously unsewered areas have become sewered. There are still a few isolated instances where water

quality is still adversely affected by input of inadequately treated domestic waste. Repeated overflows and bypasses from the Monmouth County Bayshore Outfall Authority in northern Monmouth County resulted in the prohibition of harvesting in the western portion of Raritan Bay which had previously allowed harvesting after treatment at a depuration facility or planting on a relay lot. A pump station in Margate has also had frequent problems with overflows.

Marinas have been identified as potentially affecting the suitability of shellfish growing areas. All confines of a marina are automatically designated as *Prohibited*. A buffer area may also be included in the *Prohibited* classification accounting for the size of the marina and the size of the boats. This is a precautionary measure similar to the buffer around sewage outfalls.

Recreational activities may also have a seasonal impact on these waters. In 1997, "No Discharge Zones" under the Clean Vessels Act were instituted in some areas such as the Manasquan River. The discharging of human waste from boats into the estuary/bays in these areas is prohibited. These requirements are expected to facilitate further improvements in water quality in the estuaries. In addition, many storm drains discharge to these waters. See figure A5.2.3-1. Wildlife, especially waterfowl, may also be sources of fecal pollution

7.2.4 Maintaining and Improving Harvestable Areas

In order to reach the goal of 90% harvestable waters by 2005, NJDEP developed a Shellfish Action Plan, which is summarized in Table 7.2.4-1 below. The plan addresses reduction in prohibited areas around point sources and management of non-point sources. In addition, a detailed case study is provided to demonstrate techniques of pollution source identification. Future 305(b) Reports will describe changes in water quality and shellfish harvest classifications as a result of mitigation activities.

Table 7.2.4-1 Shellfish Action Plan

Location	% Harvest	Success Probability	Action	Est. Time (yrs)	Est. Cost	Funding Source
Sandy Hook	88.2	High	More intensive sampling to enhance database for classification analysis	2	$2,490	NJDEP
OCUA-No.	88.5	High	ID new landmarks for closure delineation	1	$0	
Long Branch-Atlantic Ocean	88.8	High	Installation/upgrade of alarms at WWTP	4	$0	Utilities Authority
Flynns Knoll	89.7	High	Toxics testing of shellfish to confirm acceptable levels	1	$15,800 $1,200	USEPA2 NJDEP
Toms River	89.9	High	Shoreline survey for NSSP Report	1	$0	
Sea Isle City	89.9	High	NPS source ID & correction	3	$31,928	Not known
Sandy Hook	90.5	Mod.	More intensive sampling to enhance database for classification analysis	2	$2,490	NJDEP

New Jersey's Nonpoint Source Monitoring Strategy

New Jersey has developed a strategy to address non-point pollution (NJDEP, 1997) which incorporates the following steps: Identify a water quality use impairment; evaluate Statewide datasets to identify spatial extent of concern; and, perform more intensive monitoring in these areas to more closely define the source of the pollution. The State then works, through county and local agencies to take corrective measures to reduce or eliminate the pollution source. Additional monitoring is to evaluate the effectiveness of the corrective measures that were implemented.

Shellfish harvesting restrictions provide a good example of how this process is being applied. Restrictions on shellfish harvesting in New Jersey bays are almost entirely due to nonpoint source pollution. Since wastewater discharges have been relocated to ocean outfalls, very few point sources discharge to the back bays. An analysis of water quality monitoring data showed that in many areas, degradation of water quality was related to rainfall. Figure 1 shows an analysis of 10 years of data for fecal coliform bacteria relative to rainfall Areas highlighted are waters where fecal coliform levels were found to increase following a storm event. Figure 7.2.4-2 shows a close-up of a portion of Figure 7.2.4-1. Figure 7.2.4-2 more clearly illustrates near ore areas where the response to stormwater is more intense. These are areas of concern that coincide with waters restricted for shellfish harvest.

An initial pollution source survey identified many potential sources in the watershed of the affected area (see Figure 7.2.4-3). These potential sources included wildlife, urban runoff, marinas, dog waste, illegal discharges, and storm water outfalls.

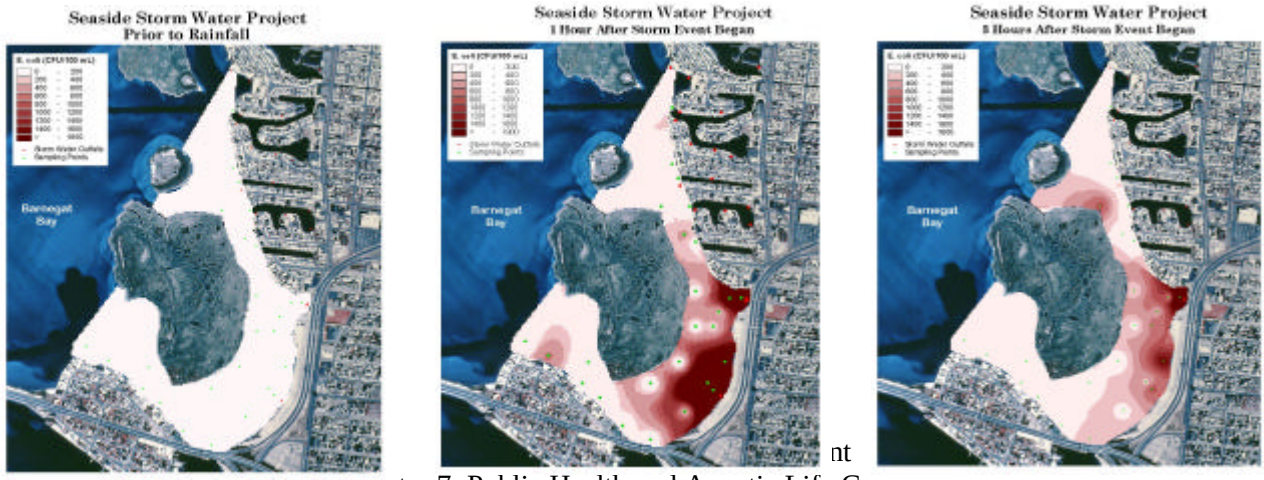
Intensive monitoring was performed under storm conditions to narrow down the list of potential sources. Sampling for coliform bacteria was performed immediately prior to a storm event and then once each hour for three hours following the onset of rainfall. Results of this monitoring are shown in Figure7.2.4-4. As can be seen from this analysis, two storm water outfalls were the primary contributors of coliform bacteria during storm events. These two outfalls were identified out of about 20 other outfalls and numerous other potential sources of coliform bacteria in the vicinity of the impacted waters.

The intensive monitoring allows us to focus resources on correcting the actual sources of the problem. The Department has recently received a proposal from the municipality to take corrective actions on these stormwater outfalls. Once this corrective action has been taken, further monitoring will be used to measure the effectiveness of the corrective action. If successful, this process will lead to a removal of restrictions to shellfish harvesting (the targeted use impairment). Two other similar projects are currently underway in New Jersey's coastal waters and additional projects are being planned.

Removal of restrictions on shellfish harvest is one possible benefit from the use of the NPS Monitoring Strategy. However, this same strategy might also be applied to other water quality-related use impairments such as bathing beach closures, nutrients and toxic pollutants.

Figure 7.2.4-3 Numerous potential pollution sources that were identified prior to intensive monitoring.

Figure 7.2.4-4. Progression of fecal coliform levels in coastal waters during a storm event.



7.3 Issues of Special Concern

7.3.1 Lead in Surface Waters Near Firing Ranges (Mirror Lake Investigation)

Recent findings (June 23, 1999) have shown lead (Pb) contamination in Mirror and Hanover Lakes in Pemberton Township, Burlington County. Elevated levels of lead have been detected in sediment samples collected from the outfall of Hanover Lake (on Fort Dix-DOD property) and at one location in Mirror Lake, which is approximately one mile downstream of Hanover Lake. Mirror Lake is located in a residential area and is used for recreational purposes, including swimming. In a series of sampling events the sources of the lead contamination were shown to be the firing ranges at the Fort Dix military base.

On November 10, 1998, the New Jersey Department of Environmental Protection (NJDEP) conducted sampling of the north and south branches of the Rancocas Creek as part of its metals monitoring program. The sample result for the outfall of Hanover Lake indicated the presence of lead (Pb) at 6,970 milligrams per kilogram (parts per million, or ppm). The expected level of lead in a sediment sample collected from a developed area is approximately 50 parts per million. In addition, lead was detected in a surface water sample collected at the same location at 20 micrograms per kilogram (parts per billion, or ppb), which is four times the New Jersey Surface Water Quality Standard of 5 ppb for this contaminant. NJDEP calculated the values for lead in lake sediments and surface water that could cause acute toxicity from direct exposure (i.e., ingestion of sediments while swimming or by playing on a shore or beach) and indirect exposure (consumption of fish that have bioaccumulated lead). The levels for acute toxicity from direct exposure while swimming were 1,100 ppm in the sediments and 6.8 ppm in the surface water. NJDEP then conducted sampling in twelve areas in and around Mirror Lake. Out of the twelve locations sampled, one location, believed to be in an area not used for swimming, had elevated levels of lead (1,660 ppm) in lakeshore sediments. All the other areas were below levels of concern. The County Health Department posted this area for restricted swimming.

In addition, NJDEP worked with Fort Dix Environmental Staff in delineating the nature and extent of the lead contamination including assisting them in designing a Remedial Investigation and Focused Feasibility Study which showed elevated levels of lead in proximity to some of its firing ranges and the presence the improper use of a firing range berm for stream bank restoration at the dam below Hanover Lake. This site contained numerous bullets (Pb) and casing fragments (Cu) which were also present in the streambed. Responsibility for further delineation and remediation of these locations has been shifter to EPA region 2 personnel and are being carried out by contractors to DOD and Ft. Dix's Environmental Department.

7.3.1.2 Fish Consumption at Mirror lake

Fish tissue data was collected from Mirror Lake to evaluate potential Pb consumption in fish from Mirror Lake. Sampling for this evaluation included recreationally targeted (i.e., sport) fish, that were likely to be consumed by humans, and included largemouth bass (*Micropterus salmoides*) and brown bullhead (*Ameiurus nebulosus)*. A total of 10 largemouth bass and 2 brown bullhead were collected and processed for analysis. The New Jersey Department of Health and Senior Services (NJDHSS) laboratory analyzed the fish samples for lead (Pb), mercury (Hg),

and copper (Cu). The average tissue concentration of the three metals were 0.3 μg Pb/g fish, 0.3 μg Hg/g fish, and 0.2 μg Cu/g fish. The 95% upper confidence interval for Pb was calculated to be 0.5 μg Pb/g fish.

The evaluation indicated that concentrations of Pb in Mirror Lake fish were below the calculated fish Pb concentration of 4.3 μg Pb/g fish for consumption by young children (the most sensitive age group). A fish advisory is already in place for Hg and the observed concentrations confirmed that Hg levels are elevated in the fish collected from Mirror Lake. Copper is an essential nutrient to humans and levels of Cu in fish were below the recommended dietary allowance (RDA). Therefore, the concentrations of Cu in fish are not a human consumption concern.

Conclusions: Concentrations of Pb and Cu in fish from Mirror Lake are below levels of concern for consumption by humans and do not pose a significant health risk. Levels of Hg in fish from this water body confirm the need for the existing consumption advisory.

7.3.2 Harmful Algal Blooms (HABs)

Harmful algal blooms (HABs) include species of microscopic, usually single celled algal plants that live in estuarine and marine waters. A "bloom" occurs when algae grow very quickly or "bloom" and accumulate into dense visible patches near the surface of the water. Only a few of the many thousands of species of algae are associated regularly with toxic or harmful algal blooms. When a given species of algae blooms and imparts a particular color to the water, due to the pigments they contain, they are known as "red tides", "green tides", or "brown tides". These algal blooms can also cause numerous ecological and/or human health problems due to the toxins produced by the species and their potential bioaccumulation in the food web, or due to the degradation of blooms which may cause hypoxic or low dissolved oxygen levels in water.

7.3.2.1 Brown Tides

In 1988 a newly described golden brown algae, *Aureococcus anophagefferens*, was determined to be the cause of harmful blooms in Long Island (NY), Peconic (NY) and Narragansett (RI) Bays. However, it was not until 1995 that it was first identified in Barnegat Bay (NJ). Generally, brown tide blooms have not posed a health risk to humans. However there can be significant ecological impacts from brown tide blooms. The 1995 brown tide bloom in Barnegat Bay was associated with reduced juvenile hard clam, *Mercenaria mercenaria*, growth as reported by the commercial aquaculture facility for hard clams (e.g., Biosphere, Inc.) in Tuckerton. Another bloom appeared in 1999, but previous blooms have not been well documented and little attempt been made to gather data which might help understand their causes. Therefore, the Division of Science, Research and Technology is conducting an assessment to confirm the presence of the brown tide blooms in Barnegat Bay in order to find out more about the spatial and temporal occurrences of the blooms and what might be promoting the blooms. The Department effort will team with scientists at Rutgers University and elsewhere.

Brown tide devastated the scallop industry in Long Island bays in the early 1980s but after years of research, little is known about direct links between cause and effect of the blooms. There are numerous hypotheses that have been tested concerning the causes. Higher salinities are associated with the promotion of brown tide blooms but other physical, chemical and biological

factors, such as nutrient loading rates may prove to be important. In Long Island bays, physical factors such as shallow bays, low water flushing rates, and longer periods in which the water resides in the bay, appear more likely to promote brown tide blooms. Barnegat Bay is a shallow bay (av. 4 ft. depth), with higher salinities and the southern part of the Bay, where the brown tide occurs, has low flushing rates and long water residence times – similar to Long Island bays experiencing the same blooms.

For the first time, in FY 2000, the NJDEP is counting the brown tide organism, *A. anophagefferens*, in water samples using a new method called monoclonal analysis (NJDEP/DSRT Brown Tide Assessment Project). This procedure, developed by Dr. David Caron of the University of Southern California, is highly accurate and precise and provides results within one day of sampling. As the NJDEP collects data, other scientists are collecting data on natural resources (e.g., hard clams and eelgrass) as well as other factors possibly relating to the occurrence of the brown tide bloom in the Bay. The NJDEP hopes to identify factors associated with or resulting from these blooms which will assist in managing these blooms. For example, Dr. Mary Downes Gastrich (NJDEP/DSRT), Dr. O.R. Anderson (Columbia University) and Dr. Elizabeth Cosper (Coastal Environmental Studies) are assessing the presence of viruses in natural populations of *A. anophagefferens* in Barnegat Bay and the possible role that viruses may play in diminishing or controlling blooms.

A significant brown tide bloom is occurring this year FY 2000 in Little Egg Harbor in southern Barnegat Bay. The highest counts of the brown tide alga, *Aureococcus anophagefferens*, were at one and a half million (1.56×10^6) cells per milliliter to over two million per milliliter in Little Egg Harbor on June 8 and the week of June12. Algal counts greater than one million cells per milliliter are considered full bloom conditions. The Bureau of Shellfisheries reports that shellfishermen are observing slow growth in planted hard clams due to the cessation of feeding by clams during brown tide blooms. Biosphere, Inc., a commercial hard clam culture facility has reported that they had to relocate their hard clams to another area because of the brown tide bloom influence during June 2000.

7.3.2.2 *Pfiesteria* Monitoring and Planning

Pfiesteria piscicida and *Pfiesteria shumwayae* are single cell organisms that are able to swim in water and remain dormant in bottom sediment in certain areas of marine estuaries (back bays and tidal tributaries). They are not found in fresh water. *Pfiesteria* appear to be a natural part of the marine environment. *Pfiesteria* are not normally toxic but, under certain environmental conditions, are able to prey upon and kill fish and other marine animals through the release of toxic chemicals. The environmental conditions that allow a toxic outbreak of *Pfiesteria* to develop are not fully understood. However, toxic outbreaks have always been associated with the presence of high densities of fish (*e.g.*, Atlantic menhaden [*Brevoortia tyrannus*]) and warm, brackish, poorly flushed waters with high levels of nutrients.

A NJDEP *Pfiesteria* Contingency Plan is in place for New Jersey waters. It was crafted by personnel from NJDEP the NJ Department of Health and Senior Services (NJDHSS). A draft of this plan was used in response to a September 1999 Tuckahoe River fish-kill and worked well. The Plan will be used by the NJDEP and the NJDHSS to protect the public and state-sampling

personnel in the event that a fish kill occurs in which there is evidence that *Pfiesteria* may be involved.

On August 17, 23, 24, and 25th 1999 NJDEP's Division of Science, Research and Technology collected water column samples from 20 estuary sites in NJ and sent these samples to the University of North Carolina at Greensboro for analysis for *Pfiesteria piscicida*, *Pfiesteria shumwayae* [*nee P. piscicida* species B], and *Cryptoperidiniopsis* (an organism responsible for a fish kill in Florida and a close relative of *P. piscicida*) using a new gene probe assay. The assay is able to detect ribosomal DNA of these organisms, if present (Oldach *et. al.*, 2000).

The sites sampled were a subset of NJDEP, Office of Water Monitoring Management, Bureau of Marine Water Monitoring's 260 Nutrient Biomonitoring Stations. The sites selected were from: Raritan Bay (2 sites), Navesink - Shrewsbury River estuary (4 sites), Metedeconk River estuary (2 sites), Barnegat Bay (2 sites), Mullica River estuary (2 sites), Egg Harbor/Tuckahoe River estuary (2 sites), and several Delaware Bay estuary sites between the Maurice and Salem Rivers (6 sites)(Figure 1). The sites were selected by DSRT using a map of two GIS coverages: the Nutrient Biomonitoring Network coverage and a coverage created by the Bureau of Marine Water Monitoring, showing estuary areas that have a combination of environmental conditions (salinity, nitrogen, phosphate, flushing, etc.) that would have a higher than average potential in NJ of being conducive to *Pfiesteria* growth.

Sampling took place toward the end of a multi-month period of drought. The test results showed that none of the three organisms were found in any of the samples. One of the samples was collected from the Tuckahoe River; approximately 9 miles east (downstream) from the site of a later fish kill. A re-analysis of an archived sample from the Tuckahoe River site was also negative for these organisms.

On November 10 and 17, 1999, DSRT collected 15 water column and 15 sediment samples from 7 estuary locations in New Jersey, including the Tuckahoe River site of the 9/99 fish kill. Five sample sites were Nutrient Biomonitoring Station sites that had been previously sampled in August. Four sites were Nutrient Biomonitoring sites that had not been previously sampled and six sites, including the previously sampled fish kill site, were not Nutrient Biomonitoring sites. The estuary locations sampled were the Mullica River (3 sites), the Egg Harbor River (2 sites), the Tuckahoe River (4 sites), the Maurice River (2 sites), the Dividing Creek (1 site), the Cohansey River (2 sites), and Stowe Creek (1 site). The test results showed that none of the three organisms were found in any of the samples.

It is hopeful that DSRT will collect additional water and sediment samples during summer 2000. Rather than sampling fixed NJDEP sampling locations as was done (for the most part) in past surveys, sampling will be targeted at estuary locations with high levels of organic matter (as determined by visible inspection of ponar grab samples) and salinity that approach the optimum salinity for *Pfiesteria* (15 ppt), *Aphanomyces* (2-10 ppt), and juvenile Atlantic menhaden growth. Areas with comparatively lower flushing rates will be targeted, as will sites with higher than average potentials for nutrient loading.

Table A3.1.1-1: Surface Water Quality Standards Criteria

	FW2-TP	FW2-TM	FW2-NT	PL	DRBC-1C	DRBC-1D	DRBC-1E
DO	>7.0 ppm	>5.0 ppm	> 4.0 ppm	> 4.0 ppm	>4.0 ppm	>4.0 ppm	>4.0 ppm
FC (1)	< 400/100 ml	< 400/100 ml	< 400/100 ml	< 400/100 ml	< 400/100 ml	< 400/100 ml	< 400/100 ml
NH3- un-ionized (4)	< 20 ppb	< 20 ppb	< 50 ppb	< 50 ppb	N/A	N/A	N/A
NO3	< 10 ppm	< 10 ppm	< 10 ppm	<2 ppm	<10 ppm	<10 ppm	<10 ppm
P (total) (2)	< 0.05, < 0.1 ppm	< 0.05, < 0.1 ppm	< 0.05, < 0.1 ppm	< 0.05, < 0.1 ppm	N/A	N/A	N/A
pH	6.5-8.5	6.5-8.5	6.5-8.5	3.5-5.5	6.0-8.5	6.0-8.5	6.0-8.5
TSS	< 25 ppm	< 25 ppm	< 40 ppm	< 40 ppm	N/A	N/A	N/A
Temp (3)	< 20 C	< 20 C	< 27.8 C, < 30 C	< 30 C	N/A	N/A	N/A
Notes:							
FW2-TP: Freshwater Category 2, Trout Production							
FW2-TM: Freshwater Category 2, Trout Maintenance							
FW2-NT: Freshwater Category 2, NonTrout							
PL: Pinelands							
(1) FC: < 400/100 ml for any sample or < 200/100 ml for geometric mean							
(2) Total P: < 0.05 ppm in lakes or stream inlet into lake, < 0.1 ppm in streams and rivers							
(3) Temp: < 27.8 Celcius for waters with yellow perch or small mouth bass, < 30 Celcius for all other FW2-NT waters							
(4) Un-ionized ammonia is calculated based on Temp, pH and Total Ammonia							
EPA DWQS for NO3, Cl, Hg apply in DRBC Zones 1C, 1D and 1E							
Human Health criteria- not available, calculate Aquatic Life Acute and Chronic							
Human Health criteria cited, calculate Aquatic Life Acute and Chronic							

Table A3.1.2-1: Ambient Stream Monitoring Network Stations, Stream Classifications and Reach File Data

Region	WMA	Station #	Station Name	SWQS Class	RF3 Reach ID #	Length (miles)
NW	2	01367770	WALKILL R NR SUSSEX	FW2-NT	2020007 28 0.00	0.83
NW	2	01367910	PAPAKATING CK AT SUSSEX	FW2-NT	2020007 27 1.64	0.79
NW	2	01368000	WALLKILL R NR UNIONVILLE	FW2-NT	2020007 26 6.20	2.44
NW	2	01368950	BLACK CREEK AT VERNON	FW2-NT	2020007 30 6.16	0.76
NE	5	01377000	HACKENSACK R AT RIVERVALE	FW2-NT	2030103 5 0.00	4.77
NE	6	01379000	PASSAIC R NR MILLINGTON	FW2-NT	2030103 26 1.43	2.95
NE	6	01379500	PASSAIC R NR CATHAM	FW2-NT	2030103 2510.18	4.46
NE	6	01380500	ROCKAWAY R AT BOONTON	FW2-NT	2030103 23 6.84	1.70
NE	6	01381200	ROCKAWAY R AT PINE BROOK	FW2-NT	2030103 23 0.00	1.48
NE	6	01381500	WHIPPANY R AT MORRISTOWN	FW2-NT	2030103 24 8.82	2.61
NE	6	01381800	WHIPPANY R NR PINEBROOK	FW2-NT	2030103 24 0.00	0.73
NE	6	01382000	PASSAIC R AT TWO BRIDGES	FW2-NT	2030103 21 0.00	0.13
NE	3	01382500	PEQUANNOCK R AT MACOPIN INTAKE	FW2-TM	2030103 40 5.73	0.42
NE	3	01387500	RAMAPO R NR MAHWAH	FW2-NT	2030103 1410.11	0.82
NE	3	01388600	POMPTON R AT PACKANACK LK	FW2-NT	2030103 13 3.97	1.53
NE	4	01389500	PASSAIC R AT LITTLE FALLS	FW2-NT	2030103 1213.52	0.44
NE	4	01389880	PASSAIC R AT ELMWOOD PK	FW2-NT	2030103 1010.46	10.13
NE	4	01391500	SADDLE R AT LODI	FW2-NT	2030103 11 0.23	3.51
Rar	7	01393450	ELIZABETH R AT URSINO LK AT ELIZABETH	FW2-NT	2030104 361 0.00	5.55
Rar	7	01394500	RAHWAY R NR SPRINGFIELD	FW2-NT	2030104 1611.00	1.88
Rar	7	01395000	RAHWAY R AT RAHWAY	FW2-NT	2030104 16 5.26	2.72
Rar	8	01396280	SB RARITAN R AT MIDDLE VALLEY	FW2-TM	2030105 2210.43	4.94
Rar	8	01396535	SB RARITAN R ARCH ST AT HIGH BRIDGE	FW2-TM-C1	2030105 22 0.00	3.82
Rar	8	01396588	SPRUCE RUN NR GLEN GARDNER	FW2-TP	2030105 527 0.00	0.51
Rar	8	01396660	MULHOCKAWAY CK AT VAN SYCKEL	FW2-TP	2030105 519 7.44	0.23
Rar	8	01397000	SB RARITAN R AT STANTON STATION	FW2-TM	2030105 21 0.00	2.30
Rar	8	01397400	SB RARITAN R AT THREE BRIDGES	FW2-NT	2030105 18 3.47	0.79
Rar	8	01398000	NESHANIC R AT REAVILLE	FW2-NT	2030105 25 6.75	0.92
Rar	8	01398260	NB RARITAN R NR CHESTER	FW2-TP	2030105 8 6.98	1.46
Rar	8	01399120	NB RARITAN R AT BURNT MILLS	FW2-NT	2030105 7 0.00	1.07
Rar	8	01399500	LAMINGTON (BLACK)R NR POTTERSVILLE	FW2-TP- C1	2030105 11 7.93	1.71
Rar	8	01399700	ROCKAWAY CK AT WHITEHOUSE	FW2-NT	2030105 12 0.00	3.56
Rar	8	01399780	LAMINGTON R AT BURNT MILLS	FW2-NT	2030105 10 0.00	0.87
Rar	9	01400500	RARITAN R AT MANVILLE	FW2-NT	2030105 5 1.23	0.36
Rar	10	01400540	MILLSTONE R NR MANALAPAN	FW2-NT	2030105 3110.54	5.09
Rar	10	01400650	MILLSTONE R AT GROVERS MILL	FW2-NT	2030105 31 0.00	4.25
Rar	10	01401000	STONY BROOK AT PRINCETON	FW2-NT	2040105 885 0.00	2.39
Rar	10	01401600	BEDENS BROOK NR ROCKY HILL	FW2-NT	2030105 27 0.42	2.39

Table A3.1.2-1: Ambient Stream Monitoring Network Stations, Stream Classifications and Reach File Data

Region	WMA	Station #	Station Name	SWQS Class	RF3 Reach ID #	Length (miles)
Rar	10	01402000	MILLSTONE R AT BLACKWELLS MILLS	FW2-NT	2030105 26 5.91	0.39
Rar	9	01403300	RARITAN R AT QUEENS BRIDGE, BOUND BK	FW2-NT	2030105 210.61	2.43
Rar	9	01405302	MATCHAPONIX BK AT SPOTSWOOD	FW2-NT	2030105 35 0.00	3.66
Rar	9	01405340	MANALAPAN BK NR MANALAPAN	FW2-NT	2030105 3410.66	0.92
Atl	12	01408000	MANASQUAN R AT SQUANKUM ON RT 547	FW2-TM	2040301 210.55	0.52
Atl	13	01408500	TOMS R NR TOMS RIVER	FW2-NT	2040301 18 0.24	4.36
Atl	14	01409387	MULLICA R AT ATSION LAKE	PL	2040301 51 8.31	0.11
Atl	14	01409416	HAMMONTON CK WESCOATSVILLE	PL	2040301 54 2.36	1.56
Atl	14	01409500	BATSTO R AT BATSTO	PL	2040301 47 0.36	0.69
Atl	14	01410000	OSWEGO R AT HARRISVILLE	PL	2040301 42 0.00	0.27
Atl	14	01410150	EAST BR BASS R NR NEW GRETNA	PL	20403015244 0.00	0.97
Atl	15	01410784	GREAT EGG HARBOR R NR SICKLERVILLE	PL	2040302 1114.89	0.96
Atl	15	01411000	GREAT EGG HARBOR R AT FOLSOM	PL	2040302 11 0.85	4.30
Atl	15	01411110	GREAT EGG HARBOR R AT WEYMOUTH	PL	20403021220 0.00	0.52
L-De	17	01411500	MAURICE R AT NORMA	FW2-NT	2040206 13 2.69	1.22
L-De	17	01412800	COHANSEY R AT SEELEY	FW2-NT	2040206 21 8.08	0.57
	De-M	01438500	DELAWARE R AT MONTAGUE	1C	2040104 6 2.15	0.82
NW	1	01440000	BIG FLATBROOK AT FLATBROOKVILLE	FW2-TM	2040104 3 0.00	1.70
	De-M	01443000	DELAWARE R AT PORTLAND PA	1D	2040105 30 0.00	1.62
NW	1	01443440	PAULINS KILL AT BALESVILLE	FW2-TM	2040105 24 7.52	1.72
NW	1	01443500	PAULINS KILL AT BLAIRSTOWN	FW2-TM	2040105 23 0.00	0.97
NW	1	01445500	PEQUEST R AT PEQUEST	FW2-NT (C1)	2040105 13 5.85	1.26
	De-M	01447000	DELAWARE R AT EASTON PA	1D	2040105 11 4.53	10.88
NW	1	01455200	POHATCONG CK AT NEW VILLAGE	FW2-TM	2040105 10 7.88	5.67
NW	1	01456200	MUSCONETCONG R AT BEATTYSTOWN	FW2-TM	2040105 825.13	2.24
NW	1	01457000	MUSCONETCONG R NR BLOOMSBURY	FW2-TM	2040105 8 0.00	11.34
NW	1	01457400	MUSCONETCONG R AT RIEGELSVILLE	FW2-TM	2040105 8 0.00	11.34
	De-M	01461000	DELAWARE R AT LUMBERVILLE PA	1E	2040105 6 1.72	6.41
	De-M	01463500	DELAWARE R AT TRENTON	1E	2040105 4 0.00	5.74
NW	11	01463620	ASSUNPINK CK NR CLARKSVILLE	FW2-NT	2040105 3 2.14	2.56
NW	11	01464000	ASSUNPINK CR AT TRENTON	FW2-NT	2040105 32 0.00	2.21
L-De	20	01464500	CROSSWICKS CK AT EXTONVILLE	FW2-NT	2040201 6 5.59	3.92
L-De	20	01464515	DOCTORS CK AT ALLENTOWN	FW2-NT	2040201 9 5.37	0.98
L-De	19	01465850	SB RANCOCAS CK AT VINCENTOWN	FW2-NT	2040202 51 3.18	3.77
L-De	19	01466500	MCDONALDS BR IN LEBANON FOREST	PL	20402022450 0.00	0.39
L-De	19	01467000	NB RANCOCAS CK AT PEMBERTON	FW2-NT	2040202 5210.11	1.53
L-De	19	01467069	NB PENNSAUKEN CK NR MORRESTOWN	FW2-NT	2040202 39 3.58	2.82
L-De	19	01467081	SB PENNSAUKEN CK AT CHERRY HILL	FW2-NT	20402022234 3.72	7.17

Region	WMA	Station #	Station Name	SWQS Class	RF3 Reach ID #	Length (miles)
L-De	19	01467150	COOPER R AT HADDONFIELD	FW2-NT	2040202 34 6.83	0.35
L-De	18	01467329	SB BIG TIMBER CK AT BLACKWOOD TERR	FW2-NT	2040202 83 2.84	1.02
L-De	18	01477120	RACCOON CK NR SWEDESBORO	FW2-NT	20402022337 0.00	1.02
L-De	18	01477510	OLDMANS CK AT PORCHES MILL	FW2-NT	2040206 27 0.18	0.17
L-De	18	01482500	SALEM R AT WOODSTOWN	FW2-NT	2040206 2614.32	0.32
						200.70
Notes:						
Region:						
Atl: Atlantic Region, WMAs 12, 13, 14, 15, 16						
L-De: Lower Delaware Region, WMAs 17, 18, 19, 20						
NE: Northeast Region, WMAs 03, 04, 05, 06						
NW: Northwest Region, WMAs 01, 02, 11						
Rar: Raritan Region, WMAs 07, 08, 09, 10						
SWQS Class: New Jersey Surface Water Quality Standards Stream Classification						

Appendix A3.1.2-2: Redesigned Ambient Stream Monitoring Program

The New Jersey Department of Environmental Protection (NJDEP) and the United States Geological Survey (USGS) have cooperatively operated the Ambient Stream Monitoring Network since the 1970's. The data from this network have been used to assess the quality of freshwater streams and sediments. Although the network was sufficient to assess general status and trends, changes were needed to provide data for water quality indicators and watershed management. The new network, which was designed by a NJDEP and USGS interagency committee, has been operating since the fall of 1997. By using several different types of monitoring stations, the Redesigned Ambient Stream Monitoring Network is designed to answer several important questions about surface water quality.

What is natural ("pristine") water quality? To characterize water quality in natural settings, without pollutant inputs from sewage treatment plants, septic systems or stormwater runoff, ***6 reference stations*** have been established in the 4 physiographic regions (Valley and Ridge, Highlands, Piedmont, Coastal Plain) of the state. The reference stations are located in parks and undeveloped areas. Data from these stations will be used to evaluate degradation in developed areas and to provide additional data to support surface water quality standards.

How does land use affect water quality? To characterize the effects of land use on water quality, ***40 land use indicator stations*** have been established statewide. These stations were selected to monitor the 2 dominant land uses within each of the state's 20 watershed management areas. Drainage area size, and percent of urban, agricultural, and forest were evaluated to select these stations. The biological health of many land use indicator stations is monitored through the NJDEP s Benthic Macroinvertebrate (AMNET) Monitoring Network. These data will provide insight into the biological effects of chemical pollutants, and the effects of nonpoint sources from dominant land uses on chemical and biological water quality.

What is the status of water quality statewide? To provide a strong statistical basis for water quality indicators, ***40 status stations*** have been established. Two stations were selected at random in each of the state's 20 watershed management areas from the set of Benthic Macroinvertebrate Network stations. This random selection process will be repeated each year to increase spatial coverage. These stations will also provide site-specific data at an ever increasing number of locations, and can potentially identify problems that were not identified through fixed-station monitoring. Because these stations were randomly selected, several status stations are also sampled for another purpose (i.e., land use indicator station).

What is the overall water quality in each watershed management area? At least one ***integrator station*** has been located at the downstream end of each watershed management area. In some watershed management areas, gaps in spatial coverage and continuity for trends analysis were addressed by additional integrator stations. These ***23 integrator stations*** will be used to characterize the combined effects of pollutants from all land uses and point sources that are transported down the river. Data collected at integrator stations located at or above head of tide,

and tidal stations in the 200 station Coastal and Estuarine Water Quality Monitoring Network will be used to assess pollutant transport to back bays.

What if a problem arises? There are ***watershed reconnaissance stations*** that can be sampled each year to address specific issues or questions that are not addressed through other stations. For example, the watershed reconnaissance stations could be used to investigate the causes of impairment at benthic macroinvertebrate stations, provide preliminary watershed assessments, investigate point source impacts, and support the planned air deposition monitoring network. These stations will be selected each year based on DEP program needs. The number of stations and sampling frequency will reflect the data needs; funding is available for about 40 sampling events per year.

What parameters are monitored? Chemical and bacterial parameters are monitored in the network, and several significant changes in parameters have been implemented. ***Bacteria,*** which was previously monitored throughout the year, will now be monitored 5 times within a 30-day timespan as recommended in the NJ Surface Water Quality Standards. Samples will be collected during the summer to provide a better assessment of "swimmability". ***Dissolved oxygen*** was only monitored during the day (not at the lowest part of the diurnal cycle). Diurnal data will be collected gradually by several dissolved oxygen meters that record data for 24 hours. ***Nutrients, pH and suspended solids*** will continue to be monitored at all stations seasonally, 4 times per year.

In addition to conventional parameters, monitoring at the 6 reference stations and 40 statewide status stations also includes one sample event per year for ***total recoverable metals***, and has been significantly expanded to include ***pesticides*** currently in use and ***volatile organic chemicals***.

What are the benefits of the new network? The redesigned Ambient Stream Monitoring Network will provide watershed-based data and significant improvements to water quality indicators by characterizing: 1) background water quality; 2) water quality as a function of land use; 3) downstream water quality and 4) statistically-based sampling. By linking chemical and biological monitoring, a more comprehensive assessment of conditions will provide appropriate data for water quality indicators and watershed management. Through the Geographical Information System, links between land use and water quality can also be evaluated.

The network now includes 115 stations, up from 79 stations, and spatial coverage will be further improved as new statewide status stations are monitored each year. The added flexibility afforded by reconnaissance sampling will facilitate proactive data collection as issues arise. To ensure continuity, monitoring results and design effectiveness will be evaluated each year to effect gradual improvements, rather than major shifts. For the next several years, trends will only be available for the 41 stations carried over from the previous design. Status results will become available from all stations in 2000.

The DEP/USGS Ambient Ground Water Network has been redesigned in a manner similar to the surface water network. The revised ground water network will monitor water quality in a series of

shallow wells and attempt to: (1) establish watershed specific relationships between landuse and water quality and (2) assess ground water impacts on surface water quality.

Table A3.1.3-1: Dissolved Oxygen Attainment in NJ Rivers and Streams

Region	WMA	Station #	Station Name	SWQS Class	DO-#	DO-Mean	DO - Min (mg/l)	DO-# exc	DO-% exc	Attainment	Length (miles)	%DO Sat -#	%DO Sat-Mean
Atl	12	01408000	MANASQUAN R AT SQUANKUM	FW2-TM	14	9.8	7.3	0	0.0%	Not Impaired	0.52	14	88.6
Atl	13	01408500	TOMS R NR TOMS RIVER	FW2-NT	14	9.4	6	0	0.0%	Not Impaired	4.36	14	85.9
Atl	14	01409387	MULLICA R AT ATSION LAKE	PL	14	9.4	5.9	0	0.0%	Not Impaired	0.11	14	89.6
Atl	14	01409416	HAMMONTON CK WESCOATSVILLE	PL	14	8.5	5.4	0	0.0%	Not Impaired	1.56	13	79.7
Atl	14	01409500	BATSTO R AT BATSTO	PL	14	9.0	5.9	0	0.0%	Not Impaired	0.69	13	84.8
Atl	14	01410000	OSWEGO R AT HARRISVILLE	PL	5	10.1	7.5	0	0.0%	Not Assessed	0.27	5	93.6
Atl	14	01410150	EAST BR BASS R NR NEW GRETNA	PL	14	7.9	5	0	0.0%	Not Impaired	0.97	14	71.6
Atl	15	01410784	GREAT EGG HARBOR R NR SICKLERVILLE	PL	51	8.0	3.4	2	3.9%	Not Impaired	0.96	51	74.3
Atl	15	01411000	GREAT EGG HARBOR R AT FOLSOM	PL	14	9.6	7.5	0	0.0%	Not Impaired	4.30	14	84.5
Atl	15	01411110	GREAT EGG HARBOR R AT WEYMOUTH	PL	15	9.4	7	0	0.0%	Not Impaired	0.52	15	85.1
L-De	17	01411500	MAURICE R AT NORMA	FW2-NT	15	9.1	6.1	0	0.0%	Not Impaired	1.22	15	83.7
L-De	17	01412800	COHANSEY R AT SEELEY	FW2-NT	15	9.2	5.8	0	0.0%	Not Impaired	0.57	15	86.3
L-De	17	01482500	SALEM R AT WOODSTOWN	FW2-NT	14	10.1	6.4	0	0.0%	Not Impaired	0.32	14	93.4
L-De	18	01467069	NB PENNSAUKEN CK NR MORRESTOWN	FW2-NT	14	8.8	5	0	0.0%	Not Impaired	2.82	14	82.6
L-De	18	01467081	SB PENNSAUKEN CK AT CHERRY HILL	FW2-NT	14	8.7	5.1	0	0.0%	Not Impaired	7.17	14	77.6
L-De	18	01467150	COOPER R AT HADDONFIELD	FW2-NT	14	9.4	6.5	0	0.0%	Not Impaired	0.35	14	87.9
L-De	18	01467329	SB BIG TIMBER CK AT BLACKWOOD TERR	FW2-NT	15	9.6	6.4	0	0.0%	Not Impaired	1.02	15	89.1
L-De	18	01477120	RACCOON CK NR SWEDESBORO	FW2-NT	14	9.6	6.8	0	0.0%	Not Impaired	1.02	14	87.3
L-De	18	01477510	OLDMANS CK AT PORCHES MILL	FW2-NT	14	10.2	7.2	0	0.0%	Not Impaired	0.17	14	91.2
L-De	19	01465850	SB RANCOCAS CK AT VINCENTOWN	FW2-NT	14	8.9	5.8	0	0.0%	Not Impaired	3.77	14	79.8
L-De	19	01466500	MCDONALDS BR IN LEBANON FOREST	PL	7	4.4	2.3	3	42.9%	Not Impaired	0.39	7	37.6
L-De	19	01467000	NB RANCOCAS CK AT PEMBERTON	FW2-NT	14	9.4	6.8	0	0.0%	Not Impaired	1.53	14	84.6
L-De	20	01464500	CROSSWICKS CK AT EXTONVILLE	FW2-NT	14	8.9	6.7	0	0.0%	Not Impaired	3.92	14	83.4
L-De	20	01464515	DOCTORS CK AT ALLENTOWN	FW2-NT	15	9.0	5.2	0	0.0%	Not Impaired	0.98	14	85.1
NE	3	01382500	PEQUANNOCK R AT MACOPIN INTAKE	FW2-TM	13	10.6	8.1	0	0.0%	Not Impaired	0.42	13	96.6
NE	3	01387500	RAMAPO R NR MAHWAH	FW2-NT	14	10.5	6	0	0.0%	Not Impaired	0.82	14	93.8
NE	3	01388600	POMPTON R AT PACKANACK LK	FW2-NT	31	10.1	6.8	0	0.0%	Not Impaired	1.53	31	96.4
NE	4	01389500	PASSAIC R AT LITTLE FALLS	FW2-NT	26	9.9	6.3	0	0.0%	Not Impaired	0.44	26	97.1
NE	4	01389880	PASSAIC R AT ELMWOOD PK	FW2-NT	14	9.9	6.2	0	0.0%	Not Impaired	10.13	14	89.6
NE	4	01391500	SADDLE R AT LODI	FW2-NT	15	8.3	4.4	0	0.0%	Not Impaired	3.51	15	75.7
NE	5	01377000	HACKENSACK R AT RIVERVALE	FW2-NT	14	9.6	5.7	0	0.0%	Not Impaired	4.77	14	84.6
NE	6	01379000	PASSAIC R NR MILLINGTON	FW2-NT	16	6.1	2.3	4	25.0%	Impaired	2.95	16	54.4
NE	6	01379500	PASSAIC R NR CATHAM	FW2-NT	15	8.1	4.6	0	0.0%	Not Impaired	4.46	15	75.5
NE	6	01380500	ROCKAWAY R AT BOONTON	FW2-NT	15	10.0	6.3	0	0.0%	Not Impaired	1.70	15	90.7
NE	6	01381200	ROCKAWAY R AT PINE BROOK	FW2-NT	14	9.6	6.1	0	0.0%	Not Impaired	1.48	14	85.3
NE	6	01381500	WHIPPANY R AT MORRISTOWN	FW2-NT	15	11.2	8.3	0	0.0%	Not Impaired	2.61	15	103.5
NE	6	01381800	WHIPPANY R NR PINEBROOK	FW2-NT	15	7.7	2.7	2	13.3%	Impaired	0.73	15	68.8

Table A3.1.3-1: Dissolved Oxygen Attainment in NJ Rivers and Streams

Region	WMA	Station #	Station Name	SWQS Class	DO-#	DO-Mean	DO - Min (mg/l)	DO-# exc	DO-% exc	Attainment	Length (miles)	%DO Sat -#	%DO Sat-Mean
NE	6	01382000	PASSAIC R AT TWO BRIDGES	FW2-NT	47	8.2	2.9	3	6.4%	Not Impaired	0.13	47	79.7
NW	1	01440000	BIG FLATBROOK AT FLATBROOKVILLE	FW2-TM	9	10.9	8.6	0	0.0%	Not Impaired	1.70	8	102.8
NW	1	01443440	PAULINS KILL AT BALESVILLE	FW2-TM	14	10.3	7.1	0	0.0%	Not Impaired	1.72	14	93.8
NW	1	01443500	PAULINS KILL AT BLAIRSTOWN	FW2-TM	14	10.4	7.4	0	0.0%	Not Impaired	0.97	14	95.8
NW	1	01445500	PEQUEST R AT PEQUEST	FW2-NT-C1	14	10.6	7.9	0	0.0%	Not Impaired	1.26	14	94.8
NW	1	01455200	POHATCONG CK AT NEW VILLAGE	FW2-TM	14	10.9	8	0	0.0%	Not Impaired	5.67	13	100.6
NW	1	01456200	MUSCONETCONG R AT BEATTYSTOWN	FW2-TM	14	11.0	8.4	0	0.0%	Not Impaired	2.24	14	101.2
NW	1	01457000	MUSCONETCONG R NR BLOOMSBURY	FW2-TM	14	11.1	8.8	0	0.0%	Not Impaired	11.34	14	102.3
NW	1	01457400	MUSCONETCONG R AT RIEGELSVILLE	FW2-TM	14	10.8	8	0	0.0%	Not Impaired	11.34	14	98.6
NW	2	01367770	WALKILL R NR SUSSEX	FW2-NT	14	9.2	7.1	0	0.0%	Not Impaired	0.83	14	85.0
NW	2	01367910	PAPAKATING CK AT SUSSEX	FW2-NT	14	9.3	5.7	0	0.0%	Not Impaired	0.79	14	83.8
NW	2	01368000	WALLKILL R NR UNIONVILLE	FW2-NT	13	8.9	5.1	0	0.0%	Not Impaired	2.44	13	80.6
NW	2	01368950	BLACK CREEK AT VERNON	FW2-NT	14	7.9	3.8	1	7%	Not Impaired	0.76	14	71.5
NW	11	01463620	ASSUNPINK CK NR CLARKSVILLE	FW2-NT	14	9.6	6.5	0	0.0%	Not Impaired	2.56	13	91.3
NW	11	01464000	ASSUNPINK CR AT TRENTON	FW2-NT	9	9.5	6.5	0	0.0%	Not Impaired	2.21	9	89.4
Rar	7	01393450	ELIZABETH R AT URSINO LK AT ELIZABETH	FW2-NT	14	9.8	6.5	0	0.0%	Not Impaired	5.55	14	92.5
Rar	7	01394500	RAHWAY R NR SPRINGFIELD	FW2-NT	15	8.1	3.1	0	0.0%	Not Impaired	1.88	15	73.6
Rar	7	01395000	RAHWAY R AT RAHWAY	FW2-NT	14	10.4	6.8	0	0.0%	Not Impaired	2.72	14	95.4
Rar	8	01396280	SB RARITAN R AT MIDDLE VALLEY	FW2-TM	14	11.1	8.1	0	0.0%	Not Impaired	4.94	14	98.9
Rar	8	01396535	SB RARITAN R ARCH ST AT HIGH BRIDGE	FW2-TM-C1	15	11.0	8.5	0	0.0%	Not Impaired	3.82	14	100.9
Rar	8	01396588	SPRUCE RUN NR GLEN GARDNER	FW2-TP	15	11.0	8.8	0	0.0%	Not Impaired	0.51	14	99.9
Rar	8	01396660	MULHOCKAWAY CK AT VAN SYCKEL	FW2-TP	15	10.7	8.1	0	0.0%	Not Impaired	0.23	15	97.9
Rar	8	01397000	SB RARITAN R AT STANTON STATION	FW2-TM	14	11.2	8.5	0	0.0%	Not Impaired	2.30	14	105.4
Rar	8	01397400	SB RARITAN R AT THREE BRIDGES	FW2-NT	14	10.6	7.8	0	0.0%	Not Impaired	0.79	14	100.4
Rar	8	01398000	NESHANIC R AT REAVILLE	FW2-NT	29	11.6	7.3	0	0.0%	Not Impaired	0.92	28	110.7
Rar	8	01398260	NB RARITAN R NR CHESTER	FW2-TP	14	11.0	8.4	0	0.0%	Not Impaired	1.46	14	98.3
Rar	8	01399120	NB RARITAN R AT BURNT MILLS	FW2-NT	14	11.5	8.2	0	0.0%	Not Impaired	1.07	14	105.1
Rar	8	01399500	LAMINGTON (BLACK)R NR POTTERSVILLE	FW2-TP-C1	15	10.9	8.5	0	0.0%	Not Impaired	1.71	15	98.1
Rar	8	01399700	ROCKAWAY CK AT WHITEHOUSE	FW2-NT	14	10.7	7.5	0	0.0%	Not Impaired	3.56	14	98.6
Rar	8	01399780	LAMINGTON R AT BURNT MILLS	FW2-NT	15	11.3	7.7	0	0.0%	Not Impaired	0.87	14	103.2
Rar	9	01400500	RARITAN R AT MANVILLE	FW2-NT	14	10.9	6.6	0	0.0%	Not Impaired	0.36	14	99.9
Rar	9	01403300	RARITAN R AT QUEENS BRIDGE, BOUND BK	FW2-NT	35	9.7	6.1	0	0.0%	Not Impaired	2.43	35	94.2
Rar	9	01405302	MATCHAPONIX BK AT SPOTSWOOD	FW2-NT	14	9.3	6	0	0.0%	Not Impaired	3.66	14	83.1
Rar	9	01405340	MANALAPAN BK NR MANALAPAN	FW2-NT	14	10.3	8	0	0.0%	Not Impaired	0.92	14	92.6
Rar	10	01400540	MILLSTONE R NR MANALAPAN	FW2-NT	14	10.4	7.8	0	0.0%	Not Impaired	5.09	14	91.4
Rar	10	01400650	MILLSTONE R AT GROVERS MILL	FW2-NT	9	9.3	6	0	0.0%	Not Impaired	4.25	9	84.8
Rar	10	01401000	STONY BROOK AT PRINCETON	FW2-NT	32	11.1	6.7	0	0.0%	Not Impaired	2.39	31	105.3

Table A3.1.3-1: Dissolved Oxygen Attainment in NJ Rivers and Streams

Region	WMA	Station #	Station Name	SWQS Class	DO-#	DO-Mean	DO - Min (mg/l)	DO-# exc	DO-% exc	Attainment	Length (miles)	%DO Sat -#	%DO Sat-Mean
Rar	10	01401600	BEDEN BROOK NR ROCKY HILL	FW2-NT	15	10.7	5.5	0	0.0%	Not Impaired	2.39	15	95.9
Rar	10	01402000	MILLSTONE R AT BLACKWELLS MILLS	FW2-NT	14	9.0	4.4	0	0.0%	Not Impaired	0.39	14	80.4
	De-M	01438500	DELAWARE R AT MONTAGUE	1C	14	10.7	7.4	0	0.0%	NA	0.82	14	95.6
	De-M	01443000	DELAWARE R AT PORTLAND PA	1D	14	10.7	7	0	0.0%	NA	1.62	14	95.1
	De-M	01447000	DELAWARE R AT EASTON PA	1D	14	10.5	7	0	0.0%	NA	10.88	12	95.8
	De-M	01461000	DELAWARE R AT LUMBERVILLE PA	1E	14	10.6	6.6	0	0.0%	NA	6.41	12	96.7
	De-M	01463500	DELAWARE R AT TRENTON	1E	14	11.1	7.3	0	0.0%	NA	5.74	14	104.4
Notes:													
Region:													
Atl: Atlantic Region, WMAs 12, 13, 14, 15, 16													
L-De: Lower Delaware Region, WMAs 17, 18, 19, 20													
NE: Northeast Region, WMAs 03, 04, 05, 06													
NW: Northwest Region, WMAs 01, 02, 11													
Rar: Raritan Region, WMAs 07, 08, 09, 10													
Station Number: Ambient Stream Monitoring Network Station Number													
Station Name: Ambient Stream Monitoring Network Station Name													
# : number of samples collected in the ASMN between 1995 and 1997													
mean (mg/l): average (mean) concentration in mg/l (or ppm)													
# exc: number of samples exceeding applicable SWQS criteria													
McDonald's Branch - naturally low DO in this pristine ground water fed stream													

Table A3.1.3-2: Total Phosphorus Attainment in NJ Rivers and Streams

Region	WMA	Station #	Station Name	TP-n	TP-mean	TP Criterion	TP-# exc	TP-% exc	Trend (no Q)	Trend - mg/l/yr	Trend (Q-Adj)	Trend - mg/l/yr	TP SWQS Status
Atl	15	01410784	GREAT EGG HARBOR R NR SICKLERVILLE	53	0.040	0.05	13	24.5%	DOWN	-0.072	DOWN	-0.07	Partial
Atl	15	01411000	GREAT EGG HARBOR R AT FOLSOM	14	0.019	0.05	1	7.1%	DOWN	-0.012	NT		Full
Atl	15	01411110	GREAT EGG HARBOR R AT WEYMOUTH	15	0.013	0.05	0	0.0%	DOWN	-0.006	NT		Full
Atl	14	01409387	MULLICA R AT ATSION LAKE- PL	14	0.006	0.10	0	0.0%	DOWN	-0.002	NT		Full
Atl	14	01409416	HAMMONTON CK WESCOATSVILLE	14	0.223	0.10	11	78.6%	DOWN	-0.096	DOWN	-0.09	None
Atl	14	01409500	BATSTO R AT BATSTO- PL	14	0.007	0.10	0	0.0%	DOWN	-0.002	NT		Full
Atl	14	01410000	OSWEGO R AT HARRISVILLE- PL	5	0.012	0.10	0	0.0%					Full
Atl	14	01410150	EAST BR BASS R NR NEW GRETNA	14	0.007	0.10	0	0.0%	DOWN	-0.001	NT		Full
Atl	13	01408500	TOMS R NR TOMS RIVER -PL	15	0.010	0.10	0	0.0%	NSIG		NT		Full
Atl	12	01408000	MANASQUAN R AT SQUANKUM	14	0.041	0.10	0	0.0%	NSIG		NSIG		Full
L-De	20	01464500	CROSSWICKS CK AT EXTONVILLE	13	0.092	0.10	5	38.5%	DOWN	-0.020	DOWN	-0.014	None
L-De	20	01464515	DOCTORS CK AT ALLENTOWN	15	0.083	0.10	4	26.7%	DOWN	-0.015	DOWN	-0.01	None
L-De	19	01465850	SB RANCOCAS CK AT VINCENTOWN	13	0.094	0.10	5	38.5%	NSIG		DOWN	-0.006	None
L-De	19	01466500	MCDONALDS BR IN LEBANON FOREST	7	0.007	0.05	0	0.0%	NSIG		NT		Full
L-De	19	01467000	NB RANCOCAS CK AT PEMBERTON	14	0.020	0.10	0	0.0%	NSIG		NT		Full
L-De	18	01467069	NB PENNSAUKEN CK NR MORRESTOWN	14	0.128	0.05	11	78.6%	DOWN	-0.013	DOWN	-0.018	None
L-De	18	01467081	SB PENNSAUKEN CK AT CHERRY HILL	14	0.336	0.10	14	100.0%	DOWN	-0.043	DOWN	-0.044	None
L-De	18	01467150	COOPER R AT HADDONFIELD	14	0.239	0.05	14	100.0%	DOWN	-0.072	DOWN	-0.047	None
L-De	18	01467329	SB BIG TIMBER CK AT BLACKWOOD TERR	15	0.074	0.10	3	20.0%	DOWN	-0.008	DOWN	-0.009	Partial
L-De	18	01477120	RACCOON CK NR SWEDESBORO	14	0.155	0.10	10	71.4%	NSIG		NSIG		None
L-De	18	01477510	OLDMANS CK AT PORCHES MILL	14	0.082	0.10	3	21.4%	NSIG		NSIG		Partial
L-De	18	01482500	SALEM R AT WOODSTOWN	14	0.175	0.10	10	71.4%	NSIG		NSIG		None
L-De	17	01411500	MAURICE R AT NORMA	15	0.047	0.05	2	13.3%	NSIG		NT		Partial
L-De	17	01412800	COHANSEY R AT SEELEY	15	0.051	0.05	6	40.0%	NSIG		NT		None
NE	6	01379000	PASSAIC R NR MILLINGTON	16	0.092	0.10	5	31.3%	NSIG		NSIG		None
NE	6	01379500	PASSAIC R NR CATHAM	15	0.271	0.10	14	93.3%	NSIG		NSIG		None
NE	6	01380500	ROCKAWAY R AT BOONTON	15	0.017	0.05	0	0.0%	DOWN	-0.006	NT		Full
NE	6	01381200	ROCKAWAY R AT PINE BROOK	14	0.366	0.10	10	71.4%	NSIG		NSIG		None
NE	6	01381500	WHIPPANY R AT MORRISTOWN	15	0.090	0.10	5	33.3%	DOWN	-0.022	DOWN	-0.022	None
NE	6	01381800	WHIPPANY R NR PINEBROOK	14	0.209	0.10	10	71.4%	DOWN	-0.025	DOWN	-0.027	None
NE	6	01382000	PASSAIC R AT TWO BRIDGES	46	0.481	0.10	45	97.8%	NSIG		NSIG		None
NE	5	01377000	HACKENSACK R AT RIVERVALE	14	0.038	0.10	0	0.0%	NSIG		NSIG		Full
NE	4	01389500	PASSAIC R AT LITTLE FALLS	26	0.427	0.10	26	100.0%	UP	0.029	NSIG		None
NE	4	01389880	PASSAIC R AT ELMWOOD PK	14	0.238	0.10	13	92.9%	DOWN	-0.020	DOWN	-0.019	None
NE	4	01391500	SADDLE R AT LODI	15	0.640	0.10	15	100.0%	DOWN	-0.037	DOWN	-0.033	None
NE	3	01382500	PEQUANNOCK R AT MACOPIN INTAKE	14	0.017	0.10	0	0.0%	NSIG		NT		Full
NE	3	01387500	RAMAPO R NR MAHWAH	13	0.116	0.10	4	30.8%	NSIG		NSIG		None
NE	3	01388600	POMPTON R AT PACKANACK LK	30	0.055	0.10	3	10.0%	DOWN	-0.009	DOWN	-0.012	Full
NW	11	01463620	ASSUNPINK CK NR CLARKSVILLE	14	0.036	0.05	4	28.6%	NSIG		NSIG		None
NW	11	01464000	ASSUNPINK CR AT TRENTON	9	0.353	0.10	9	100.0%	NSIG		DOWN	-0.02	None
NW	2	01367770	WALKILL R NR SUSSEX	15	0.035	0.10	0	0.0%	NSIG		NT		Full

Table A3.1.3-2: Total Phosphorus Attainment in NJ Rivers and Streams

Region	WMA	Station #	Station Name	Length (miles)	TP-BTM-	TP-BTM-mean
Atl	15	01410784	GREAT EGG HARBOR R NR SICKLERVILLE	0.96	1	140.0
Atl	15	01411000	GREAT EGG HARBOR R AT FOLSOM	4.30	1	110.0
Atl	15	01411110	GREAT EGG HARBOR R AT WEYMOUTH	0.52	0	
Atl	14	01409387	MULLICA R AT ATSION LAKE- PL	1.26	0	
Atl	14	01409416	HAMMONTON CK WESCOATSVILLE	1.56	0	
Atl	14	01409500	BATSTO R AT BATSTO- PL	0.69	0	
Atl	14	01410000	OSWEGO R AT HARRISVILLE- PL	0.27	1	40.0
Atl	14	01410150	EAST BR BASS R NR NEW GRETNA	0.97	0	
Atl	13	01408500	TOMS R NR TOMS RIVER -PL	4.36	1	71.0
Atl	12	01408000	MANASQUAN R AT SQUANKUM	0.52	0	
L-De	20	01464500	CROSSWICKS CK AT EXTONVILLE	3.92	1	1700.0
L-De	20	01464515	DOCTORS CK AT ALLENTOWN	0.98	1	1200.0
L-De	19	01465850	SB RANCOCAS CK AT VINCENTOWN	3.77	1	640.0
L-De	19	01466500	MCDONALDS BR IN LEBANON FOREST	0.39	0	
L-De	19	01467000	NB RANCOCAS CK AT PEMBERTON	1.53	1	420.0
L-De	18	01467069	NB PENNSAUKEN CK NR MORRESTOWN	2.82	1	75.0
L-De	18	01467081	SB PENNSAUKEN CK AT CHERRY HILL	7.17	1	280.0
L-De	18	01467150	COOPER R AT HADDONFIELD	0.35	1	110.0
L-De	18	01467329	SB BIG TIMBER CK AT BLACKWOOD TERR	1.02	1	870.0
L-De	18	01477120	RACCOON CK NR SWEDESBORO	1.02	1	1100.0
L-De	18	01477510	OLDMANS CK AT PORCHES MILL	0.17	1	4200.0
L-De	18	01482500	SALEM R AT WOODSTOWN	0.32	1	270.0
L-De	17	01411500	MAURICE R AT NORMA	1.22	1	48.0
L-De	17	01412800	COHANSEY R AT SEELEY	0.57	0	
NE	6	01379000	PASSAIC R NR MILLINGTON	2.95	0	
NE	6	01379500	PASSAIC R NR CATHAM	4.46	0	
NE	6	01380500	ROCKAWAY R AT BOONTON	1.70	0	
NE	6	01381200	ROCKAWAY R AT PINE BROOK	1.48	0	
NE	6	01381500	WHIPPANY R AT MORRISTOWN	2.61	0	
NE	6	01381800	WHIPPANY R NR PINEBROOK	0.73	0	
NE	6	01382000	PASSAIC R AT TWO BRIDGES	0.13	0	
NE	5	01377000	HACKENSACK R AT RIVERVALE	4.77	0	
NE	4	01389500	PASSAIC R AT LITTLE FALLS	0.44	0	
NE	4	01389880	PASSAIC R AT ELMWOOD PK	10.13	0	
NE	4	01391500	SADDLE R AT LODI	3.51	0	
NE	3	01382500	PEQUANNOCK R AT MACOPIN INTAKE	0.42	0	
NE	3	01387500	RAMAPO R NR MAHWAH	0.82	0	
NE	3	01388600	POMPTON R AT PACKANACK LK	1.53	0	
NW	11	01463620	ASSUNPINK CK NR CLARKSVILLE	2.56	0	
NW	11	01464000	ASSUNPINK CR AT TRENTON	2.21	0	
NW	2	01367770	WALKILL R NR SUSSEX	0.83	0	

Table A3.1.3-2: Total Phosphorus Attainment in NJ Rivers and Streams

Region	WMA	Station #	Station Name	TP-n	TP-mean	TP Criterion	TP-# exc	TP-% exc	Trend (no Q)	Trend - mg/l/yr	Trend (Q-Adj)	Trend - mg/l/yr	TP SWQS Status
NW	2	01367910	PAPAKATING CK AT SUSSEX	14	0.071	0.10	3	21.4%	NSIG		DOWN	-0.006	Partial
NW	2	01368000	WALLKILL R NR UNIONVILLE	14	0.051	0.10	0	0.0%	NSIG		NT		Full
NW	2	01368950	Black Creek nr Vernon	14	0.040	0.10	1	7.1%	DOWN	-0.005	NT		Full
NW	1	01440000	BIG FLATBROOK AT FLATBROOKVILLE	9	0.013	0.10	0	0.0%	NSIG		NT		Full
NW	1	01443440	PAULINS KILL AT BALESVILLE	14	0.042	0.05	3	21.4%	DOWN	-0.016	NT		Partial
NW	1	01443500	PAULINS KILL AT BLAIRSTOWN	14	0.028	0.10	0	0.0%	DOWN	-0.004	NT		Full
NW	1	01445500	PEQUEST R AT PEQUEST	14	0.065	0.10	2	14.3%	NSIG		NSIG		Partial
NW	1	01455200	POHATCONG CK AT NEW VILLAGE	13	0.105	0.10	5	38.5%	NSIG		DOWN	-0.015	None
NW	1	01456200	MUSCONETCONG R AT BEATTYSTOWN	14	0.032	0.10	0	0.0%	DOWN	-0.014	DOWN	-0.015	Full
NW	1	01457000	MUSCONETCONG R NR BLOOMSBURY	14	0.021	0.10	0	0.0%	DOWN	-0.018	NT		Full
NW	1	01457400	MUSCONETCONG R AT RIEGELSVILLE	14	0.038	0.10	1	7.1%	DOWN	-0.017	NT		Full
Rar	10	01400540	MILLSTONE R NR MANALAPAN	14	0.126	0.10	4	28.6%	NSIG		NSIG		None
Rar	10	01400650	MILLSTONE R AT GROVERS MILL	9	0.099	0.05	7	77.8%	DOWN	-0.034	DOWN	-0.038	None
Rar	10	01401000	STONY BROOK AT PRINCETON	37	0.115	0.05	19	51.4%	NSIG		NSIG		None
Rar	10	01401600	BEDEN BROOK NR ROCKY HILL	15	0.093	0.10	4	26.7%	DOWN	-0.008	DOWN	-0.015	None
Rar	10	01402000	MILLSTONE R AT BLACKWELLS MILLS	14	0.253	0.10	14	100.0%	NSIG		NSIG		None
Rar	9	01400500	RARITAN R AT MANVILLE	13	0.055	0.10	2	15.4%	NSIG		NSIG		Partial
Rar	9	01403300	RARITAN R AT QUEENS BRIDGE	35	0.235	0.10	28	80.0%	NSIG		NSIG		None
Rar	9	01405302	MATCHAPONIX BK AT SPOTSWOOD	14	0.029	0.05	2	14.3%	DOWN	-0.012	NT		Partial
Rar	9	01405340	MANALAPAN BK NR MANALAPAN	14	0.070	0.05	8	57.1%	NSIG		NSIG		None
Rar	8	01396280	SB RARITAN R AT MIDDLE VALLEY	14	0.070	0.10	2	14.3%	DOWN	-0.009	DOWN	-0.014	Partial
Rar	8	01396535	SB RARITAN R ARCH ST AT HIGH BRIDGE	15	0.042	0.10	0	0.0%	DOWN	-0.009	NT		Full
Rar	8	01396588	SPRUCE RUN NR GLEN GARDNER	15	0.027	0.05	2	13.3%	DOWN	-0.016	NT		Partial
Rar	8	01396660	MULHOCKAWAY CK AT VAN SYCKEL	15	0.014	0.05	1	6.7%	DOWN	-0.015	NT		Full
Rar	8	01397000	SB RARITAN R AT STANTON STATION	14	0.021	0.05	0	0.0%	DOWN	-0.010	DOWN	-0.009	Full
Rar	8	01397400	SB RARITAN R AT THREE BRIDGES	14	0.121	0.10	8	57.1%	NSIG		NSIG		None
Rar	8	01398000	NESHANIC R AT REAVILLE	33	0.080	0.10	4	12.1%	NSIG		NSIG		Partial
Rar	8	01398260	NB RARITAN R NR CHESTER	13	0.037	0.10	0	0.0%	DOWN	-0.049	NT		Full
Rar	8	01399120	NB RARITAN R AT BURNT MILLS	14	0.024	0.10	0	0.0%	DOWN	-0.010	NT		Full
Rar	8	01399500	LAMINGTON (BLACK)R NR POTTERSVILLE	15	0.045	0.10	1	6.7%	DOWN	-0.009	DOWN	-0.012	Full
Rar	8	01399700	ROCKAWAY CK AT WHITEHOUSE	14	0.074	0.10	2	14.3%	NSIG		NSIG		Partial
Rar	8	01399780	LAMINGTON R AT BURNT MILLS	15	0.078	0.10	2	13.3%	NSIG		DOWN	-0.003	Partial
Rar	7	01393450	ELIZABETH R AT URSINO LK AT ELIZABETH	14	0.082	0.10	4	28.6%	NSIG		NSIG		None
Rar	7	01394500	RAHWAY R NR SPRINGFIELD	15	0.084	0.10	1	6.7%	NSIG		NSIG		Full
Rar	7	01395000	RAHWAY R AT RAHWAY	14	0.085	0.10	3	21.4%	NSIG		NSIG		Partial
	De-M	01438500	DELAWARE R AT MONTAGUE	14	0.014	NA			NSIG		NT		NA
	De-M	01443000	DELAWARE R AT PORTLAND PA	14	0.033	NA			NSIG		NT		NA
	De-M	01447000	DELAWARE R AT EASTON PA	14	0.020	NA			NSIG		NT		NA
	De-M	01461000	DELAWARE R AT LUMBERVILLE PA	14	0.044	NA			NSIG		NSIG		NA
	De-M	01463500	DELAWARE R AT TRENTON	14	0.054	NA			NSIG		NSIG		NA

Table A3.1.3-2: Total Phosphorus Attainment in NJ Rivers and Streams

Region	WMA	Station #	Station Name	Length (miles)	TP-BTM-	TP-BTM-mean
NW	2	01367910	PAPAKATING CK AT SUSSEX	0.79	0	
NW	2	01368000	WALLKILL R NR UNIONVILLE	2.44	0	
NW	2	01368950	Black Creek nr Vernon	0.76	0	
NW	1	01440000	BIG FLATBROOK AT FLATBROOKVILLE	1.70	1	230.0
NW	1	01443440	PAULINS KILL AT BALESVILLE	1.72	1	350.0
NW	1	01443500	PAULINS KILL AT BLAIRSTOWN	0.97	1	430.0
NW	1	01445500	PEQUEST R AT PEQUEST	1.26	1	390.0
NW	1	01455200	POHATCONG CK AT NEW VILLAGE	5.67	1	400.0
NW	1	01456200	MUSCONETCONG R AT BEATTYSTOWN	2.24	1	460.0
NW	1	01457000	MUSCONETCONG R NR BLOOMSBURY	11.34	1	450.0
NW	1	01457400	MUSCONETCONG R AT RIEGELSVILLE	11.34	1	260.0
Rar	10	01400540	MILLSTONE R NR MANALAPAN	5.09	0	
Rar	10	01400650	MILLSTONE R AT GROVERS MILL	4.25	0	
Rar	10	01401000	STONY BROOK AT PRINCETON	2.39	0	
Rar	10	01401600	BEDEN BROOK NR ROCKY HILL	2.39	0	
Rar	10	01402000	MILLSTONE R AT BLACKWELLS MILLS	0.39	1	270.0
Rar	9	01400500	RARITAN R AT MANVILLE	0.36	0	
Rar	9	01403300	RARITAN R AT QUEENS BRIDGE	2.43	0	
Rar	9	01405302	MATCHAPONIX BK AT SPOTSWOOD	3.66	0	
Rar	9	01405340	MANALAPAN BK NR MANALAPAN	0.92	0	
Rar	8	01396280	SB RARITAN R AT MIDDLE VALLEY	4.94	1	260.0
Rar	8	01396535	SB RARITAN R ARCH ST AT HIGH BRIDGE	3.82	1	230.0
Rar	8	01396588	SPRUCE RUN NR GLEN GARDNER	0.51	1	230.0
Rar	8	01396660	MULHOCKAWAY CK AT VAN SYCKEL	0.23	1	170.0
Rar	8	01397000	SB RARITAN R AT STANTON STATION	2.30	1	210.0
Rar	8	01397400	SB RARITAN R AT THREE BRIDGES	0.79	1	250.0
Rar	8	01398000	NESHANIC R AT REAVILLE	0.92	1	680.0
Rar	8	01398260	NB RARITAN R NR CHESTER	1.46	0	
Rar	8	01399120	NB RARITAN R AT BURNT MILLS	1.07	0	
Rar	8	01399500	LAMINGTON (BLACK)R NR POTTERSVILLE	1.71	0	
Rar	8	01399700	ROCKAWAY CK AT WHITEHOUSE	3.56	1	300.0
Rar	8	01399780	LAMINGTON R AT BURNT MILLS	0.87	0	
Rar	7	01393450	ELIZABETH R AT URSINO LK AT ELIZABETH	5.55	0	
Rar	7	01394500	RAHWAY R NR SPRINGFIELD	1.88	0	
Rar	7	01395000	RAHWAY R AT RAHWAY	2.72	0	
	De-M	01438500	DELAWARE R AT MONTAGUE	0.82	0	
	De-M	01443000	DELAWARE R AT PORTLAND PA	1.62	0	
	De-M	01447000	DELAWARE R AT EASTON PA	10.88	0	
	De-M	01461000	DELAWARE R AT LUMBERVILLE PA	6.41	0	
	De-M	01463500	DELAWARE R AT TRENTON	5.74	0	

Table A3.1.3-2: Total Phosphorus Attainment in NJ Rivers and Streams

Region	WMA	Station #	Station Name	TP-n	TP-mean	TP Criterion	TP-# exc	TP-% exc	Trend (no Q)	Trend - mg/l/yr	Trend (Q-Adj)	Trend - mg/l/yr	TP SWQS Status
Notes:													
Region:													
Atl: Atlantic Region, WMAs 12, 13, 14, 15, 16													
L-De: Lower Delaware Region, WMAs 17, 18, 19, 20													
NE: Northeast Region, WMAs 03, 04, 05, 06													
NW: Northwest Region, WMAs 01, 02, 11													
Rar: Raritan Region, WMAs 07, 08, 09, 10													
Station Number: Ambient Stream Monitoring Network Station Number													
Station Name: Ambient Stream Monitoring Network Station Name													
n : number of samples collected in the ASMN between 1995 and 1997													
mean (mg/l): average (mean) concentration in mg/l (or ppm)													
# exc: number of samples exceeding applicable SWQS criteria													
Trend - no Q: trends without flow adjustment (NSIG- not significant, NT- not tested, UP - increasing concentration, DOWN- decreasing concentration													
Trend - mg/l/yr: annual change in concentration													
Trend (Q-adj): trends with flow adjustment													

Table A3.1.3-2: Total Phosphorus Attainment in NJ Rivers and Streams

Region	WMA	Station #	Station Name	Length (miles)	TP-BTM-	TP-BTM-mean
Notes:						
Region:						
Atl: Atlantic Region, WMAs 12, 13, 14, 15, 16						
L-De: Lower Delaware Region, WMAs 17, 18, 19, 20						
NE: Northeast Region, WMAs 03, 04, 05, 06						
NW: Northwest Region, WMAs 01, 02, 11						
Rar: Raritan Region, WMAs 07, 08, 09, 10						
Station Number: Ambient Stream Monitoring Network Station Number						
Station Name: Ambient Stream Monitoring Network Station Name						
n : number of samples collected in the ASMN between 1995 and 1997						
mean (mg/l): average (mean) concentration in mg/l (or ppm)						
# exc: number of samples exceeding applicable SWQS criteria						
Trend - no Q: trends without flow adjustment (NSIG- not significant, NT- not						
Trend - mg/l/yr: annual change in concentration						
Trend (Q-adj): trends with flow adjustment						

Table A3.1.3-3: Un-Ionized Ammonia Attainment in NJ Rivers and Streams

Region	WMA	Station #	Station Name	SWQS_CLASS	UIA-#	UIA- mean (ppb)	UIA- # exc	UIA-% Exc	Attainment	Length (miles)
Atl	12	01408000	MANASQUAN R AT SQUANKUM	FW2-TM	13	0.2	0	0.0%	Not Impaired	0.52
Atl	13	01408500	TOMS R NR TOMS RIVER	FW2-NT	15	0.0	0	0.0%	Not Impaired	4.36
Atl	14	01409387	MULLICA R AT ATSION LAKE	PL	14	0.0	0	0.0%	Not Impaired	0.11
Atl	14	01409416	HAMMONTON CK WESCOATSVILLE	PL	13	0.1	0	0.0%	Not Impaired	1.56
Atl	14	01409500	BATSTO R AT BATSTO	PL	14	0.0	0	0.0%	Not Impaired	0.69
Atl	14	01410000	OSWEGO R AT HARRISVILLE	PL	4	0.0	0	0.0%	Not Assessed	0.27
Atl	14	01410150	EAST BR BASS R NR NEW GRETNA	PL	13	0.0	0	0.0%	Not Impaired	0.97
Atl	15	01410784	GREAT EGG HARBOR R NR SICKLERVILLE	PL	52	0.0	0	0.0%	Not Impaired	0.96
Atl	15	01411000	GREAT EGG HARBOR R AT FOLSOM- PL	PL	14	0.1	0	0.0%	Not Impaired	4.30
Atl	15	01411110	GREAT EGG HARBOR R AT WEYMOUTH	PL	14	0.0	0	0.0%	Not Impaired	0.52
L-De	17	01411500	MAURICE R AT NORMA	FW2-NT	14	0.0	0	0.0%	Not Impaired	1.22
L-De	17	01412800	COHANSEY R AT SEELEY	FW2-NT	14	0.2	0	0.0%	Not Impaired	0.57
L-De	17	01482500	SALEM R AT WOODSTOWN	FW2-NT	13	1.6	0	0.0%	Not Impaired	0.32
L-De	18	01467069	NB PENNSAUKEN CK NR MORRESTOWN	FW2-NT	14	0.9	0	0.0%	Not Impaired	2.82
L-De	18	01467081	SB PENNSAUKEN CK AT CHERRY HILL	FW2-NT	14	4.3	0	0.0%	Not Impaired	7.17
L-De	18	01467150	COOPER R AT HADDONFIELD	FW2-NT	13	0.9	0	0.0%	Not Impaired	0.35
L-De	18	01467329	SB BIG TIMBER CK AT BLACKWOOD TERR	FW2-NT	14	0.7	0	0.0%	Not Impaired	1.02
L-De	18	01477120	RACCOON CK NR SWEDESBORO	FW2-NT	13	0.9	0	0.0%	Not Impaired	1.02
L-De	18	01477510	OLDMANS CK AT PORCHES MILL	FW2-NT	13	0.5	0	0.0%	Not Impaired	0.17
L-De	19	01465850	SB RANCOCAS CK AT VINCENTOWN	FW2-NT	14	0.0	0	0.0%	Not Impaired	3.77
L-De	19	01466500	MCDONALDS BR IN LEBANON FOREST	PL	7	0.0	0	0.0%	Not Assessed	0.39
L-De	19	01467000	NB RANCOCAS CK AT PEMBERTON	FW2-NT	14	0.0	0	0.0%	Not Impaired	1.53
L-De	20	01464500	CROSSWICKS CK AT EXTONVILLE	FW2-NT	13	0.3	0	0.0%	Not Impaired	3.92
L-De	20	01464515	DOCTORS CK AT ALLENTOWN	FW2-NT	14	1.9	0	0.0%	Not Impaired	0.98
NE	3	01382500	PEQUANNOCK R AT MACOPIN INTAKE	FW2-TM	13	0.2	0	0.0%	Not Impaired	0.42
NE	3	01387500	RAMAPO R NR MAHWAH	FW2-NT	14	1.6	0	0.0%	Not Impaired	0.82
NE	3	01388600	POMPTON R AT PACKANACK LK	FW2-NT	30	0.9	0	0.0%	Not Impaired	1.53
NE	4	01389500	PASSAIC R AT LITTLE FALLS	FW2-NT	26	2.1	0	0.0%	Not Impaired	0.44
NE	4	01389880	PASSAIC R AT ELMWOOD PK	FW2-NT	14	0.6	0	0.0%	Not Impaired	10.13
NE	4	01391500	SADDLE R AT LODI	FW2-NT	15	8.6	0	0.0%	Not Impaired	3.51
NE	5	01377000	HACKENSACK R AT RIVERVALE	FW2-NT	14	1.3	0	0.0%	Not Impaired	4.77
NE	6	01379000	PASSAIC R NR MILLINGTON	FW2-NT	16	0.2	0	0.0%	Not Impaired	2.95
NE	6	01379500	PASSAIC R NR CATHAM	FW2-NT	15	0.8	0	0.0%	Not Impaired	4.46
NE	6	01380500	ROCKAWAY R AT BOONTON	FW2-NT	15	0.5	0	0.0%	Not Impaired	1.70
NE	6	01381200	ROCKAWAY R AT PINE BROOK	FW2-NT	14	0.7	0	0.0%	Not Impaired	1.48
NE	6	01381500	WHIPPANY R AT MORRISTOWN	FW2-NT	14	1.8	0	0.0%	Not Impaired	2.61
NE	6	01381800	WHIPPANY R NR PINEBROOK	FW2-NT	14	0.8	0	0.0%	Not Impaired	0.73

Table A3.1.3-3: Un-Ionized Ammonia Attainment in NJ Rivers and Streams

Region	WMA	Station #	Station Name	SWQS_CLASS	UIA-#	UIA- mean (ppb)	UIA- # exc	UIA-% Exc	Attainment	Length (miles)
NE	6	01382000	PASSAIC R AT TWO BRIDGES	FW2-NT	46	1.2	0	0.0%	Not Impaired	0.13
NW	1	01440000	BIG FLATBROOK AT FLATBROOKVILLE	FW2-TM	9	1.2	0	0.0%	Not Impaired	1.70
NW	1	01443440	PAULINS KILL AT BALESVILLE	FW2-TM	14	1.6	0	0.0%	Not Impaired	1.72
NW	1	01443500	PAULINS KILL AT BLAIRSTOWN	FW2-TM	14	1.2	0	0.0%	Not Impaired	0.97
NW	1	01445500	PEQUEST R AT PEQUEST	FW2-NT (C1)	14	3.1	0	0.0%	Not Impaired	1.26
NW	1	01455200	POHATCONG CK AT NEW VILLAGE	FW2-TM	13	3.7	0	0.0%	Not Impaired	5.67
NW	1	01456200	MUSCONETCONG R AT BEATTYSTOWN	FW2-TM	13	1.0	0	0.0%	Not Impaired	2.24
NW	1	01457000	MUSCONETCONG R NR BLOOMSBURY	FW2-TM	14	1.8	0	0.0%	Not Impaired	11.34
NW	1	01457400	MUSCONETCONG R AT RIEGELSVILLE	FW2-TM	14	1.7	0	0.0%	Not Impaired	11.34
NW	2	01367770	WALKILL R NR SUSSEX	FW2-NT	15	0.8	0	0.0%	Not Impaired	0.83
NW	2	01367910	PAPAKATING CK AT SUSSEX	FW2-NT	14	1.3	0	0.0%	Not Impaired	0.79
NW	2	01368000	WALLKILL R NR UNIONVILLE	FW2-NT	14	0.8	0	0.0%	Not Impaired	2.44
NW	2	01368950	BLACK CR NR VERNON	FW2-NT	14	0.9	0	0.0%	Not Impaired	0.76
NW	11	01463620	ASSUNPINK CK NR CLARKSVILLE	FW2-NT	14	0.5	0	0.0%	Not Impaired	2.56
NW	11	01464000	ASSUNPINK CR AT TRENTON	FW2-NT	9	0.7	0	0.0%	Not Impaired	2.21
Rar	7	01393450	ELIZABETH R AT URSINO LK	FW2-NT	14	1.6	0	0.0%	Not Impaired	5.55
Rar	7	01394500	RAHWAY R NR SPRINGFIELD	FW2-NT	15	0.9	0	0.0%	Not Impaired	1.88
Rar	7	01395000	RAHWAY R AT RAHWAY	FW2-NT	14	1.6	0	0.0%	Not Impaired	2.72
Rar	8	01396280	SB RARITAN R AT MIDDLE VALLEY	FW2-TM	13	0.9	0	0.0%	Not Impaired	4.94
Rar	8	01396535	SB RARITAN R ARCH ST AT HIGH BRIDGE	FW2-TM-C1	14	1.6	0	0.0%	Not Impaired	3.82
Rar	8	01396588	SPRUCE RUN NR GLEN GARDNER	FW2-TP	15	0.6	0	0.0%	Not Impaired	0.51
Rar	8	01396660	MULHOCKAWAY CK AT VAN SYCKEL	FW2-TP	15	0.7	0	0.0%	Not Impaired	0.23
Rar	8	01397000	SB RARITAN R AT STANTON STATION	FW2-TM	13	2.9	1	7.7%	Not Impaired	2.30
Rar	8	01397400	SB RARITAN R AT THREE BRIDGES	FW2-NT	14	1.3	0	0.0%	Not Impaired	0.79
Rar	8	01398000	NESHANIC R AT REAVILLE	FW2-NT	30	3.6	0	0.0%	Not Impaired	0.92
Rar	8	01398260	NB RARITAN R NR CHESTER	FW2-TP	14	0.8	0	0.0%	Not Impaired	1.46
Rar	8	01399120	NB RARITAN R AT BURNT MILLS	FW2-NT	14	2.8	0	0.0%	Not Impaired	1.07
Rar	8	01399500	LAMINGTON (BLACK)R NR POTTERSVILLE	FW2-TP- C1	15	0.7	0	0.0%	Not Impaired	1.71
Rar	8	01399700	ROCKAWAY CK AT WHITEHOUSE	FW2-NT	14	2.7	0	0.0%	Not Impaired	3.56
Rar	8	01399780	LAMINGTON R AT BURNT MILLS	FW2-NT	15	1.5	0	0.0%	Not Impaired	0.87
Rar	9	01400500	RARITAN R AT MANVILLE	FW2-NT	13	1.9	0	0.0%	Not Impaired	0.36
Rar	9	01403300	RARITAN R AT QUEENS BRIDGE	FW2-NT	35	0.6	0	0.0%	Not Impaired	2.43
Rar	9	01405302	MATCHAPONIX BK AT SPOTSWOOD	FW2-NT	14	0.5	0	0.0%	Not Impaired	3.66
Rar	9	01405340	MANALAPAN BK NR MANALAPAN	FW2-NT	14	0.2	0	0.0%	Not Impaired	0.92
Rar	10	01400540	MILLSTONE R NR MANALAPAN	FW2-NT	13	0.1	0	0.0%	Not Impaired	5.09
Rar	10	01400650	MILLSTONE R AT GROVERS MILL	FW2-NT	8	0.2	0	0.0%	Not Impaired	4.25
Rar	10	01401000	STONY BROOK AT PRINCETON	FW2-NT	33	1.7	0	0.0%	Not Impaired	2.39

Table A3.1.3-3: Un-Ionized Ammonia Attainment in NJ Rivers and Streams

Region	WMA	Station #	Station Name	SWQS_CLASS	UIA-#	UIA- mean (ppb)	UIA- # exc	UIA-% Exc	Attainment	Length (miles)
Rar	10	01401600	BEDEN BROOK NR ROCKY HILL	FW2-NT	15	0.6	0	0.0%	Not Impaired	2.39
Rar	10	01402000	MILLSTONE R AT BLACKWELLS MILLS	FW2-NT	14	0.5	0	0.0%	Not Impaired	0.39
	De-M	01438500	DELAWARE R AT MONTAGUE	1C	13	0.5			NA	0.82
	De-M	01443000	DELAWARE R AT PORTLAND PA	1D	13	0.4			NA	1.62
	De-M	01447000	DELAWARE R AT EASTON PA	1D	13	0.7			NA	10.88
	De-M	01461000	DELAWARE R AT LUMBERVILLE PA	1E	13	1.3			NA	6.41
	De-M	01463500	DELAWARE R AT TRENTON	1E	12	2.5			NA	5.74
Notes:										
Region:										
Atl: Atlantic Region, WMAs 12, 13, 14, 15, 16										
L-De: Lower Delaware Region, WMAs 17, 18, 19, 20										
NE: Northeast Region, WMAs 03, 04, 05, 06										
NW: Northwest Region, WMAs 01, 02, 11										
Rar: Raritan Region, WMAs 07, 08, 09, 10										
Station Number: Ambient Stream Monitoring Network Station Number										
Station Name: Ambient Stream Monitoring Network Station Name										
n : number of samples collected in the ASMN between 1995 and 1997										
mean: average (mean) concentration in ug/l (or ppb)										
# exc: number of samples exceeding applicable SWQS criteria										

Table A3.1.3-4: pH and TSS Attainment Status in NJ Rivers and Streams

Region	WMA	Station #	Station Name	SWQS Class	Years	pH-n	pH - Mean	pH - Min	pH - Max	pH-# exc	pH-% exc	pH Attainment	Length (miles)
Atl	12	01408000	MANASQUAN R AT SQUANKUM	FW2-TM	95-97	14	7.31	7.1	7.6	0	0.0%	Not Impaired	0.52
Atl	13	01408500	TOMS R NR TOMS RIVER	FW2-NT	95-97	15	5.39	4.5	6	15	100.0%	Impaired	4.36
Atl	14	01409387	MULLICA R AT ATSION LAKE	PL	95-97	14	4.64	4.2	5	0	0.0%	Not Impaired	0.11
Atl	14	01409416	HAMMONTON CK WESCOATSVILLE	PL	95-97	14	6.52	5.7	7.1	14	100.0%	Impaired	1.56
Atl	14	01409500	BATSTO R AT BATSTO	PL	95-97	14	4.97	4.3	5.8	3	21.4%	Impaired	0.69
Atl	14	01410000	OSWEGO R AT HARRISVILLE	PL	95-97	5	4.36	4.1	4.6	0	0.0%	Not Assessed	0.27
Atl	14	01410150	EAST BR BASS R NR NEW GRETNA	PL	95-97	14	4.45	4.2	4.8	0	0.0%	Not Impaired	0.97
Atl	15	01410784	GREAT EGG HARBOR R NR	PL	95-97	54	5.97	4.49	6.8	45	83.3%	Impaired	0.96
Atl	15	01411000	GREAT EGG HARBOR R AT FOLSOM	PL	95-97	14	5.91	4.4	6.6	11	78.6%	Impaired	4.30
Atl	15	01411110	GREAT EGG HARBOR R AT	PL	95-97	16	5.48	4.5	6.2	12	75.0%	Impaired	0.52
L-De	17	01411500	MAURICE R AT NORMA	FW2-NT	95-97	15	6.40	5.9	6.7	14	93.3%	Impaired	1.22
L-De	17	01412800	COHANSEY R AT SEELEY	FW2-NT	95-97	15	6.86	6.4	7.1	1	6.7%	Not Impaired	0.57
L-De	17	01482500	SALEM R AT WOODSTOWN	FW2-NT	95-97	14	7.57	7.1	8.4	0	0.0%	Not Impaired	0.32
L-De	18	01467069	NB PENNSAUKEN CK NR	FW2-NT	95-97	14	6.97	6.7	7.4	0	0.0%	Not Impaired	2.82
L-De	18	01467081	SB PENNSAUKEN CK AT CHERRY HILL	FW2-NT	95-97	14	7.26	7	7.4	0	0.0%	Not Impaired	7.17
L-De	18	01467150	COOPER R AT HADDONFIELD	FW2-NT	95-97	14	7.15	6.8	7.5	0	0.0%	Not Impaired	0.35
L-De	18	01467329	SB BIG TIMBER CK AT BLACKWOOD	FW2-NT	95-97	16	7.16	6.6	7.4	0	0.0%	Not Impaired	1.02
L-De	18	01477120	RACCOON CK NR SWEDESBORO	FW2-NT	95-97	14	7.27	6.8	7.6	0	0.0%	Not Impaired	1.02
L-De	18	01477510	OLDMANS CK AT PORCHES MILL	FW2-NT	95-97	14	7.29	6.9	7.8	0	0.0%	Not Impaired	0.17
L-De	19	01465850	SB RANCOCAS CK AT VINCENTOWN	FW2-NT	95-97	14	5.89	4.4	6.6	13	92.9%	Impaired	3.77
L-De	19	01466500	MCDONALDS BR IN LEBANON	PL	95-97	7	4.13	3.6	4.7	0	0.0%	Not Assessed	0.39
L-De	19	01467000	NB RANCOCAS CK AT PEMBERTON	FW2-NT	95-97	14	4.96	4.1	6.2	14	100.0%	Impaired	1.53
L-De	20	01464500	CROSSWICKS CK AT EXTONVILLE	FW2-NT	95-97	14	7.24	7	7.9	0	0.0%	Not Impaired	3.92
L-De	20	01464515	DOCTORS CK AT ALLENTOWN	FW2-NT	95-97	15	7.23	6.75	7.7	0	0.0%	Not Impaired	0.98
NE	3	01382500	PEQUANNOCK R AT MACOPIN INTAKE	FW2-TM	95-97	13	7.40	7	7.7	0	0.0%	Not Impaired	0.42
NE	3	01387500	RAMAPO R NR MAHWAH	FW2-NT	95-97	14	7.69	7	8.3	0	0.0%	Not Impaired	0.82
NE	3	01388600	POMPTON R AT PACKANACK LK	FW2-NT	95-97	31	7.78	7	8.4	0	0.0%	Not Impaired	1.53
NE	4	01389500	PASSAIC R AT LITTLE FALLS	FW2-NT	95-97	26	7.84	7	8.5	2	7.7%	Not Impaired	0.44
NE	4	01389880	PASSAIC R AT ELMWOOD PK	FW2-NT	95-97	14	7.61	7.4	7.9	0	0.0%	Not Impaired	10.13
NE	4	01391500	SADDLE R AT LODI	FW2-NT	95-97	16	7.65	7.16	8	0	0.0%	Not Impaired	3.51
NE	5	01377000	HACKENSACK R AT RIVERVALE	FW2-NT	95-97	14	7.82	7.3	8.1	0	0.0%	Not Impaired	4.77
NE	6	01379000	PASSAIC R NR MILLINGTON	FW2-NT	95-97	17	7.03	6.5	7.4	1	5.9%	Not Impaired	2.95
NE	6	01379500	PASSAIC R NR CATHAM	FW2-NT	95-97	16	7.43	7	8.1	0	0.0%	Not Impaired	4.46
NE	6	01380500	ROCKAWAY R AT BOONTON	FW2-NT	95-97	16	7.53	7.01	8	0	0.0%	Not Impaired	1.70
NE	6	01381200	ROCKAWAY R AT PINE BROOK	FW2-NT	95-97	14	7.56	7.3	7.8	0	0.0%	Not Impaired	1.48
NE	6	01381500	WHIPPANY R AT MORRISTOWN	FW2-NT	95-97	15	7.82	7	9.2	1	6.7%	Not Impaired	2.61

Table A3.1.3-4: pH and TSS Attainment Status in NJ Rivers and Streams

Region	WMA	Station #	Station Name	SWQS Class	Years	pH-n	pH - Mean	pH - Min	pH - Max	pH-# exc	pH-% exc	pH Attainment	Length (miles)
NE	6	01381800	WHIPPANY R NR PINEBROOK	FW2-NT	95-97	15	7.31	6.8	7.8	0	0.0%	Not Impaired	0.73
NE	6	01382000	PASSAIC R AT TWO BRIDGES	FW2-NT	95-97	48	7.54	6.95	8.6	2	4.2%	Not Impaired	0.13
NW	1	01440000	BIG FLATBROOK AT	FW2-TM	95-97	9	7.92	7.5	8.6	1	11.1%	Impaired	1.70
NW	1	01443440	PAULINS KILL AT BALESVILLE	FW2-TM	95-97	14	8.04	7.7	8.3	0	0.0%	Not Impaired	1.72
NW	1	01443500	PAULINS KILL AT BLAIRSTOWN	FW2-TM	95-97	14	8.13	8	8.3	0	0.0%	Not Impaired	0.97
NW	1	01445500	PEQUEST R AT PEQUEST	FW2-NT (C	95-97	14	8.24	7.9	8.5	1	7.1%	Not Impaired	1.26
NW	1	01455200	POHATCONG CK AT NEW VILLAGE	FW2-TM	95-97	13	8.08	7.6	9.2	3	23.1%	Impaired	5.67
NW	1	01456200	MUSCONETCONG R AT	FW2-TM	95-97	14	8.13	7.7	8.6	1	7.1%	Not Impaired	2.24
NW	1	01457000	MUSCONETCONG R NR	FW2-TM	95-97	14	8.26	7.7	8.8	3	21.4%	Impaired	11.34
NW	1	01457400	MUSCONETCONG R AT RIEGELSVILLE	FW2-TM	95-97	14	8.14	7.6	8.4	0	0.0%	Not Impaired	11.34
NW	2	01367770	WALKILL R NR SUSSEX	FW2-NT	95-97	16	7.83	6.73	8.3	0	0.0%	Not Impaired	0.83
NW	2	01367910	PAPAKATING CK AT SUSSEX	FW2-NT	95-97	14	7.74	7.3	8.2	0	0.0%	Not Impaired	0.79
NW	2	01368000	WALLKILL R NR UNIONVILLE	FW2-NT	95-97	14	7.72	7.1	8.1	0	0.0%	Not Impaired	2.44
NW	2	01368950	BLACK CREEK AT VERNON	FW2-NT	95-97	14	7.70	7.2	8.2	0	0.0%	Not Impaired	0.76
NW	11	01463620	ASSUNPINK CK NR CLARKSVILLE	FW2-NT	95-97	14	7.08	6.7	7.9	0	0.0%	Not Impaired	2.56
NW	11	01464000	ASSUNPINK CR AT TRENTON	FW2-NT	95-97	9	7.42	6.9	7.7	0	0.0%	Not Impaired	2.21
Rar	7	01393450	ELIZABETH R AT URSINO LK AT	FW2-NT	95-97	14	7.86	7.3	8.1	0	0.0%	Not Impaired	5.55
Rar	7	01394500	RAHWAY R NR SPRINGFIELD	FW2-NT	95-97	16	7.63	7	8.1	0	0.0%	Not Impaired	1.88
Rar	7	01395000	RAHWAY R AT RAHWAY	FW2-NT	95-97	14	7.85	7.2	8.4	0	0.0%	Not Impaired	2.72
Rar	8	01396280	SB RARITAN R AT MIDDLE VALLEY	FW2-TM	95-97	13	8.04	7.7	8.4	0	0.0%	Not Impaired	4.94
Rar	8	01396535	SB RARITAN R ARCH ST AT HIGH	FW2-TM-C	95-97	15	8.03	7.34	8.4	0	0.0%	Not Impaired	3.82
Rar	8	01396588	SPRUCE RUN NR GLEN GARDNER	FW2-TP	95-97	16	7.75	7.3	8.3	0	0.0%	Not Impaired	0.51
Rar	8	01396660	MULHOCKAWAY CK AT VAN SYCKEL	FW2-TP	95-97	16	7.76	7.08	8.2	0	0.0%	Not Impaired	0.23
Rar	8	01397000	SB RARITAN R AT STANTON STATION	FW2-TM	95-97	13	7.96	7.4	8.8	2	15.4%	Impaired	2.30
Rar	8	01397400	SB RARITAN R AT THREE BRIDGES	FW2-NT	95-97	14	7.86	7.6	8.3	0	0.0%	Not Impaired	0.79
Rar	8	01398000	NESHANIC R AT REAVILLE	FW2-NT	95-97	33	8.06	7	9.4	8	24.2%	Impaired	0.92
Rar	8	01398260	NB RARITAN R NR CHESTER	FW2-TP	95-97	14	7.78	7.6	8	0	0.0%	Not Impaired	1.46
Rar	8	01399120	NB RARITAN R AT BURNT MILLS	FW2-NT	95-97	14	8.14	7.8	8.5	1	7.1%	Not Impaired	1.07
Rar	8	01399500	LAMINGTON (BLACK)R NR	FW2-TP- C	95-97	16	7.78	7.33	8.2	0	0.0%	Not Impaired	1.71
Rar	8	01399700	ROCKAWAY CK AT WHITEHOUSE	FW2-NT	95-97	14	8.15	7.5	9.1	2	14.3%	Impaired	3.56
Rar	8	01399780	LAMINGTON R AT BURNT MILLS	FW2-NT	95-97	16	7.97	7.04	8.8	3	18.8%	Impaired	0.87
Rar	9	01400500	RARITAN R AT MANVILLE	FW2-NT	95-97	13	7.88	7.2	8.7	2	15.4%	Impaired	0.36
Rar	9	01403300	RARITAN R AT QUEENS BRIDGE,	FW2-NT	95-97	38	7.65	7.1	8.88	2	5.3%	Not Impaired	2.43
Rar	9	01405302	MATCHAPONIX BK AT SPOTSWOOD	FW2-NT	95-97	14	6.50	5.4	7.4	6	42.9%	Impaired	3.66
Rar	9	01405340	MANALAPAN BK NR MANALAPAN	FW2-NT	95-97	14	6.61	5.8	7.3	7	50.0%	Impaired	0.92
Rar	10	01400540	MILLSTONE R NR MANALAPAN	FW2-NT	95-97	13	6.76	6	8.1	4	30.8%	Impaired	5.09

Table A3.1.3-4: pH and TSS Attainment Status in NJ Rivers and Streams

Region	WMA	Station #	Station Name	SWQS Class	Years	pH-n	pH - Mean	pH - Min	pH - Max	pH-# exc	pH-% exc	pH Attainment	Length (miles)
Rar	10	01400650	MILLSTONE R AT GROVERS MILL	FW2-NT	95-97	8	6.86	6.5	7.2	1	12.5%	Impaired	4.25
Rar	10	01401000	STONY BROOK AT PRINCETON	FW2-NT	95-97	38	7.88	6.7	9.5	8	21.1%	Impaired	2.39
Rar	10	01401600	BEDEN BROOK NR ROCKY HILL	FW2-NT	95-97	16	7.69	7.3	8.2	0	0.0%	Not Impaired	2.39
Rar	10	01402000	MILLSTONE R AT BLACKWELLS MILLS	FW2-NT	95-97	14	7.34	6.8	8	0	0.0%	Not Impaired	0.39
	De-M	01438500	DELAWARE R AT MONTAGUE	1C	95-97	14	7.61	6.9	8.4	0	0.0%	NA	0.82
	De-M	01443000	DELAWARE R AT PORTLAND PA	1D	95-97	14	7.65	7.2	8.1	0	0.0%	NA	1.62
	De-M	01447000	DELAWARE R AT EASTON PA	1D	95-97	14	7.82	7.6	8.1	0	0.0%	NA	10.88
	De-M	01461000	DELAWARE R AT LUMBERVILLE PA	1E	95-97	14	8.00	7.6	8.4	0	0.0%	NA	6.41
	De-M	01463500	DELAWARE R AT TRENTON	1E	95-97	14	8.07	7.5	9.2	2	14.3%	NA	5.74
Notes:													
Region:													
Atl: Atlantic Region, WMAs 12, 13, 14, 15, 16													
L-De: Lower Delaware Region, WMAs 17, 18, 19, 20													
NE: Northeast Region, WMAs 03, 04, 05, 06													
NW: Northwest Region, WMAs 01, 02, 11													
Rar: Raritan Region, WMAs 07, 08, 09, 10													
Station Number: Ambient Stream Monitoring Network Station Number													
Station Name: Ambient Stream Monitoring Network Station Name													
n : number of samples collected in the ASMN between 1995 and 1997													
mean (mg/l): average (mean) concentration in mg/l (or ppm) or average pH measurement													
# exc: number of samples exceeding applicable SWQS criteria													

Table A3.1.3-4: pH and TSS Attainment Status in NJ Rivers and Streams

Region	WMA	Station #	Station Name	SWQS Class	Years	TSS-n	TSS-mean	TSS-Max	TSS-# exc	TSS- % exc	TSS Attainment	Length (miles)
Atl	12	01408000	MANASQUAN R AT SQUANKUM	FW2-TM	95-97	0		NA			Not Assessed	0.52
Atl	13	01408500	TOMS R NR TOMS RIVER	FW2-NT	95-97	2	4.0	NA	0		Not Assessed	4.36
Atl	14	01409387	MULLICA R AT ATSION LAKE	PL	95-97	0		NA			Not Assessed	0.11
Atl	14	01409416	HAMMONTON CK WESCOATSVILLE	PL	95-97	0		NA			Not Assessed	1.56
Atl	14	01409500	BATSTO R AT BATSTO	PL	95-97	0		NA			Not Assessed	0.69
Atl	14	01410000	OSWEGO R AT HARRISVILLE	PL	95-97	0		NA			Not Assessed	0.27
Atl	14	01410150	EAST BR BASS R NR NEW GRETNA	PL	95-97	0		NA			Not Assessed	0.97
Atl	15	01410784	GREAT EGG HARBOR R NR	PL	95-97	41	4.9	NA	0	0.0%	Not Impaired	0.96
Atl	15	01411000	GREAT EGG HARBOR R AT FOLSOM	PL	95-97	0		NA			Not Assessed	4.30
Atl	15	01411110	GREAT EGG HARBOR R AT	PL	95-97	2	6.5	NA	0		Not Assessed	0.52
L-De	17	01411500	MAURICE R AT NORMA	FW2-NT	95-97	6	4.2	NA	0	0.0%	Not Assessed	1.22
L-De	17	01412800	COHANSEY R AT SEELEY	FW2-NT	95-97	1	6.0	NA	0		Not Assessed	0.57
L-De	17	01482500	SALEM R AT WOODSTOWN	FW2-NT	95-97	0		NA			Not Assessed	0.32
L-De	18	01467069	NB PENNSAUKEN CK NR	FW2-NT	95-97	0		NA			Not Assessed	2.82
L-De	18	01467081	SB PENNSAUKEN CK AT CHERRY HILL	FW2-NT	95-97	0		NA			Not Assessed	7.17
L-De	18	01467150	COOPER R AT HADDONFIELD	FW2-NT	95-97	0		NA			Not Assessed	0.35
L-De	18	01467329	SB BIG TIMBER CK AT BLACKWOOD	FW2-NT	95-97	4	19.8	NA	0		Not Assessed	1.02
L-De	18	01477120	RACCOON CK NR SWEDESBORO	FW2-NT	95-97	0		NA			Not Assessed	1.02
L-De	18	01477510	OLDMANS CK AT PORCHES MILL	FW2-NT	95-97	0		NA			Not Assessed	0.17
L-De	19	01465850	SB RANCOCAS CK AT VINCENTOWN	FW2-NT	95-97	0		NA			Not Assessed	3.77
L-De	19	01466500	MCDONALDS BR IN LEBANON	PL	95-97	7	5.4	NA	0	0.0%	Not Assessed	0.39
L-De	19	01467000	NB RANCOCAS CK AT PEMBERTON	FW2-NT	95-97	0		NA			Not Assessed	1.53
L-De	20	01464500	CROSSWICKS CK AT EXTONVILLE	FW2-NT	95-97	0		NA			Not Assessed	3.92
L-De	20	01464515	DOCTORS CK AT ALLENTOWN	FW2-NT	95-97	1	8.0	NA	0		Not Assessed	0.98
NE	3	01382500	PEQUANNOCK R AT MACOPIN INTAKE	FW2-TM	95-97	1	5.0	NA	0		Not Assessed	0.42
NE	3	01387500	RAMAPO R NR MAHWAH	FW2-NT	95-97	2	8.0	NA	0		Not Assessed	0.82
NE	3	01388600	POMPTON R AT PACKANACK LK	FW2-NT	95-97	4	3.0	NA	0		Not Assessed	1.53
NE	4	01389500	PASSAIC R AT LITTLE FALLS	FW2-NT	95-97	0		NA			Not Assessed	0.44
NE	4	01389880	PASSAIC R AT ELMWOOD PK	FW2-NT	95-97	0		NA			Not Assessed	10.13
NE	4	01391500	SADDLE R AT LODI	FW2-NT	95-97	2	9.0	NA	0		Not Assessed	3.51
NE	5	01377000	HACKENSACK R AT RIVERVALE	FW2-NT	95-97	3	28.0	NA	1		Not Assessed	4.77
NE	6	01379000	PASSAIC R NR MILLINGTON	FW2-NT	95-97	2	32.5	NA	1		Not Assessed	2.95
NE	6	01379500	PASSAIC R NR CATHAM	FW2-NT	95-97	3	21.3	NA	0		Not Assessed	4.46
NE	6	01380500	ROCKAWAY R AT BOONTON	FW2-NT	95-97	2	3.5	NA	0		Not Assessed	1.70
NE	6	01381200	ROCKAWAY R AT PINE BROOK	FW2-NT	95-97	1	9.0	NA	0		Not Assessed	1.48
NE	6	01381500	WHIPPANY R AT MORRISTOWN	FW2-NT	95-97	4	23.8	NA	1		Not Assessed	2.61

Table A3.1.3-4: pH and TSS Attainment Status in NJ Rivers and Streams

Region	WMA	Station #	Station Name	SWQS Class	Years	TSS-n	TSS-mean	TSS-Max	TSS-# exc	TSS- % exc	TSS Attainment	Length (miles)
NE	6	01381800	WHIPPANY R NR PINEBROOK	FW2-NT	95-97	2	34.5	NA	0		Not Assessed	0.73
NE	6	01382000	PASSAIC R AT TWO BRIDGES	FW2-NT	95-97	18	47.3	NA	1	5.6%	Not Impaired	0.13
NW	1	01440000	BIG FLATBROOK AT	FW2-TM	95-97	0		NA			Not Assessed	1.70
NW	1	01443440	PAULINS KILL AT BALESVILLE	FW2-TM	95-97	0		NA			Not Assessed	1.72
NW	1	01443500	PAULINS KILL AT BLAIRSTOWN	FW2-TM	95-97	0		NA			Not Assessed	0.97
NW	1	01445500	PEQUEST R AT PEQUEST	FW2-NT (C	95-97	0		NA			Not Assessed	1.26
NW	1	01455200	POHATCONG CK AT NEW VILLAGE	FW2-TM	95-97	0		NA			Not Assessed	5.67
NW	1	01456200	MUSCONETCONG R AT	FW2-TM	95-97	0		NA			Not Assessed	2.24
NW	1	01457000	MUSCONETCONG R NR	FW2-TM	95-97	0		NA			Not Assessed	11.34
NW	1	01457400	MUSCONETCONG R AT RIEGELSVILLE	FW2-TM	95-97	0		NA			Not Assessed	11.34
NW	2	01367770	WALKILL R NR SUSSEX	FW2-NT	95-97	1	24.0	NA	0		Not Assessed	0.83
NW	2	01367910	PAPAKATING CK AT SUSSEX	FW2-NT	95-97	0		NA			Not Assessed	0.79
NW	2	01368000	WALLKILL R NR UNIONVILLE	FW2-NT	95-97	0		NA			Not Assessed	2.44
NW	2	01368950	BLACK CREEK AT VERNON	FW2-NT	95-97	14	7.6	NA	0	0.0%	Not Impaired	0.76
NW	11	01463620	ASSUNPINK CK NR CLARKSVILLE	FW2-NT	95-97	0		NA			Not Assessed	2.56
NW	11	01464000	ASSUNPINK CR AT TRENTON	FW2-NT	95-97	0		NA			Not Assessed	2.21
Rar	7	01393450	ELIZABETH R AT URSINO LK AT	FW2-NT	95-97	0		NA			Not Assessed	5.55
Rar	7	01394500	RAHWAY R NR SPRINGFIELD	FW2-NT	95-97	2	10.5	NA	0		Not Assessed	1.88
Rar	7	01395000	RAHWAY R AT RAHWAY	FW2-NT	95-97	2	27.0	NA	0		Not Assessed	2.72
Rar	8	01396280	SB RARITAN R AT MIDDLE VALLEY	FW2-TM	95-97	0		NA			Not Assessed	4.94
Rar	8	01396535	SB RARITAN R ARCH ST AT HIGH	FW2-TM-C	95-97	1	8.0	NA	0		Not Assessed	3.82
Rar	8	01396588	SPRUCE RUN NR GLEN GARDNER	FW2-TP	95-97	1	9.0	NA	0		Not Assessed	0.51
Rar	8	01396660	MULHOCKAWAY CK AT VAN SYCKEL	FW2-TP	95-97	1	2.0	NA	0		Not Assessed	0.23
Rar	8	01397000	SB RARITAN R AT STANTON STATION	FW2-TM	95-97	0		NA			Not Assessed	2.30
Rar	8	01397400	SB RARITAN R AT THREE BRIDGES	FW2-NT	95-97	0		NA			Not Assessed	0.79
Rar	8	01398000	NESHANIC R AT REAVILLE	FW2-NT	95-97	19	46.6	NA	3	15.8%	Impaired	0.92
Rar	8	01398260	NB RARITAN R NR CHESTER	FW2-TP	95-97	0		NA			Not Assessed	1.46
Rar	8	01399120	NB RARITAN R AT BURNT MILLS	FW2-NT	95-97	0		NA			Not Assessed	1.07
Rar	8	01399500	LAMINGTON (BLACK)R NR	FW2-TP- C	95-97	1	7.0	NA	0		Not Assessed	1.71
Rar	8	01399700	ROCKAWAY CK AT WHITEHOUSE	FW2-NT	95-97	0		NA			Not Assessed	3.56
Rar	8	01399780	LAMINGTON R AT BURNT MILLS	FW2-NT	95-97	1	7.0	NA	0		Not Assessed	0.87
Rar	9	01400500	RARITAN R AT MANVILLE	FW2-NT	95-97	0		NA			Not Assessed	0.36
Rar	9	01403300	RARITAN R AT QUEENS BRIDGE,	FW2-NT	95-97	26	58.6	NA	7	26.9%	Impaired	2.43
Rar	9	01405302	MATCHAPONIX BK AT SPOTSWOOD	FW2-NT	95-97	0		NA			Not Assessed	3.66
Rar	9	01405340	MANALAPAN BK NR MANALAPAN	FW2-NT	95-97	0		NA			Not Assessed	0.92
Rar	10	01400540	MILLSTONE R NR MANALAPAN	FW2-NT	95-97	0		NA			Not Assessed	5.09

Table A3.1.3-4: pH and TSS Attainment Status in NJ Rivers and Streams

Region	WMA	Station #	Station Name	SWQS Class	Years	TSS-n	TSS-mean	TSS-Max	TSS-# exc	TSS- % exc	TSS Attainment	Length (miles)
Rar	10	01400650	MILLSTONE R AT GROVERS MILL	FW2-NT	95-97	0		NA			Not Assessed	4.25
Rar	10	01401000	STONY BROOK AT PRINCETON	FW2-NT	95-97	22	53.2	NA	5	22.7%	Impaired	2.39
Rar	10	01401600	BEDEN BROOK NR ROCKY HILL	FW2-NT	95-97	1	4.0	NA	0		Not Assessed	2.39
Rar	10	01402000	MILLSTONE R AT BLACKWELLS MILLS	FW2-NT	95-97	0		NA			Not Assessed	0.39
	De-M	01438500	DELAWARE R AT MONTAGUE	1C	95-97	0		NA			Not Assessed	0.82
	De-M	01443000	DELAWARE R AT PORTLAND PA	1D	95-97	0		NA			Not Assessed	1.62
	De-M	01447000	DELAWARE R AT EASTON PA	1D	95-97	0		NA			Not Assessed	10.88
	De-M	01461000	DELAWARE R AT LUMBERVILLE PA	1E	95-97	0		NA			Not Assessed	6.41
	De-M	01463500	DELAWARE R AT TRENTON	1E	95-97	4	5.5	NA			Not Assessed	5.74
Notes:												
Region:												
Atl: Atlantic Region, WMAs 12, 13, 14, 15, 16												
L-De: Lower Delaware Region, WMAs 17, 18, 19, 20												
NE: Northeast Region, WMAs 03, 04, 05, 06												
NW: Northwest Region, WMAs 01, 02, 11												
Rar: Raritan Region, WMAs 07, 08, 09, 10												
Station Number: Ambient Stream Monitoring Network Station Number												
Station Name: Ambient Stream Monitoring Network Station Name												
n : number of samples collected in the ASMN between 1995 and 1997												
mean (mg/l): average (mean) concentration in mg/l (or ppm) or average pH measuremer												
# exc: number of samples exceeding applicable SWQS criteria												

Table A3.3.2-1: Fecal Coliform Attainment Status in NJ Rivers and Streams (1995-97)

Region	WMA	Station #	Station Name	FC-#	FC-geomean	FC-# exc 400 MPN/100 ml	FC-% exc 400 MPN/ 100 ml	Trend (no Q)	Trend (FC/yr)	Trend (Q adj)	Trend (FC/ yr)	FC SWQS Attainment	Length (miles)
Atl	12	01408000	MANASQUAN R AT SQUANKUM	13	228.4	4	30.8%	NSIG		NT		None	0.52
Atl	13	01408500	TOMS R NR TOMS RIVER	14	21.2	1	7.1%	NT		NT		Full	4.36
Atl	14	01409387	MULLICA R AT ATSION LAKE	14	11.0	0	0.0%	NSIG		NT		Full	1.26
Atl	14	01409416	HAMMONTON CK WESCOATSVILLE	13	38.8	2	15.4%	NSIG		NT		Partial	1.56
Atl	14	01409500	BATSTO R AT BATSTO	14	14.6	0	0.0%	NSIG		NT		Full	0.69
Atl	14	01410000	OSWEGO R AT HARRISVILLE	4	10.0	0	0.0%	NT		NT		Full	0.27
Atl	14	01410150	EAST BR BASS R NR NEW GRETNA	13	21.7	0	0.0%	UP	1.3	NT		Full	0.97
Atl	15	01410784	GREAT EGG HARBOR R NR	13	18.9	1	7.7%	NSIG		NSIG		Full	0.96
Atl	15	01411000	GREAT EGG HARBOR R AT FOLSOM-	14	15.1	0	0.0%	DOWN	-23	NT		Full	4.30
Atl	15	01411110	GREAT EGG HARBOR R AT	13	19.2	2	15.4%	NSIG		NT		Partial	0.52
L-De	17	01411500	MAURICE R AT NORMA	13	14.0	0	0.0%	NT		NT		Full	1.22
L-De	17	01412800	COHANSEY R AT SEELEY	13	74.3	3	23.1%	NSIG		NSIG		Partial	0.57
L-De	17	01482500	SALEM R AT WOODSTOWN	12	285.1	5	41.7%	NSIG		NT		None	0.32
L-De	18	01467069	NB PENNSAUKEN CK NR	14	231.6	5	35.7%	DOWN	-400	NT		None	2.82
L-De	18	01467081	SB PENNSAUKEN CK AT CHERRY HILL	14	2261.7	12	85.7%	NSIG		NSIG		None	7.17
L-De	18	01467150	COOPER R AT HADDONFIELD	13	630.2	8	61.5%	NSIG		NSIG		None	0.35
L-De	18	01467329	SB BIG TIMBER CK AT BLACKWOOD	13	237.9	5	38.5%	NSIG		NSIG		None	1.02
L-De	18	01477120	RACCOON CK NR SWEDESBORO	13	297.6	5	38.5%	NSIG		NSIG		None	1.02
L-De	18	01477510	OLDMANS CK AT PORCHES MILL	13	195.4	4	30.8%	DOWN	-35	NT		Partial	0.17
L-De	19	01465850	SB RANCOCAS CK AT VINCENTOWN	14	30.1	1	7.1%	DOWN	-100	NT		Full	3.77
L-De	19	01466500	MCDONALDS BR IN LEBANON FOREST	7	3.8	0	0.0%	NT		NT		Full	0.39
L-De	19	01467000	NB RANCOCAS CK AT PEMBERTON	13	8.4	1	7.7%	DOWN	-19	NT		Full	1.53
L-De	20	01464500	CROSSWICKS CK AT EXTONVILLE	13	245.2	4	30.8%	NSIG		NSIG		None	3.92
L-De	20	01464515	DOCTORS CK AT ALLENTOWN	13	353.2	7	53.8%	DOWN	-260	DOWN	-250	None	0.98
NE	3	01382500	PEQUANNOCK R AT MACOPIN INTAKE	14	12.9	0	0.0%	DOWN	-5.7	NT		Full	0.42
NE	3	01387500	RAMAPO R NR MAHWAH	14	395.8	8	57.1%	NSIG		NT		None	0.82
NE	3	01388600	POMPTON R AT PACKANACK LK	14	146.3	3	21.4%	NSIG		NT		Partial	1.53
NE	4	01389500	PASSAIC R AT LITTLE FALLS	0	NA	NA	NA	NT		NT		NA	0.44
NE	4	01389880	PASSAIC R AT ELMWOOD PK	14	1034.5	9	64.3%	NSIG		NT		None	10.13
NE	4	01391500	SADDLE R AT LODI	14	2911.9	12	85.7%	NSIG		NT		None	3.51
NE	5	01377000	HACKENSACK R AT RIVERVALE	13	262.6	5	38.5%	NSIG		NSIG		None	4.77
NE	6	01379000	PASSAIC R NR MILLINGTON	14	155.0	4	28.6%	NSIG		NT		Partial	2.95
NE	6	01379500	PASSAIC R NR CATHAM	13	618.4	7	53.8%	NSIG		NSIG		None	4.46

Table A3.3.2-1: Fecal Coliform Attainment Status in NJ Rivers and Streams (1995-97)

Region	WMA	Station #	Station Name	FC-#	FC-geomean	FC-# exc 400 MPN/100 ml	FC-% exc 400 MPN/ 100 ml	Trend (no Q)	Trend (FC/yr)	Trend (Q adj)	Trend (FC/ yr)	FC SWQS Attainment	Length (miles)
NE	6	01380500	ROCKAWAY R AT BOONTON	13	121.6	1	7.7%	NSIG		NSIG		Full	1.70
NE	6	01381200	ROCKAWAY R AT PINE BROOK	14	269.5	4	28.6%	NSIG		NT		None	1.48
NE	6	01381500	WHIPPANY R AT MORRISTOWN	13	1138.3	10	76.9%	NSIG		NT		None	2.61
NE	6	01381800	WHIPPANY R NR PINEBROOK	13	963.9	10	76.9%	NSIG		NT		None	0.73
NE	6	01382000	PASSAIC R AT TWO BRIDGES	14	179.7	3	21.4%	NSIG		NT		Partial	0.13
NW	1	01440000	BIG FLATBROOK AT FLATBROOKVILLE	9	17.0	0	0.0%	NSIG		NT		Full	1.70
NW	1	01443440	PAULINS KILL AT BALESVILLE	14	279.4	5	35.7%	NSIG		NSIG		None	1.72
NW	1	01443500	PAULINS KILL AT BLAIRSTOWN	14	96.6	4	28.6%	NSIG		NT		Partial	0.97
NW	1	01445500	PEQUEST R AT PEQUEST	14	335.3	4	28.6%	NSIG		UP	45	None	1.26
NW	1	01455200	POHATCONG CK AT NEW VILLAGE	14	700.8	10	71.4%	NSIG		NSIG		None	5.67
NW	1	01456200	MUSCONETCONG R AT	14	124.9	2	14.3%	NSIG		NT		Partial	2.24
NW	1	01457000	MUSCONETCONG R NR BLOOMSBURY	14	296.7	6	42.9%	NSIG		NSIG		None	11.34
NW	1	01457400	MUSCONETCONG R AT RIEGELSVILLE	14	283.9	6	42.9%	NSIG		NSIG		None	11.34
NW	2	01367770	WALKILL R NR SUSSEX	14	398.3	7	50.0%	NSIG		NSIG		None	0.83
NW	2	01367910	PAPAKATING CK AT SUSSEX	14	1030.2	9	64.3%	NSIG		NSIG		None	0.79
NW	2	01368000	WALLKILL R NR UNIONVILLE	14	436.5	7	50.0%	NSIG		NSIG		None	2.44
NW	2	01368950	BLACK CR NR VERNON	14	482.0	7	50.0%	NSIG		NSIG		None	0.76
NW	11	01463620	ASSUNPINK CK NR CLARKSVILLE	14	57.0	1	7.1%	NSIG		NT		Full	2.56
NW	11	01464000	ASSUNPINK CR AT TRENTON	9	2002.4	8	88.9%	UP	870	NT		None	2.21
Rar	7	01393450	ELIZABETH R AT URSINO LK	14	2508.8	12	85.7%	DOWN	-4700	DOWN	-3400	None	5.55
Rar	7	01394500	RAHWAY R NR SPRINGFIELD	14	1951.9	12	85.7%	NSIG		NSIG		None	1.88
Rar	7	01395000	RAHWAY R AT RAHWAY	14	1048.4	10	71.4%	NSIG		NT		None	2.72
Rar	8	01396280	SB RARITAN R AT MIDDLE VALLEY	14	257.4	6	42.9%	NSIG		NT		None	4.94
Rar	8	01396535	SB RARITAN R ARCH ST AT HIGH	14	261.6	6	42.9%	NSIG		NSIG		None	3.82
Rar	8	01396588	SPRUCE RUN NR GLEN GARDNER	14	199.2	6	42.9%	NSIG		NT		Partial	0.51
Rar	8	01396660	MULHOCKAWAY CK AT VAN SYCKEL	14	240.2	6	42.9%	NSIG		NT		None	0.23
Rar	8	01397000	SB RARITAN R AT STANTON STATION	13	134.4	3	23.1%	NSIG		NT		Partial	2.30
Rar	8	01397400	SB RARITAN R AT THREE BRIDGES	14	260.0	4	28.6%	NSIG		NT		None	0.79
Rar	8	01398000	NESHANIC R AT REAVILLE	14	473.3	9	64.3%	NSIG		NSIG		None	0.92
Rar	8	01398260	NB RARITAN R NR CHESTER	14	106.9	2	14.3%	DOWN	-210	NT		Partial	1.46
Rar	8	01399120	NB RARITAN R AT BURNT MILLS	14	179.5	6	42.9%	NSIG		NSIG		Partial	1.07
Rar	8	01399500	LAMINGTON (BLACK)R NR	14	89.1	3	21.4%	NSIG		NT		Partial	1.71
Rar	8	01399700	ROCKAWAY CK AT WHITEHOUSE	14	229.5	7	50.0%	NSIG		NT		None	3.56

Table A3.3.2-1: Fecal Coliform Attainment Status in NJ Rivers and Streams (1995-97)

Region	WMA	Station #	Station Name	FC-#	FC-geomean	FC-# exc 400 MPN/100 ml	FC-% exc 400 MPN/ 100 ml	Trend (no Q)	Trend (FC/yr)	Trend (Q adj)	Trend (FC/ yr)	FC SWQS Attainment	Length (miles)
Rar	8	01399780	LAMINGTON R AT BURNT MILLS	14	308.5	6	42.9%	NSIG		NSIG		None	0.87
Rar	9	01400500	RARITAN R AT MANVILLE	14	216.3	4	28.6%	NSIG		NT		None	0.36
Rar	9	01403300	RARITAN R AT QUEENS BRIDGE	13	226.8	4	30.8%	NT		NT		None	2.43
Rar	9	01405302	MATCHAPONIX BK AT SPOTSWOOD	14	45.1	1	7.1%	NSIG		NT		Full	3.66
Rar	9	01405340	MANALAPAN BK NR MANALAPAN	14	57.4	3	21.4%	NSIG		NT		Partial	0.92
Rar	10	01400540	MILLSTONE R NR MANALAPAN	14	122.3	5	35.7%	NSIG		NT		Partial	5.09
Rar	10	01400650	MILLSTONE R AT GROVERS MILL	9	72.5	2	22.2%	NSIG		NT		Partial	4.25
Rar	10	01401000	STONY BROOK AT PRINCETON	14	290.5	6	42.9%	NSIG		NT		None	2.39
Rar	10	01401600	BEDEN BROOK NR ROCKY HILL	14	622.7	8	57.1%	NSIG		NT		None	2.39
Rar	10	01402000	MILLSTONE R AT BLACKWELLS MILLS	14	243.7	6	42.9%	NSIG		NSIG		None	0.39
	De-M	01438500	DELAWARE R AT MONTAGUE	13	15.1	0	0.0%	NSIG		NT		NA	0.82
	De-M	01443000	DELAWARE R AT PORTLAND PA	13	17.4	0	0.0%	NSIG		NT		NA	1.62
	De-M	01447000	DELAWARE R AT EASTON PA	13	55.8	2	15.4%	NSIG		NT		NA	10.88
	De-M	01461000	DELAWARE R AT LUMBERVILLE PA	13	58.6	2	15.4%	DOWN	-34	NT		NA	6.41
	De-M	01463500	DELAWARE R AT TRENTON	13	26.6	1	7.7%	NT		NT		NA	5.74

Notes:

Region:

Atl: Atlantic Region, WMAs 12, 13, 14, 15, 16

L-De: Lower Delaware Region, WMAs 17, 18, 19, 20

NE: Northeast Region, WMAs 03, 04, 05, 06

NW: Northwest Region, WMAs 01, 02, 11

Rar: Raritan Region, WMAs 07, 08, 09, 10

Station Number: Ambient Stream Monitoring Network Station Number

Station Name: Ambient Stream Monitoring Network Station Name

FC # : number of samples collected in the ASMN between 1995 and 1997

geomean: geometric average (geomean) concentration in FC/ 100 ml

exc: number of samples exceeding applicable SWQS criteria

Trend - no Q: trends without flow adjustment (NSIG- not significant, NT- not tested, UP - increasing concentration, DOWN- decreasing concentration)

Trend - mg/l/yr: annual change in concentration

Trend (Q-adj): trends with flow adjustment

Table A3.3.3-1. Fecal Coliform in the Passaic River Above and Below Patterson CSOs (1991-94)

Station ID	DATES	Fecal Coliform		Station ID	DATES	Fecal Coliform	
Little Falls- Upstream				**Elmwood Park- Downstream**		**MPN**	
01389500	19901108			01389880	19910725	24000	
01389500	19910114			01389880	19911030	5400	
01389500	19910322			01389880	19920115	700	
01389500	19910509			01389880	19920325	1600	
01389500	19910724	1700		01389880	19920528	24000	
01389500	19910905			01389880	19920723	24000	
01389500	19911030	130		01389880	19921029	2100	
01389500	19911120			01389880	19930208	490	
01389500	19920122	1300		01389880	19930324	17000	
01389500	19920527	490		01389880	19930527	1300	
01389500	19920722	140		01389880	19930721	35000	
01389500	19920917			01389880	19931021	92000	
01389500	19921029	50		01389880	19940224	9200	
01389500	19921119			01389880	19940317	28000	
01389500	19930128	130		01389880	19940525	230	
01389500	19930325	80		01389880	19940718	4900	
01389500	19930527	110		01389880	19941101	11000	
01389500	19930719				**Geomean**	**6051.1**	
01389500	19930819						
01389500	19931021	1600					
01389500	19940208						
01389500	19940224	350					
01389500	19940317	1100					
01389500	19940510						
01389500	19940523	180					
01389500	19940721	1600					
01389500	19940906						
	Geomean	**332.3**					

TABLE A3.4-1 Potable Surface Water Supply Intakes in New Jersey

SITE-ID	FACID NAME	SYSTEM NAME	SOURCE NAME	TYPE	AVAILABILITY
1	Haworth WTP	United Water NJ	Oradell Reservoir	public community	permanent
2	Haworth WTP	United Water NJ	Oradell Reservoir	public community	permanent
3	Haworth WTP	United Water NJ	Oradell Reservoir	public community	permanent
4	Haworth WTP	United Water NJ	Oradell Reservoir	public community	permanent
5	Pequannock WTP	Newark Water Dept	Charlottesburg Reservoir	public community	permanent
6	Beech Street & Bally WTP	Orange Water Dept	West Branch Raritan River	public community	permanent
7	Wanaque WTP	N.J.D.W.S.C. Wanaque No.	Wanaque Reservoir	public community	permanent
8	Little Falls WTP	Passaic Valley W Comm	Stanley Levine Reservoir	public community	permanent
9	Little Falls WTP	Passaic Valley W Comm	Point View Reservoir	public community	permanent
10	Little Falls WTP	Passaic Valley Water Comm	Passaic River	public community	permanent
11	Little Falls WTP	Passaic Valley W Comm	Great Notch Reservoir	public community	permanent
12	Little Falls WTP	Passaic Valley W Comm	New Street Reservoir	public community	permanent
13	Morris Lake WTP	Franklin Board Of Public	Wallkill River	public community	emergency
14	Reservoir WTP	Branchville W Dept	Dry Brook Reservoir	public community	emergency
15	Morris Lake WTP	Newton Water & Sewer Uti	Lake Morris	public community	permanent
16	Surface WTP	Hackettstown MUA	Lower Mine Hill Reservoir	public community	permanent
17	Surface WTP	Hackettstown MUA	Burd Reservoir	public community	permanent
18	Colesville WTP	Sussex W Dept	Colesville Reservoir/Lake Rute	public community	permanent
19	Clyde Potts Res. WTP	Southeast Morris County	Clyde Potts Reservoir	public community	unspecified
20	Taylortown Road WTP	Boonton Water Dept	Taylortown Reservoir	public community	permanent
21	Kakeout WTP	Butler Water Dept	Kakeout Reservoir	public community	permanent
22	Canoe Brook WT Plant #2	NJ American W Co Short H	Canoe Brook	public community	permanent
23	Bordentown WTP	Sayreville W Dept	South River	public community	permanent
24	Canoe Brook WT Plant #2	NJ American W Co Short H	Passaic River	public community	permanent
25	Bordentown WTP	Sayreville W Dept	South River	public community	permanent
26	William Miller Central WT	Brick Township Mua	Metedeconk River	public community	permanent
27	Manasquan WTP	NJ Water Supply Auth Man	Manasquan Reservoir	public community	permanent
28	Matchaponix WSCTP	United Water-Matchaponix	Matchaponix Brook	public community	permanent
29	Main WTP	U S Army Fort Dix	Rancocas Creek	public community	permanent
30	Jumping Brook WTP	NJ American W Co Monmout	Glendola Reservoir	public community	permanent
31	Jumping Brook WTP	NJ American W Co Monmout	Jumping Brook	public community	permanent
32	Swimming River WTP	NJ American W Co Monmout	Swimming River	public community	permanent
33	Jumping Brook TP	NJ American W Co Monmout	Shark River	public community	permanent
34	Howell Twp. Mun. WTP	Howell Twp. Dept. Of S &	Manasquan Reservoir	public community	permanent
35	Surface Water Treat Plant	Middlesex W Co	Delaware Raritan Canal	public community	permanent
36	Comstock Street WTP	New Brunswick W Dept	Delaware Raritan Canal	public community	permanent

TABLE A3.4-1 Potable Surface Water Supply Intakes in New Jersey

SITE-ID	FACID NAME	SYSTEM NAME	SOURCE NAME	TYPE	AVAILABILITY
37	Manasquan WTP	NJ Water Supply Auth Man	Manasquan Reservoir	public community	permanent
38	Surface WTP	Rahway W Dept	Rahway River	public community	permanent
39	Water Treatment Plant	Salem W Dept	Laurel Lake	public community	permanent
40	Water Treatment Plant	Salem W Dept	Laurel Lake	public community	permanent
41	Water Treatment Plant	North Brunswick W Dept	Delaware Raritan Canal	public community	permanent
42	Raritan-Millstone WTP	Elizabethtown Water Co	Millstone/Raritan Riv, D&R Can	public community	permanent
43	Raritan-Millstone WTP	Elizabethtown Water Co	Millstone/Raritan Riv, D&R Can	public community	permanent
44	Raritan-Millstone WTP	Elizabethtown Water Co	Millstone/Raritan Riv, D&R Can	public community	permanent
45	Raritan-Millstone WTP	Elizabethtown Water Co	Millstone/Raritan Riv, D&R Can	public community	permanent
46	Raritan-Millstone WTP	Elizabethtown Water Co	Millstone/Raritan Riv, D&R Can	public community	permanent
47	Raritan-Millstone WTP	Elizabethtown Water Co	Millstone/Raritan Riv, D&R Can	public community	permanent
48	Route 29 WTP	Trenton Water Department	Delaware River	public community	permanent
49	Pearl Street WTP	Burlington City Water De	Delaware River	public community	permanent
50	Tri-County WTP	NJ American W Co Delawar	Delaware River	public community	permanent
51	1141 North Main	Atlantic City MUA	Doughty Reservoir	public community	permanent
52	Route 518 WTP	United Water Lambertville	Swan Creek Reservoir	public community	permanent
53	Jersey City Res. WTP	Dept Of Water Jersey Cit	Boonton Reservoir	public community	permanent
54	Haledon WTP	Haledon Water Dept	Molly Ann's Brook Reservoir	public community	permanent

RESERVOIR NAME	ACRES
Lake Rutherford	62.0
Branchville	9.7
Monksville	494.2
Canistear	310.5
Wanaque	2371.1
Franklin Pond	36.5
Clinton	415.8
Oak Ridge	455.0
Echo Lake	274.7
Oak Ridge	4.2
Morris Lake	140.5
Lake Tappan	661.8
Charlotteburg	328.6
Woodcliff Lake	121.2
Macopin Intake	10.4
Western	2.8
Pompton Lakes	185.3
Longwood Valley	2151.5
Split Rock	555.2
Butler-Kakeout	172.6
Haledon	13.7
Haledon	71.9
Oradell	106.9
Oradell	617.0
Point View	415.2
Haledon	4.4
Boonton-Taylortown	79.7
Picatinny Lake	109.0
Longwood Valley	96.8
Grand Street	7.4
Pulaski	320.7
New Street	11.4
Boonton	785.5
Great Notch	30.5
Cedar Grove	87.1
Minehill	5.2
Minehill	3.2
Burd	1.1
Washington Valley	744.4
Clyde Potts	52.7
Buckhorn Creek	0.3
Livingston (Res. N0.3 [)	159.7
Orange	61.2
Roaring Rock Creek	1.7
Roaring Rock Creek	0.2
Reservoir No.2	10.9
Canoe Brook No. 1	202.9
Canoe Brook No. 2	76.7
Merrill Creek	677.6
Spruce Run	1336.3

Round Valley	2219.6
Robinson'S Branch	124.2
Lawrence Brook	216.7
Runyon Pond	46.4
Reservoir No. 2	30.0
Reservoir No. 1	2.9
Swimming River	612.8
Trenton	14.9
Glendola	116.3
Elkinton Lake	28.3
Laurel Lake	23.7
Doughty Pond	157.1
Kuehnle Pond	124.5
Manasquan	1261.2

Table A3.4.4-1: Maximum NO3 Concentrations (1995-97) and NO3 Trends (1986-95)

Region	WMA	Station Number	Station Name	NO3-n (1995-1997)	NO3-mean (mg/l)	NO3 Max mg/l	NO3-# exc	NO3- % exc	Trend (No Q)	Trend - mg/l/yr (NoQ)	Trend (Q-Adj)	Trend - mg/l/yr (Q-adj)	Overall trend
Atl	12	1408000	Manasquan R @ Squankum on Rt 547	13	0.512	0.79	0	0.0%	DOWN	-0.027	NSIG		DOWN
Atl	13	1408500	Toms River Near Toms River	15	0.468	0.77	0	0.0%	UP	0.030	UP	0.017	UP
Atl	14	1409387	Mullica R @ Outlet of Atison LK @ Atison	13	0.106	0.21	0	0.0%	NSIG		NT		NSIG
Atl	14	1409416	Hammonton Creek @ Wescoatville	13	1.297	2.30	1	7.7%	UP	0.130	UP	0.130	UP
Atl	14	1409500	Batsto River @ Batsto	14	0.126	0.33	0	0.0%	UP	0.018	NT		UP
Atl	14	1410150	East Branch Bass River Near New Gretna	13	0.039	0.07	0	0.0%	NSIG		NT		NSIG
Atl	14	1410000	Oswego R at Harrisville	4	0.185	0.60	0	0.0%					
Atl	15	1410784	Great Egg Harbor R Near Sicklerville	52	0.372	0.78	0	0.0%	DOWN	-0.093	DOWN	-0.100	DOWN
Atl	15	1411000	Great Egg Harbor River @ Folsom	14	0.506	0.79	0	0.0%	DOWN	-0.054	DOWN	-0.049	DOWN
Atl	15	1411110	Great Egg Harbor R @ Weymouth	14	0.354	0.62	0	0.0%	NSIG		NSIG		NSIG
L-De	17	1411500	Maurice River @ Norma	14	1.291	2.50	0	0.0%	UP	0.049	UP	0.033	UP
L-De	17	1412800	Cohansey River @ Seeley	14	4.457	5.70	0	0.0%	UP	0.120	UP	0.110	UP
L-De	18	1467069	NB Pennsauken Creek Near Moorestown	14	0.398	0.71	0	0.0%	DOWN	-0.063	DOWN	-0.057	DOWN
L-De	18	1467081	SB Pennsauken Creek @ Cherry Hill	14	2.587	13.02	1	7.1%	UP	0.170	UP	0.130	UP
L-De	18	1467150	Cooper @ Haddonfield	13	0.322	0.57	0	0.0%	DOWN	-0.044	DOWN	-0.020	DOWN
L-De	18	1467329	SB Big Timber C @ Blackwood Terrace	14	1.004	1.50	0	0.0%	NSIG		NSIG		NSIG
L-De	18	1477120	Raccoon Creek Near Swedesboro	13	1.322	2.00	0	0.0%	NSIG		NSIG		NSIG
L-De	18	1477510	Oldmans Creek @ Porches Mill	13	1.790	2.90	0	0.0%	NSIG		NSIG		NSIG
L-De	18	1482500	Salem River @ Woodstown	13	2.198	4.20	0	0.0%	NSIG		NSIG		NSIG
L-De	19	1465850	SB Rancocas C @ Vincentown	14	0.466	0.71	0	0.0%	NSIG		NSIG		NSIG
L-De	19	1466500	McDonalds Branch in Lebanon State Forest	7	0.020	0.03	0	0.0%	NT		NT		NT
L-De	19	1467000	NB Rancocas Creek @ Pemberton	14	0.067	0.12	0	0.0%	NSIG		NSIG		NSIG
L-De	20	1464500	Crosswicks Creek @ Extonville	13	0.511	1.10	0	0.0%	DOWN	-0.070	DOWN	-0.068	DOWN
L-De	20	1464515	Doctors Creek @ Allentown	14	0.908	1.80	0	0.0%	NSIG		DOWN	-0.036	DOWN
NE	3	1382500	Pequannock R @ Macopin Intake	14	0.225	1.10	0	0.0%	NSIG		NSIG		NSIG
NE	3	1387500	Ramapo River Near Mahwah	13	1.183	2.90	0	0.0%	NSIG		NSIG		NSIG
NE	3	1388600	Pompton R @ Packanack Lake	30	0.634	1.60	0	0.0%	NSIG		NSIG		NSIG
NE	4	1389500	Passaic River @ Little Falls	25	2.588	5.50	0	0.0%	UP	0.270	UP	0.140	UP
NE	4	1389880	Passaic R 2 Rt 46 @ Elmwood Park	14	1.314	3.10	0	0.0%	UP	0.130	UP	0.059	UP
NE	4	1391500	Saddle River @ Lodi	15	4.577	9.10	0	0.0%	UP	0.160	UP	0.150	UP
NE	5	1377000	Hackensack River @ Rivervale	14	0.505	1.10	0	0.0%	NSIG		NSIG		NSIG
NE	6	1379000	Passaic River near Millington	16	0.297	0.88	0	0.0%	DOWN	-0.017	NSIG		DOWN
NE	6	1379500	Passaic River near Chatham	15	1.225	3.10	0	0.0%	NSIG		UP	0.045	UP
NE	6	1380500	Rockaway R at Boonton	15	0.405	0.76	0	0.0%	NSIG		DOWN	-0.015	DOWN
NE	6	1381200	Rockaway R at Pine Brook	14	1.789	5.50	0	0.0%	NSIG		UP	0.077	UP
NE	6	1381500	Whippany River @ Morristown	14	1.296	1.80	0	0.0%	NSIG		NSIG		NSIG
NE	6	1381800	Whippany River Near Pine Brook	14	1.343	2.87	0	0.0%	UP	0.060	UP	0.061	UP

Table A3.4.4-1: Maximum NO3 Concentrations (1995-97) and NO3 Trends (1986-95)

Region	WMA	Station Number	Station Name	NO3-n (1995-1997)	NO3-mean (mg/l)	NO3 Max mg/l	NO3-# exc	NO3- % exc	Trend (No Q)	Trend - mg/l/yr (NoQ)	Trend (Q-Adj)	Trend - mg/l/yr (Q-adj)	Overall trend
NE	6	1382000	Passaic R @ Two Bridges	44	2.612	7.20	0	0.0%	UP	0.350	UP	0.250	UP
NW	1	1440000	Big Flatbrook @ Flatbrookville	9	0.148	0.39	0	0.0%	NSIG		NT		NSIG
NW	1	1443440	Paulins Kill @ Balesville	14	1.001	1.40	0	0.0%	NSIG		NSIG		NSIG
NW	1	1443500	Paulins Kill @ Blairstown	14	0.573	1.10	0	0.0%	DOWN	-0.015	NSIG		DOWN
NW	1	1445500	Pequest R @ Pequest	14	1.190	1.70	0	0.0%	NSIG		NSIG		NSIG
NW	1	1455200	Pohatcong Creek @ New Village	13	2.023	2.80	0	0.0%	UP	0.041	NSIG		UP
NW	1	1456200	Musconetcong R @ Beattystown	14	1.381	2.16	0	0.0%	UP	0.078	UP	0.073	UP
NW	1	1457000	Musconetcong R Near Bloomsbury	14	1.889	2.50	0	0.0%	NSIG		NSIG		NSIG
NW	1	1457400	Musconetcong R at Riegelsville	14	1.833	2.53	0	0.0%	UP	0.035	UP	0.028	UP
NW	2	1367770	Wallkill R nr Sussex	15	0.960	2.75	0	0.0%	NSIG		NSIG		NSIG
NW	2	1367910	Papakating C AT Sussex	14	0.795	1.60	0	0.0%	NSIG		NSIG		NSIG
NW	2	1368000	Wallkill River NR Unionville	14	1.075	1.40	0	0.0%	UP	0.039	UP	0.025	UP
NW	2	1368950	Black Creek nr Vernon	14	0.7	2.50	0	0.0%	NSIG		NSIG		NSIG
NW	11	1463620	Assunpink Creek Near Clarksville	14	0.727	1.30	0	0.0%	NSIG		NSIG		NSIG
NW	11	1464000	Assunpink @ Trenton	9	2.897	5.70	0	0.0%	UP	0.330	UP	0.110	UP
Rar	7	1393450	Elizabeth R @ Ursino Lake @ Elizabeth	14	1.890	3.30	0	0.0%	UP	0.054	NSIG		UP
Rar	7	1394500	Rahway R Near Springfield	15	1.543	2.50	0	0.0%	NSIG		NSIG		NSIG
Rar	7	1395000	Rahway R @ Rahway	14	1.139	2.10	0	0.0%	NSIG		NSIG		NSIG
Rar	8	1396280	SB Raritan R @ Middle Valley	14	1.451	2.00	0	0.0%	NSIG		NSIG		NSIG
Rar	8	1396535	SB Raritan R Arch St @ High Bridge	15	1.318	1.80	0	0.0%	NSIG		NSIG		NSIG
Rar	8	1396588	Spruce Run Near Glen Gardener	15	1.058	2.00	0	0.0%	NSIG		NSIG		NSIG
Rar	8	1396660	Mulhockaway Creek @ Van Syckel	15	0.904	1.50	0	0.0%	NSIG		NSIG		NSIG
Rar	8	1397000	South BR Raritan R @ Statoon Station Rd	14	1.044	1.40	0	0.0%	NSIG		NSIG		NSIG
Rar	8	1397400	SB Raritan R @ Three Bridges	14	1.410	0.92	0	0.0%	NSIG		NSIG		NSIG
Rar	8	1398000	Neshanic River @ Reaville	32	1.620	2.00	0	0.0%	NSIG		NSIG		NSIG
Rar	8	1398260	NB Raritan R Near Chester	14	2.059	4.90	0	0.0%	UP	0.250	UP	0.210	UP
Rar	8	1399120	NB Raritan R @ Burnt Mills	14	0.914	1.40	0	0.0%	NSIG		NSIG		NSIG
Rar	8	1399500	Lamington (Black) R Near Pottersville	15	0.941	3.90	0	0.0%	NSIG		NSIG		NSIG
Rar	8	1399700	Rockaway Creek @ Whitehouse	14	1.121	1.60	0	0.0%	NSIG		NSIG		NSIG
Rar	8	1399780	Lamington R @ Burnt Mills	15	0.845	1.70	0	0.0%	NSIG		NSIG		NSIG
Rar	9	1400500	Raritan @ Manville	14	1.267	2.30	0	0.0%	NSIG		NSIG		NSIG
Rar	9	1403300	Raritan R @ Queens Bridge	36	1.811	3.57	0	0.0%	NSIG		NSIG		NSIG
Rar	9	1405302	Matchaponix BK @ Spotswood	14	4.489	9.76	0	0.0%	NSIG		NSIG		NSIG
Rar	9	1405340	Manalapan BK Near Manalapan	14	0.844	1.20	0	0.0%	NSIG		NSIG		NSIG
Rar	10	1400540	Millstone R Near Manalapan	14	1.216	1.80	0	0.0%	NSIG		DOWN	-0.051	DOWN
Rar	10	1400650	Millstone R N @ Grovers Mill	9	3.771	6.30	0	0.0%	UP	0.200	UP	0.180	UP
Rar	10	1401000	Stony Brook @ Princeton	36	0.707	1.57	0	0.0%	NSIG		NT		NSIG

Table A3.4.4-1: Maximum NO3 Concentrations (1995-97) and NO3 Trends (1986-95)

Region	WMA	Station Number	Station Name	NO3-n (1995-1997)	NO3-mean (mg/l)	NO3 Max mg/l	NO3-# exc	NO3- % exc	Trend (No Q)	Trend - mg/l/yr (NoQ)	Trend (Q-Adj)	Trend - mg/l/yr (Q-adj)	Overall trend
Rar	10	1401600	Bedon Brook Near Rocky Hill	15	1.802	4.14	0	0.0%	UP	0.072	NSIG		UP
Rar	10	1402000	Millstone R @ Blackwells Mills	14	2.488	4.00	0	0.0%	UP	0.160	UP	0.100	UP
	De-M	1438500	Delaware River @ Montague	13	0.279	0.60	0	0.0%	NSIG		NSIG		NSIG
	De-M	1447000	Delaware River @ Easton PA	13	0.529	0.92	0	0.0%	NSIG		NSIG		NSIG
	De-M	1457500	Delaware R @ Riegelsville	14	1.002	2.53	0	0.0%	NSIG		NSIG		NSIG
	De-M	1461000	Delaware R @ Lumberville PA	13	0.979	1.38	0	0.0%	NSIG		NSIG		NSIG
	De-M	1463500	Delaware River @ Trenton	12	0.893	1.50	0	0.0%	NSIG		NSIG		NSIG
	De-M	1443000	Delaware R at Portland PA	13	0.268	2.30	0	0.0%	NSIG		NSIG		NSIG
Notes:													
Region:													
Atl: Atlantic Region, WMAs 12, 13, 14, 15, 16													
L-De: Lower Delaware Region, WMAs 17, 18, 19, 20													
NE: Northeast Region, WMAs 03, 04, 05, 06													
NW: Northwest Region, WMAs 01, 02, 11													
Rar: Raritan Region, WMAs 07, 08, 09, 10													
Station Number: Ambient Stream Monitoring Network Station Number													
Station Name: Ambient Stream Monitoring Network Station Name													
n : number of samples collected in the ASMN between 1995 and 1997													
mean (mg/l): average (mean) concentration in mg/l (or ppm)													
# exc: number of samples exceeding applicable SWQS criteria													
Trend - no Q: trends without flow adjustment (NSIG- not significant, NT- not tested, UP - increasing concentration, DOWN- decreasing concentration													
Trend - mg/l/yr: annual change in concentration													
Trend (Q-adj): trends with flow adjustment													

Table A4.2.2-1: Recreational Lake Beach Water Quality in 1999

County	Township	Recreational Beach	98 Ex	99 FC Geomean	99 Hi/Lo	99 # Exc	99% Ex (%)	DU Assessment	Lake Name on GIS	Acres
Atl	Buena Vista	Buena Vista CG	0	15.8	72/3	0	0.0%	Full		
Atl	Buena Vista	Collings Lakes #1 (Braddock)	0	164.6	401/46	1	8.0%	Full	Braddock Lake	81.08
Atl	Buena Vista	Collings Lakes #2 (Jays Lake North)	0	121.6	192/50	0	0.0%	Full		
Atl	Buena Vista	Collings Lakes #3 (Jays Lake South)	0	225.7	364/81	9	69.2%	None		
Atl	Egg Harbor	Egg Harbor City Lake (Eastside)	0	2.3	8/2	0	0.0%	Full	Egg Harbor City Lake	16.75
Atl	Egg Harbor City	Egg Harbor City Lake (Westside)	0	3.1	20/2	0	0.0%	Full	Egg Harbor City Lake	16.75
Atl	Pomona	Evergreen Woods	0	11.3	190/1	0	0.0%	Full		
Atl	Hammonton	Hammonton Bathing Beach		69.0	2147/2	19	18.3%	Partial	Hammonton Lake	34.88
Atl	Hammonton	Indian Branch		1.5	10/1	0	0.0%	Full		
Atl	Mays Landing	Lake Lenape "The Cove"	0	10.7	348/2	3	12.0%	Partial	Lenape Lake	296.35
Atl	Estell Manor	Lazy River	1	24.1	1600/1	2	18.2%	Partial		
Atl	Mays Landing	Lenape Park	1	36.6	186/2	0	0.0%	Full		
Atl	Port Republic	Nacote Creek Beach	0	34.0	244/2	1	5.0%	Full		
Atl	Hammonton	Paradise Lake		45.3	350/10	1	25.0%	None		
Atl	Port Republic	Red Wing	0	18.6	187/1	0	0.0%	Full		
Atl	Sculville	Sleepy Hollow		5.5	190/1	0	0.0%	Full		
Berg	Oakland	Crystal Lake	1	23.7	160/10	0	0.0%	Full	Crystal Lake	22.41
Berg	Franklin Lakes	Indian Trail Club	0	12.6	300/10	1	0.6%	Full		
Burl	Shamong	Atsion Rec. Area	0	25.2	210/3	1	2.0%	Full	Atsion Lake	86.36
Burl	Bass River	Bass River SF	1	16.9	1730/3	3	6.1%	Full		
Burl	Medford Twp.	Birchwood Lakes Beach	0	2.5	23/1	0	0.0%	Full		
Burl	Medford Twp.	Blue Lake Beach	0	2.7	15/1	0	0.0%	Full	Blue Lake	6.51
Burl	Tabernacle	Boy Scouts	0	2.9	168/1	0	0.0%	Full		
Burl	Medford Twp.	Braddocks Mill Lake	0	2.2	220/1	1	6.7%	Full	Braddocks Mill Pond	25.88
Burl	Medford Twp.	Camp Darkwaters	7	266.9	tntc/230	8	100.0%	None		
Burl	Tabernacle	Camp Inawendiwin	0	48.7	180/1	0	0.0%	Full		
Burl	Medford Twp.	Camp Ockanickon Boys	0	47.1	190/20	0	0.0%	Full		
Burl	Medford Twp.	Camp Ockanickon Family	0	50.6	150/1	0	0.0%	Full		
Burl	Medford Twp.	Camp Ockanickon Girls	0	58.0	190/1	0	0.0%	Full		
Burl	Medford Twp.	Camp Ockanickon Pomona	0	41.5	190/1	0	0.0%	Full		
Burl	Medford Twp.	Cardinal Ridge Condos	0	19.9	190/1	0	0.0%	Full		
Burl	Medford Twp.	Centennial Lake	0	13.5	50/10	0	0.0%	Full	Centennial Lake	57.15
Burl	Bass River	Chips Folly	0	36.6	117/1	0	0.0%	Full		
Burl	Evesham	Clubhouse Marlton Lake Civic Assn.	0	17.2	190/40	0	0.0%	Full		
Burl	Pemberton Twp.	Country Lakes	3	3.8	20/1	0	0.0%	Full	Country Lake	162.63

Table A4.2.2-1: Recreational Lake Beach Water Quality in 1999

Table A4.2.2-1: Recreational Lake Beach Water Quality in 1999

County	Township	Recreational Beach	98 Ex	99 FC Geomean	99 Hi/Lo	99 # Exc	99% Ex (%)	DU Assessment	Lake Name on GIS	Acres
Burl	Tabernacle	Delanco Camp Meeting	0	24.4	70/1	0	0.0%	Full		
Burl	Medford Twp.	East Lake Pine Colony Club	2	53.2	215/25	1	6.7%	Full		
Burl	Medford Twp.	Girl Scouts Kettle Run	0	3.0	14/1	0	0.0%	Full		
Burl	Evesham	Harmony Lake			no data			NA		
Burl	Medford Twp.	Holly Lake Association	0	61.8	190/1	0	0.0%	Full		
Burl	Medford Twp.	JCC Camps at Medford	0	14.6	55/1	0	0.0%	Full		
Burl	Evesham	Kings Grant	12	38.2	100/10	0	0.0%	Full		
Burl	Medford	Lakeside		15.7	30/10	0	0.0%	Full		
Burl	Mansfield	Liberty Lake	0	12.9	95/1	0	0.0%	Full		
Burl	Medford Twp.	Main Lake Pine Colony Club	2	82.3	320/30	2	12.5%	Partial	Pine Lake	20.87
Burl	Medford Lakes	Medford Lakes Colony Club Beach 1	0	3.3	120/1	0	0.0%	Full	Medford Lakes Colony Club	6.06
Burl	Medford Lakes	Medford Lakes Colony Club Beach 2	0	2.0	42/1	0	0.0%	Full	Lake Mishe-Mokwa	6.06
Burl	Medford Lakes	Medford Lakes Colony Club Beach 3	0	2.5	80/1	0	0.0%	Full	Lower Aetna Lake	6.06
Burl	Medford Lakes	Medford Lakes Colony Club Beach 4	0	3.6	200/1	0	0.0%	Full	Medford Lakes Colony Club	6.06
Burl	Medford Lakes	Medford Lakes Colony Club Beach 5	0	1.6	14/1	0	0.0%	Full	Medford Lakes Colony Club	6.06
Burl	Medford	Medford Pines		10.0	10/10	0	0.0%	Full		
Burl	Pemberton Twp.	Methodist Camps	0	1.7	29/1	0	0.0%	Full		
Burl	Medford Twp.	Mimosa Lake Beach	0	1.2	14/1	0	0.0%	Full	Mimosa Lakes	15.18
Burl	Pemberton Twp.	Mirror Lake	4	13.5	270/1	1	7.7%	Full	Mirror Lake	122.25
Burl	Evesham	Mohegan Lake YMCA Camp Moore	0	46.0	190/10	0	0.0%	Full		
Burl	Medford Twp.	Oakwood Lakes	0	168.8	190/150	0	0.0%	Full	Oakwood Lake	21.78
Burl	Bass River	Pilgrim Lake Campground	0	59.8	190/10	0	0.0%	Full		
Burl	Pemberton Twp.	Presidential Lakes	3	3.6	20/1	0	0.0%	Full	Presidential Lakes	32.73
Burl	Medford Twp.	Shawnee Country OSA	0	49.7	140/1	0	0.0%	Full		
Burl	Medford Twp.	Sherwood Forest	0	1.9	27/1	0	0.0%	Full		
Burl	Medford Twp.	South Lake Pine Colony Club	1	56.7	215/10	1	7.1%	Full		
Burl	Burlington Twp.	Sylvan Lake	0	8.7	40/1	0	0.0%	Full	Sylvan Lake	13.32
Burl	Medford Twp.	Tamarac Lake	0	22.0	90/10	0	0.0%	Full	Tamarack Lake	7.20
Burl	Medford Twp.	Taunton Lake	0	18.4	50/5	0	0.0%	Full	Taunton Lake	34.29
Burl	Bass River	Timberline Lake Campground	0	20.3	190/1	0	0.0%	Full		
Burl	Evesham	Union Mill Lake Colony Club	0	39.7	190/1	0	0.0%	Full		
Burl	Evesham	West Lake Marlton Lake Civic Assn.	0	137.7	190/20	0	0.0%	Full		
Burl	Evesham	YMCA Camp Moore Family Lake	0	37.9	190/10	0	0.0%	Full		
Cam	Bellmawr	Bellmawr Lake	0	10.0	10/10	0	0.0%	Full		
Cam	Ancora	Camp Haluwasa	0	7.0	700/1	1	8.3%	Full		

Table A4.2.2-1: Recreational Lake Beach Water Quality in 1999

Table A4.2.2-1: Recreational Lake Beach Water Quality in 1999

County	Township	Recreational Beach	98 Ex	99 FC Geomean	99 Hi/Lo	99 # Exc	99% Ex (%)	DU Assessment	Lake Name on GIS	Acres
Cam	Pine Hill	Camp Pine Hill	0	21.0	9500/4	1	8.3%	Full		
Cam	Vorhees	Chatham Lake	0	30.0	100/10	0	0.0%	Full		
Cam	Vorhees	Foxview Beach	1	27.7	90/10	0	0.0%	Full		
Cam	Winslow	Great Times Camp	0	80.1	995/10	1	9.1%	Full		
CapeM	Upper	Bayberry Cove (large)	0	76.7	250/10	1	7.1%	Full		
CapeM	Upper	Bayberry Cove (small)	0	59.4	190/2	0	0.0%	Full		
CapeM	Lower	Beachcomer Campground	1	58.5	184/20	0	0.0%	Full		
CapeM	Dennis	Belleplain SF, Lake Nummy	0	23.2	1360/3	3	6.8%	Full	Lake Nummy	7.46
CapeM	Middle	Big Timber Lake	2	4.7	20/2	0	0.0%	Full		
CapeM	Dennis	Driftwood Camping Resorts	0		no data			NA		
CapeM	Middle	Garden Park Lake	0	50.6	400/2	1	7.7%	Full		
CapeM	Dennis	Hidden Acres	0	7.6	190/2	0	0.0%	Full		
CapeM	Dennis	Holly Lake Campground	8	49.2	1900/10	5	27.8%	None		
CapeM	Lower	Lake Laurie Campground	1	18.2	220/2	1	11.1%	Partial		
CapeM	Dennis	Oceanview Campground		2.8	40/2	0	0.0%	Full		
CapeM	Dennis	Outdoor World Lake and Shore	0	42.9	198/2	0	0.0%	Full		
CapeM	Middle	Outdoor World Sea Pines	1	106.2	332/36	1	12.5%	Partial		
CapeM	Dennis	Pine Haven Campground	3	79.6	111/23	0	0.0%	Full		
CapeM	Dennis	Resort County Club	0	7.1	280/2	1	9.1%	Full		
CapeM	Lower	Seashore Campsites	0	6.4	60/2	0	0.0%	Full		
Cumb	Lawence	Cedar Lake	3	39.8	2200/20	1	7.1%	Full	Cedar Lake	21.37
Cumb	Fairfield	Clarks Pond Capps Day Camp Beach	0	20.0	20/20	0	0.0%	Full	Clarks Pond	40.07
Cumb	Maurice River	Hands Mill Pond Bathing Area	0	54.9	5400/20	1	7.1%	Full	Hands Mill Pond	32.32
Cumb	Commercial	Laurel Lake Mist Road Bathing Area	0	20.0	20/20	0	0.0%	Full	Laurel Lake	7.90
Cumb	Millville City	Laurel Lake Narcissus Rd Bathing Area	0	22.4	50/20	0	0.0%	Full	Laurel Lake	7.90
Cumb	Commercial	Laurel Lake Nymph Road Bathing Area	0	21.5	50/20	0	0.0%	Full	Laurel Lake	7.90
Cumb	Commercial	Laurel Lake Olive Road Bathing Area	0	20.0	20/20	0	0.0%	Full	Laurel Lake	7.90
Cumb	Greenwich	Sheppards Mill Pond	0	20.0	20/20	0	0.0%	Full	Sheppards Millpond	52.68
Cumb	Bridgeton	Sunset Lake Bathing Beach	2	26.5	140/20	0	0.0%	Full		
Cumb	Millville City	Union Lake Bathing Area	0	29.6	130/20	0	0.0%	Full	Union Lake	825.42
Glouc	Franklinville	Eastern Gate Lake	9	60.7	360/5	2	11.1%	Partial		
Glouc	Franklinville	Franklinville Lake	8	110.6	296/12	4	25.0%	None	Franklinville Lake	29.22
Glouc	Turnersville	Greenwood Park Bells Lake	3	13.2	160/1	0	0.0%	Full		

Table A4.2.2-1: Recreational Lake Beach Water Quality in 1999

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County	Township	Recreational Beach	98 Ex	99 FC Geomean	99 Hi/Lo	99 # Exc	99% Ex (%)	DU Assessment	Lake Name on GIS	Acres
Glouc	Monroeville	Holly Green Campground	1	101.9	1800/6	7	38.9%	None		
Glouc	Williamstown	Hospitality Creek Campground	3	11.6	1800/5	3	16.7%	Partial		
Glouc	Sewell	Hurff Lake	0	1.4	130/1	0	0.0%	Full		
Glouc	Franklinville	Iona Lake	4	76.0	420/10	5	31.3%	None	Iona Lake	31.12
Glouc	Monroeville	Lake Garrison	0	44.6	400/10	3	18.8%	Partial		
Glouc	Sewell	Lake Kandle	1	14.1	140/1	0	0.0%	Full		
Glouc	Malaga	Malaga Lake	5	107.7	330/29	5	31.3%	None	Malaga Lake	98.31
Glouc	Monroeville	Old Cedar Lake	2	11.3	190/1	0	0.0%	Full		
Glouc	Monroeville	Oldmans Creek Lake	4	1.0	1/1	0	0.0%	Full		
Glouc	Williamstown	Timber Lake	1	63.6	350/2	1	10.0%	Full	Timber Lake	13.36
Glouc	Sewell	Washington Township Lake	1	12.7	400/1	2	14.3%	Partial		
Glouc	Wehonah	Wenonah Lake Playground	0	9.0	350/1	1	6.3%	Full		
Glouc	Clayton	Wilson Lake	2	55.0	760/10	2	25.0%	None	Wilson Lake	49.80
Hun	Clinton	Baptist Camp and Conf. Ctr.	1	2.0	170/2	0	0.0%	Full		
Hun	Lebanon	Beisler Camping and Retreat Ctr.	0	32.0	192/16	0	0.0%	Full		
Hun	Lebanon	Camp Bernie	0	33.3	108/4	0	0.0%	Full		
Hun	Clinton	Round Valley Recreational Area	6	47.5	790/20	2	11.1%	Partial	Round Valley Reservoir	######
Hun	Union Township	Spruce Run SP (East Beach)	0	22.1	50/20	0	0.0%	Full	Spruce Run Reservoir	661.90
Hun	Union Township	Spruce Run SP (West Beach)	0	20.0	20/20	0	0.0%	Full	Spruce Run Reservoir	661.90
Midd	Monroe	Carroll's Garden Lake	1	34.2	2900/1	2	11.1%	Partial		
Midd	Old Bridge	Cheesequake SP	5	86.8	24000/20	7	17.1%	Partial		
Mor	Mountain Lakes	Birchwood Lake	0	22.7	240/10	1	6.3%	Full	Birchwood Lake	9.46
Mor	Rockaway	Camp Lewis	1	12.2	30/10	0	0.0%	Full		
Mor	Rockaway	Camp Winnebago	0	12.6	30/10	0	0.0%	Full		
Mor	Denville	Cedar/1 (East)	0	10.7	20/10	0	0.0%	Full	Cedar Lake	43.85
Mor	Denville	Cedar/2 (West)	0	27.4	160/10	0	0.0%	Full	Cedar Lake	43.85
Mor	Jefferson	Community Assoc. of Prospect Point	2	37.4	1000/10	2	15.4%	Partial		
Mor	Denville	Cooks Lake Main Beach	1	19.3	40/10	0	0.0%	Full	Cooks Pond	8.28
Mor	Denville	Cooks Lake Small Beach	0	16.5	50/10	0	0.0%	Full	Cooks Pond	8.28
Mor	Jefferson	Cozy Lakers	7	97.3	1600/2	10	45.5%	None	Cozy Lake	27.54
Mor	Par Troy	Drewes Beach Lake Parsippany	0	27.6	600/10	1	8.3%	Full	Parsippany Lake	51.17
Mor	Denville	Estling Lake	0	39.2	572/1	3	25.0%	None	Estling Lake	75.56
Mor	Rockaway	Green Pond	0	15.5	70/10	0	0.0%	Full	Green Pond	498.81
Mor	Par Troy	Hoffman Beach Lake Parsippany	0	12.3	840/10	1	2.6%	Full	Parsippany Lake	51.17
Mor	Roxbury	Hoptacong SP	0	38.3	360/10	1	9.1%	Full		

Table A4.2.2-1: Recreational Lake Beach Water Quality in 1999

Table A4.2.2-1: Recreational Lake Beach Water Quality in 1999

County	Township	Recreational Beach	98 Ex	99 FC Geomean	99 Hi/Lo	99 # Exc	99% Ex (%)	DU Assessment	Lake Name on GIS	Acres
Mor	Succasunna	Horseshoe Lake	0	8.6	72/1	0	0.0%	Full	Horseshoe Lake	16.73
Mor	Denville	Indian Clubhouse	0	17.3	150/10	0	0.0%	Full	Indian Lake	28.82
Mor	Denville	Indian Franklin	1	135.8	860/10	5	38.5%	None	Indian Lake	28.82
Mor	Denville	Indian Main	0	21.3	220/10	1	8.3%	Full	Indian Lake	28.82
Mor	Par Troy	Johnson Beach Lake Parsippany	0	11.5	40/10	0	0.0%	Full	Parsippany Lake	51.17
Mor	Denville	Lake Arrowhead	0	48.1	220/10	1	12.5%	Partial	Arrowhead Lake	16.97
Mor	Butler	Lake Edenwold	0	24.0	310/10	1	7.7%	Full		
Mor	Lake Hopatcong	Lake Forest Yacht Club	5	69.1	440/10**	2	8.0%	Full		
Mor	Lake Hopatcong	Lake Hopatcong - East Shores POA	1	27.6	60/10	0	0.0%	Full	Lake Hopatcong	125.81
Mor	Par Troy	Lake Intervale	3	26.8	1600/2	5	31.3%	None	Intervale Lake	11.15
Mor	Kinnelon	Lake Reality	0	2.3	10/1	0	0.0%	Full	Lake Reality	7.96
Mor	Kinnelon	Lake Rickabear Beach	0	10.6	1050/1	1	20.0%	Partial	Ricabear Lake	25.62
Mor	Landing	Lake Rogerene Civic Assoc.	0					NA	Rogerene Lake	8.53
Mor	Lake Hoptacong	Lake Shawnee Club		12.8	1100/1	1	8.3%	Full	Shawnee Lake	74.83
Mor	Kenvil	Lake Silver Springs	0	14.9	60/10	0	0.0%	Full		
Mor	Jefferson	Lake Swannanoa Country Club	6	8.6	46/2	0	0.0%	Full	Lake Swannanoa	47.90
Mor	Rockaway	Lake Telemark	3	13.9	30/10	0	0.0%	Full	Telemark Lake	3.68
Mor	Montville	Lake Valhalla Beach	0	6.3	704/1	1	3.4%	Full	Valhalla Lake	94.55
Mor	Jefferson	Lake Winona Civic Association		11.2	408/1	1	9.1%	Full	Lake Winona	8.35
Mor	Lincoln Park	Lincoln Park Community Lake	1	22.3	380/10	3	11.1%	Partial		
Mor	Mendham	Mendham Township Pond	0	17.6	80/10	0	0.0%	Full	Mendham Twp Pond	1.64
Mor	Madison	Mine Hill Beach	1					NA	Mine Hill Reservoir	2.07
Mor	Rockaway	Mount Hope Pond	1	18.7	720/10	1	2.9%	Full	Mount Hope Pond	16.48
Mor	Mountain Lakes	Mountain Lake	4	28.3	240/10	2	11.8%	Partial	Mountain Lake	112.01
Mor	Madison	Mt Arlington Beach	1					NA		
Mor	Mt. Olive	Mt. Olive Municipal Beach	3	42.5	2550/1	7	25.0%	None		
Mor	Jefferson	NYODA Girls Camp Inc.	2	13.4	58/1	0	0.0%	Full		
Mor	Pequannock	P.V. Park	0		no data			NA		
Mor	Rockaway	Park Lake	14	44.2	890/10	5	13.9%	Partial		
Mor	Par Troy	Rainbow Lakes Comm. Club	1	52.1	430/10	2	16.6%	Partial	Rainbow Lakes	29.10
Mor	Randolph	Randolph Park Lake	12	33.6	890/10	5	11.1%	Partial		
Mor	Denville	Rock Ridge	2	16.7	50/10	0	0.0%	Full	Rock Ridge Lake	16.38
Mor	Kinnelon	Sabeys Beach	0	1.7	6/1	0	0.0%	Full	Stickle Pond	125.78
Mor	Succasunna	Shongum Lake	0	32.2	112/4	0	0.0%	Full	Shongum Lake	72.60
Mor	Landing	Shore Hills	1	37.6	230/10	3	21.4%	Partial		

Table A4.2.2-1: Recreational Lake Beach Water Quality in 1999

Table A4.2.2-1: Recreational Lake Beach Water Quality in 1999

County	Township	Recreational Beach	98 Ex	99 FC Geomean	99 Hi/Lo	99 # Exc	99% Ex (%)	DU Assessment	Lake Name on GIS	Acres
Mor	Kinnelon	Smoke Rise Beach	1	54.2	3000/7	1	10.0%	Full		
Mor	Butler	Stoneybrook Swim Club	1	16.5	60/10	0	0.0%	Full		
Mor	Oak Ridge	Sun Air Campground	0	8.9	150/1	0	0.0%	Full		
Mor	Mendham	Sunrise Lake	0	38.2	210/10	1	10.0%	Full	Sunrise Lake	3.61
Mor	Par Troy	Tabor Lake Corporation	2	25.8	820/10	1	12.5%	Partial		
Mor	Kinnelon	West Fayson Lake Main Beach	2	4.3	20/1	0	0.0%	Full	West Lake	56.43
Mor	Rockaway	White Meadow Lake	1	32.9	3400/10	5	12.5%	Partial	White Meadow Lake	140.99
Mor	Jefferson	White Rock Lake Assoc.	0	21.8	2300/10	1	7.1%	Full		
Ocn	Stafford	A. Pauling Park Beach	4	183.1	1118/33	11	40.7%	None	Manahawkin	
Ocn	Lacey	Bamber Lake - East Lake	2	19.7	800/1	1	5.0%	Full	Bamber Lake	28.50
Ocn	Lacey	Bamber Lake - West Lake	1	22.8	800/1	1	5.0%	Full	Bamber Lake	28.50
Ocn	Lacey	Deer Head - Upper beach	2	29.0	800/1	2	9.5%	Full	Deer Head Lake	48.97
Ocn	Manchester	Harry Wright Lake High Beach	0	18.3	196/1	0	0.0%	Full	Harry Wrights Lake	6.10
Ocn	Manchester	Harry Wright Lake Low Beach	1	10.9	144/1	0	0.0%	Full	Harry Wrights Lake	6.10
Ocn	Lacey	Lake Barnegat- Middle Beach	3	37.3	1120/1	2	9.1%	Full	Lake Barnegat	92.76
Ocn	Lakewood	Lake Carasalijo North Beach	19	194.8	4000/1	18	90.9%	None	Carasaljo Lake	42.87
Ocn	Lakewood	Lake Carasalijo South Beach	3	181.2	2000/1	9	52.9%	None	Carasaljo Lake	42.87
Ocn	Lacey	Lake Horicon Beach - North	0	24.4	280/1	1	6.7%	Full	Horicon Lake	28.51
Ocn	Lacey	Lake Horicon Beach - South	0	17.1	140/1	0	0.0%	Full	Horicon Lake	28.51
Ocn	Stafford	Ocean Acres Beach	6	107.8	1680/1	8	33.3%	None		
Ocn	Lakewood	Ocean County Park Beach	29	394.5	4100/17	13	56.5%	None		
Ocn	Ocean	Ocean Twp Bathing Beach	1	20.3	3900/1	3	17.6%	Partial	Ocean Twp Bathing Beach	6.07
Ocn	Manchester	Pine Lake Bathing Beach	7	60.0	1400/10	3	16.7%	Partial	Pine Lake	48.18
Pass	West Milford	Awosting Association		9.4	74/2	0	0.0%	Full		
Pass	West Milford	Bubbling Springs	6	2.9	118/1	0	0.0%	Full		
Pass	West Milford	Camp Vacamus	0	12.4	196/1	0	0.0%	Full		
Pass	Ringwood	Cupsaw	2	31.1	140/10	0	0.0%	Full	Cupsaw Lake	63.65
Pass	West Milford	Echo Lake		12.3	73/1	0	0.0%	Full	Echo Lake	268.35
Pass	Ringwood	Erskine Little Beach	0	11.5	20/10	0	0.0%	Full	Erskine Lake	51.20
Pass	Ringwood	Erskine Main Beach	0	39.9	340/10	2	20.0%	Partial	Erskine Lake	12.80
Pass	Ringwood	Erskine Upper Beach	0	30.4	170/10	0	0.0%	Full	Erskine Lake	12.80
Pass	West Milford	Farm Crest Acres Assoc.	0	11.6	60/10	0	0.0%	Full		
Pass	West Milford	Forest Hill Park	0	16.2	2500/2	1	11.1%	Partial		
Pass	Bloomingdale	Glen Wild Lake	0	23.3	558/2	2	15.4%	Partial	Glen Wild Lake	102.46
Pass	West Milford	Greenbrook POA	0	72.3	270/20	1	33.3%	None		

Table A4.2.2-1: Recreational Lake Beach Water Quality in 1999

Table A4.2.2-1: Recreational Lake Beach Water Quality in 1999

County	Township	Recreational Beach	98 Ex	99 FC Geomean	99 Hi/Lo	99 # Exc	99% Ex (%)	DU Assessment	Lake Name on GIS	Acres
Pass	West Milford	Greenwood Lake Beach Assoc	2	23.6	394/1	1	10.0%	Full	Greenwood Lake	810.13
Pass	Ringwood	Harrison Mountain Lake	0	15.1	50/10	0	0.0%	Full	Harrison Mountain Lake	9.84
Pass	West Milford	High Crest Lake	0	23.2	190/10	0	0.0%	Full	High Crest Lake	38.08
Pass	Ringwood	Highlands/Weis	0	19.3	50/10	0	0.0%	Full		
Pass	Bloomingdale	Kampfe Lake Assoc.	0	9.7	76/2	0	0.0%	Full	Kampfe Lake	28.32
Pass	Wayne	Kilroy Park (Tom's Lake)	0	8.6	164/2	0	0.0%	Full	Tom'S Lake	4.88
Pass	West Milford	Kitchell Lake Assoc.	3	20.7	3680/1	2	12.5%	Partial	Kitchell Lake	21.15
Pass	Bloomingdale	Lake Iosco	1	29.9	770/10	2	16.7%	Partial	Lake Ioscoe	64.68
Pass	West Milford	Lake Lookover	0	19.4	70/2	0	0.0%	Full	Lookover Lake	12.84
Pass	Ringwood	Lake Riconda Beach	0	16.3	320/10	1	10.0%	Full	Rickonda Lake	6.32
Pass	West Milford	Lakeside Community Club	0	4.8	26/1	0	0.0%	Full		
Pass	West Milford	Lindy Lake Association	1	14.9	346/3	1	11.1%	Partial	Lindy Lake	19.05
Pass	Wayne	Lions Head Lake	3	28.5	259/4	1	7.1%	Full	Lionhead Lake	4.47
Pass	West Milford	Montclair YMCA	2	15.3	3120/1	1	3.7%	Full		
Pass	Bloomingdale	Morse Lake POA	0	53.5	1300/10	2	16.7%	Partial	Morse Lake	12.45
Pass	West Milford	Mountain Springs Lake		7.9	58/1	0	0.0%	Full	Mountain Springs Lake	3.32
Pass	West Milford	Mt. Glen Lakes	0	8.7	90/2	0	0.0%	Full	Mt Glen Lakes	13.83
Pass	West Milford	Mt. Laurel Beach Club	0	5.8	18/1	0	0.0%	Full	Mount Laurel Lake	16.73
Pass	Wayne	North Cove	8	8.9	144/1	0	0.0%	Full		
Pass	Wayne	Packanack Lake	3	10.6	258/1	1	3.7%	Full	Packanack Lake	83.83
Pass	West Milford	Pinecliff Lake	0	13.1	50/10	0	0.0%	Full	Pinecliff Lake	142.37
Pass	Wayne	Pines Lake	4	10.4	1243/1	2	7.7%	Full	Pines Lake	142.86
Pass	West Milford	Post Brook Farms CC	0	8.7	63/1	0	0.0%	Full		
Pass	Ringwood	Ringwood SP, Shepherd Lake	0	22.2	240/1	1	7.1%	Full	Sheppard Pond	72.84
Pass	West Milford	Simplicity Inn at Blueberry Point	0	1.3	4/1	0	0.0%	Full		
Pass	Ringwood	Skyline Lake	5	77.3	654/10	6	24.0%	Partial	Skyline Lakes	10.32
Pass	Ringwood	Skyline Lakes Upper Beach	0		no data			NA	Skyline Lakes	10.32
Pass	West Milford	Solid Rock Day Camp, Camp Gigal	0	3.5	28/1	0	0.0%	Full		
Pass	Bloomingdale	Star Lake Camp	3	19.5	4600/10	6	4.6%	Full	Star Lake	19.94
Pass	West Milford	Upper Greenwood Lake POA	0	48.8	3900/10	2	18.2%	Partial	Upper Greenwood Lake	400.80
Sal	Salem	Camp Grice			no data			NA		
Sal	Vineland	Camp Merrywood	4	64.1	120/30	0	0.0%	Full		
Sal	Millville	Camp Roosevelt	1	9.7	100/2	0	0.0%	Full		
Sal	Pilesgrove	Four Seasons	0	304.6	1140/70	6	31.6%	None		
Sal	Pittsgrove	Parvin SP, Parvin Lake	11	113.4	200/8	1	0.0%	Full	Parvin Lake	93.13

Table A4.2.2-1: Recreational Lake Beach Water Quality in 1999

Table A4.2.2-1: Recreational Lake Beach Water Quality in 1999

County	Township	Recreational Beach	98 Ex	99 FC Geomean	99 Hi/Lo	99 # Exc	99% Ex (%)	DU Assessment	Lake Name on GIS	Acres
Sal	Penns Grove	Sportsman Club	0	3.4	24/1	0	0.0%	Full		
Som	Far Hills	Ravine Lake (Somerset Lake)		42.1	160/4	0	0.0%	Full	Ravine Lake	38.68
Som	Bridgewater	Sunset Lake	0	87.8	400/24	1	10.0%	Full	Sunset Lake	101.42
Sus	Sparta	Arapaho Lake	0	12.7	190/10	0	0.0%	Full	Arapho Lake	4.81
Sus	Vernon	Barry Lakes	0	30.8	340/10	1	10.0%	Full	Barry Lakes	55.25
Sus	Hardyston	Beaver Lake	0	3.3	30/1	0	0.0%	Full	Beaver Lake	113.36
Sus	Sandyston	Bell Lake	0	1.9	7/1	0	0.0%	Full	Bells Lake	25.52
Sus	Hoptacong	Byram Bay Community Club		51.4	200/20	0	0.0%	Full		
Sus	Sandyston	Camp Linwood MacDonald	0	2.2	8/1	0	0.0%	Full		
Sus	Stillwater	Camp Lou Henry Hoover	0	11.1	20/10	0	0.0%	Full		
Sus	Vernon	Cliffwood Lake	0	10.0	10/10	0	0.0%	Full		
Sus	Byram	Cranberry Lake Club House	0	4.6	7/0	0	0.0%	Full	Cranberry Lake	95.63
Sus	Byram	Cranberry Lake Rose Beach	0	5.8	23/2	0	0.0%	Full	Cranberry Lake	95.63
Sus	Hampton	Crandon Lakes East	0	2.8	9/1	0	0.0%	Full	Crandon Lakes	37.09
Sus	Hampton	Crandon Lakes West	0	7.2	150/1	0	0.0%	Full	Crandon Lakes	37.09
Sus	Hardyston	Crystal Springs: The Quarry	0	10.0	10/10	0	0.0%	Full		
Sus	Frankford	Culvers Lake	0	3.2	12/1	0	0.0%	Full	Culvers Lake	556.50
Sus	Hoptacong	Davis Cove			no data			NA		
Sus	Sandyston	Deer Lake	0	39.9	3700/10	3	16.7%	Partial		
Sus	Hardyston	Deer Trail Lake	0		closed			NA	Deer Trail Lake	7.89
Sus	Stillwater	Fairfield Lake YMCA	0	10.0	10/10	0	0.0%	Full		
Sus	Stillwater	Fairfield Lake: Blue Mt. Day Camp	0	11.5	20/10	0	0.0%	Full		
Sus	Hardyston	Fawn Lake	0	40.0	40/40**	0	0.0%	Full	Fawn Lake	4.29
Sus	Byram	Forest Lake: Boardwalk Beach	0	20.4	190/10	0	0.0%	Full	Forest Lake	10.58
Sus	Byram	Forest Lake: Cove Beach	1	12.5	20/10	0	0.0%	Full	Forest Lake	10.58
Sus	Byram	Forest Lake: Harbor View Beach	0	36.8	180/10	0	0.0%	Full	Forest Lake	10.58
Sus	Byram	Forest Lake: Main Beach	0	27.6	40/10	0	0.0%	Full	Forest Lake	10.58
Sus	Sparta	Fox Hollow Lake	3	40.2	630/10	3	17.6%	Partial	Fox Hollow Lake	73.73
Sus	Green	Garden State Academy Pond	0		closed			NA		
Sus	Vernon	Glen Harbor HOA	0	13.4	50/10	0	0.0%	Full		
Sus	Sparta	Glen Lake	1	18.1	460/10	2	12.5%	Partial	Glen Lake	3.02
Sus	Green	Green Valley Beach Campground	0	72.4	2000/0	2	14.3%	Partial		
Sus	Frankford	Harmony Ridge Beach at Large Lake	1	13.1	120/2	0	0.0%	Full	Harmony Lake	2.02
Sus	Frankford	Harmony Ridge Beach at Small Lake	1	10.6	160/2	0	0.0%	Full	Harmony Lake	2.02
Sus	Ogdensburg	Heaters Pond		21.0	190/10	0	0.0%	Full	Heaters Pond	13.25

Table A4.2.2-1: Recreational Lake Beach Water Quality in 1999

Table A4.2.2-1: Recreational Lake Beach Water Quality in 1999

County	Township	Recreational Beach	98 Ex	99 FC Geomean	99 Hi/Lo	99 # Exc	99% Ex (%)	DU Assessment	Lake Name on GIS	Acres
Sus	Hamburg	Heritage Lakes The Quarry	0	12.2	20/10	0	0.0%	Full		
Sus	Vernon	Hidden Valley Lake	1	24.2	70/1	0	0.0%	Full	Hidden Valley Lake	3.55
Sus	Montague	High Point SP, Lake Marcia	0	7.3	131/1	0	0.0%	Full	Marcia Lake	17.56
Sus	Vernon	Highland Lake, Lake 1 Beach1	0	19.5	2500/10	2	4.3%	Full	Highland Lake	105.14
Sus	Vernon	Highland Lake, Lake 2 Beach 4	0	17.2	90/10	0	0.0%	Full	Upper Highland Lake	13.14
Sus	Vernon	Highland Lake, Lake 2 Beach2	0	17.3	80/10	0	0.0%	Full	Highland Lake	105.14
Sus	Vernon	Highland Lake, Lake 2 Beach3	0	14.6	40/10	0	0.0%	Full	Highland Lake	105.14
Sus	Vernon	Highland Lake, Lake 3 Beach6	1	15.9	140/10	0	0.0%	Full	East Highland Lake	20.14
Sus	Vernon	Highland Lake, Lake 4 Beach5	0	17.5	310/10	1	6.7%	Full	Highland Lake 4	18.49
Sus	Vernon	Highland Lake, Lake 5 Beach7	0	13.5	150/10	0	0.0%	Full	Highland Lake 5	10.10
Sus	Montague	Holiday Lakes	0	11.0	1125/1	1	7.1%	Full	Holiday Lake	71.81
Sus	Byram	Jefferson Lakes	0	38.1	84/12	0	0.0%	Full	Jefferson Lake	41.25
Sus	Hampton	Kemah Lake Big Beach	0	2.0	7/1	0	0.0%	Full	Lake Kemah	48.84
Sus	Hampton	Kemah Lake Little Beach	0	1.3	3/1	0	0.0%	Full	Lake Kemah	48.84
Sus	Sanyston	Kittatinny Lake East Shore	1	10.4	376/1	1	16.7%	Partial	Kittatinny Lake	41.18
Sus	Sandyston	Kittatinny Lake West Shore	0	23.1	192/4	0	0.0%	Full	Kittatinny Lake	41.18
Sus	Lafayette	Lafayette Municipal Beach	0	8.7	164/1	0	0.0%	Full		
Sus	Sandyston	Lake Ashroe: Kittatinny Mt. BSA Res.	0	3.1	12/1	0	0.0%	Full	Lake Ashroe	34.03
Sus	Vernon	Lake Conway			no data			NA		
Sus	Hardyston	Lake Gerard			closed			NA	Gerard Lake	87.61
Sus	Vernon	Lake Glenwood	0	10.0	10/10	0	0.0%	Full	Glenwood Lake	27.22
Sus	Lake Hopatcong	Lake Hopatcong - Beck Lane Properties	0	3.4	18/1	0	0.0%	Full	Lake Hopatcong	125.81
Sus	Lake Hoptacong	Lake Hopatcong - Colony Club		3.1	24/1	0	0.0%	Full	Lake Hopatcong	125.81
Sus	Lake Hopatcong	Lake Hopatcong - Crescent Cove	2	10.9	212/1	1	16.7%	Partial	Lake Hopatcong	125.81
Sus	Lake Hopatcong	Lake Hopatcong - Dox Incorporated	0	34.6	120/10	0	0.0%	Full	Lake Hopatcong	125.81
Sus	Lake Hopatcong	Lake Hopatcong - Elba Point Homeowners	0	5.5	17/1	0	0.0%	Full	Lake Hopatcong	125.81
Sus	Lake Hopatcong	Lake Hopatcong - Homestead Beach	0	28.4	114/12	0	0.0%	Full	Lake Hopatcong	125.81
Sus	Lake Hopatcong	Lake Hopatcong - Hopatcong Gardens Comm. Club	0	28.7	1800/10	1	14.3%	Partial	Lake Hopatcong	125.81
Sus	Lake Hopatcong	Lake Hopatcong - Hopatcong Shores Property			closed			NA	Lake Hopatcong	125.81
Sus	Lake Hopatcong	Lake Hopatcong - Ingram Cove Community	2	41.7	394/1	1	20.0%	Partial	Lake Hopatcong	125.81

Table A4.2.2-1: Recreational Lake Beach Water Quality in 1999

Table A4.2.2-1: Recreational Lake Beach Water Quality in 1999

County	Township	Recreational Beach	98 Ex	99 FC Geomean	99 Hi/Lo	99 # Exc	99% Ex (%)	DU Assessment	Lake Name on GIS	Acres
Sus	Lake Hopatcong	Lake Hopatcong - Jewish Center	2		closed			NA	Lake Hopatcong	125.81
Sus	Lake Hopatcong	Lake Hopatcong - Logan Hills Beach Club			closed			NA	Lake Hopatcong	125.81
Sus	Lake Hopatcong	Lake Hopatcong - Randal Beach Club	0	9.7	54/1	0	0.0%	Full	Lake Hopatcong	125.81
Sus	Lake Hopatcong	Lake Hopatcong - Shady Lawn Beach Club	0	69.1	331/2	2	25.0%	None	Lake Hopatcong	125.81
Sus	Lake Hoptacong	Lake Hopatcong - Shawnee Dock Association		10.0	10/10	0	0.0%	Full	Lake Hopatcong	125.81
Sus	Lake Hopatcong	Lake Hopatcong - Sperry Springs	0	4.5	16/2	0	0.0%	Full	Lake Hopatcong	125.81
Sus	Lake Hopatcong	Lake Hopatcong - Wildwood Shores POA	0	38.5	220/10	1	25.0%	None	Lake Hopatcong	125.81
Sus	Lake Hopatcong	Lake Hopatcong - Wildwood Shores POA	0	40.6	340/10	1	25.0%	None	Lake Hopatcong	125.81
Sus	Lake Hopatcong	Lake Hopatcong - Wildwood Shores POA	0	32.0	350/10	1	25.0%	None	Lake Hopatcong	125.81
Sus	Andover	Lake Iliff	1	21.4	36/13	0	0.0%	Full	Iliff Lake	34.01
Sus	Byram	Lake Lackawanna: Speers beach	3	29.3	120/10	0	0.0%	Full	Lackawanna Lake	110.03
Sus	Andover	Lake Lenape	0	16.4	136/1	0	0.0%	Full	Lake Lenape	42.15
Sus	Montague	Lake Masipacong: Trail Blazers Boys	0	2.2	10/1	0	0.0%	Full	Mashipacong Pond	23.80
Sus	Montague	Lake Masipacong: Trail Blazers Girls	0	1.0	1/1	0	0.0%	Full	Mashipacong Pond	23.80
Sus	Sparta	Lake Mohawk Alpine Beach	0	18.1	160/10	0	0.0%	Full	Lake Mohawk	66.15
Sus	Sparta	Lake Mohawk Beach 1		29.7	280/10	2	11.1%	Partial	Lake Mohawk	66.15
Sus	Sparta	Lake Mohawk Beach 2	4	53.4	590/10	4	20.0%	Partial	Lake Mohawk	66.15
Sus	Sparta	Lake Mohawk Beach 3	0	21.2	4600/10	1	6.3%	Full	Lake Mohawk	66.15
Sus	Sparta	Lake Mohawk Beach 4	0	30.9	530/10	1	5.9%	Full	Lake Mohawk	66.15
Sus	Sparta	Lake Mohawk Beach 5	0	38.3	450/10	2	11.8%	Partial	Lake Mohawk	66.15
Sus	Sparta	Lake Mohawk Beach 6	3	69.2	11000/10	5	23.8%	Partial	Lake Mohawk	66.15
Sus	Sparta	Lake Mohawk Happly Valley Beach	3	75.4	490/10	4	25.0%	None	Lake Mohawk	66.15
Sus	Sparta	Lake Mohawk Manitou Beach	0		closed			NA	Lake Mohawk	66.15
Sus	Sparta	Lake Mohawk Tamarack Beach	2	54.3	2300/10	3	15.8%	Partial	Lake Mohawk	66.15
Sus	Byram	Lake Mohawk: Sleepy Lagoon	3	37.6	250/5	1	7.1%	Full	Lake Mohawk	66.15
Sus	Vernon	Lake Panorama	0	10.0	10/10	0	0.0%	Full	Panorama Lake	10.61
Sus	Sandyston	Lake Shawanni; Lindley Cook 4H	0	5.2	37/1	0	0.0%	Full	Lake Shawanni	7.45
Sus	Hardyston	Lake Stockholm North	0	9.7	75/1	0	0.0%	Full	Lake Stockholm	14.89
Sus	Hardyston	Lake Stockholm South	0	3.0	35/1	0	0.0%	Full	Lake Stockholm	14.89

Table A4.2.2-1: Recreational Lake Beach Water Quality in 1999

Table A4.2.2-1: Recreational Lake Beach Water Quality in 1999

County	Township	Recreational Beach	98 Ex	99 FC Geomean	99 Hi/Lo	99 # Exc	99% Ex (%)	DU Assessment	Lake Name on GIS	Acres
Sus	Green	Lake Tranquility Beach A		9.4	90/2	0	0.0%	Full	Lake Tranquility	27.67
Sus	Green	Lake Tranquility Beach B			no data			NA	Lake Tranquility	27.67
Sus	Vernon	Lake Wallkill	0	19.4	320/10	1	7.7%	Full	Wallkill Lake	27.08
Sus	Sandyston	Lake Wapalanne: NJ School of Cons.	0	12.6	20/0	0	0.0%	Full	Wapalanne Lake	9.04
Sus	Byram	Mt Allamuchy Scout Reservation	0	40.8	110/10	0	0.0%	Full		
Sus	Byram	Panther Lake Beach 1	0	26.7	50/10	0	0.0%	Full	Panther Lake	20.00
Sus	Byram	Panther Lake Beach 2			no data			NA	Panther Lake	20.00
Sus	Stillwater	Paulinskill Lake #1	2	3.0	11/1	0	0.0%	Full	Paulins Kill Lake	77.39
Sus	Stillwater	Paulinskill Lake #2	2	5.7	58/1	0	0.0%	Full	Paulins Kill Lake	77.39
Sus	Vernon	Pleasant Valley Lake	0	15.7	60/10	0	0.0%	Full	Pleasant Valley Lake	12.83
Sus	Stillwater	Plymouth Lake	0	3.2	21/1	0	0.0%	Full		
Sus	Hardyston	Rock Lodge Club	0		no data			NA	Rock Lodge Pond	3.17
Sus	Sparta	Saginaw Lake	1	17.4	120/10	0	0.0%	Full	Saginaw Lake	10.82
Sus	Vernon	Scenic Lakes	1	11.6	20/10	0	0.0%	Full		
Sus	Sparta	Seneca Lake	2	22.8	170/10	0	0.0%	Full	Seneca Lake	24.70
Sus	Vernon	Spa at Great Gorge Lake			no data			NA		
Sus	Sparta	Sparta Lake	1	33.3	260/10	1	6.3%	Full	Sparta Lake	15.64
Sus	Sandyston	Stokes SF, Stoney Lake	0	33.8	530/3	1	7.7%	Full	Stony Lake	16.00
Sus	Hardyston	Summit Lake	1	68.6	110/30	0	0.0%	Full	Summit Lake	10.04
Sus	Stillwater	Swartswood SP Beach	8	19.5	195/4	0	0.0%	Full	Swartswood Lake	505.41
Sus	Vernon	Tall Timbers POA	0	53.3	2300/10	3	30.0%	None		
Sus	Hardyston	Tamarack Lake North	0	10.0	10/10	0	0.0%	Full	Tamaracks Lake	15.65
Sus	Hardyston	Tamarack Lake South	1	14.1	20/10	0	0.0%	Full	Tamaracks Lake	15.65
Sus	Vernon	The Resorts Club Lake	1	13.8	60/10	0	0.0%	Full		
Sus	Byram	Tomahawk Lake	0	6.2	10/0	0	0.0%	Full	Tomahawk Lake	3.10
Sus	Vernon	Toyes Recreation			no data			NA		
Sus	Sparta	Upper Lake Mohawk	0	41.6	580/10	4	21.1%	Partial	Upper Mohawk Lake	20.31
Sus	Vernon	Vernon Valley Lake	1	10.0	10/10	0	0.0%	Full		
Sus	Vernon	Wawayanda SP	3	7.9	120/1	0	0.0%	Full	Wawayanda Lake	239.32
Sus	Sparta	White Lake Camp Sacajawea	0	12.2	40/10	0	0.0%	Full	White Lake	17.75
Sus	Sparta	White Lake Swim Club Bathing Area 1	2	14.0	70/10	0	0.0%	Full	White Lake	17.75
Sus	Sparta	White Lake Swim Club Bathing Area 2	1	11.0	30/10	0	0.0%	Full	White Lake	17.75
Sus	Walpack	YMCA Long Pine Pond		10.0	10/10	0	0.0%	Full	Long Pine Pond	27.85
War	Millbrook	Camp No-Be-Bos-Co	0	14.4	90/10	0	0.0%	Full		
War	Knowlton	Camp Taylor Lake	0	19.5	150/10	0	0.0%	Full		

Table A4.2.2-1: Recreational Lake Beach Water Quality in 1999

Table A4.2.2-1: Recreational Lake Beach Water Quality in 1999

County	Township	Recreational Beach	98 Ex	99 FC Geomean	99 Hi/Lo	99 # Exc	99% Ex (%)	DU Assessment	Lake Name on GIS	Acres
War	Oxford	Furnace Lake Beach	1	26.5	400/10	2	10.5%	Partial		
War	Franklin	Lawrenceville School Camp Pond	0	21.1	180/10	0	0.0%	Full		
War	Liberty	Mountain Lake	1	38.3	160/10	0	0.0%	Full		
War	Hardwick	Princeton-Blairstown Lake	0	18.1	130/10	0	0.0%	Full		

Table A4.2.2-1: Recreational Lake Beach Water Quality in 1999

County	Lake	Surface Area (Acres)	Total Phosphorus (mg/l)	Chlorophyll a (mg/m3)	Trophic Indicator	Trophic Status	Report Date	Remediation Project (1)	Lake Beach (2)
Atlantic	Hammonton	75	0.03		Macrophytes	Eutrophic	1991	CLP, LBA	YES
Atlantic	Lenape	350	0.05	30.95	Algae	Eutrophic	1988		YES
Atlantic	Stockton State(Fred)	50	0.02	11.05	Algae, Macrophytes	Eutrophic	1988		
Bergen	Overpeck	288	0.33	541.1	Algae, TP	Eutrophic	1983		
Burlington	Absegami	92	0.03		Macrophytes	Eutrophic	1989	LBA	
Burlington	Atsion	90	0.02	5.52		Mesotrophic	1991		YES
Burlington	Batsto	62	0.07	2.31	Macrophytes, TP	Eutrophic	1991		
Burlington	Crystal	25	0.08	78.48	Algae	Eutrophic	1989		
Burlington	Evans	8	0.06	13.88	Algae	Eutrophic	1989		
Burlington	Harrisville Pond	40	0.05	0.89	Macrophytes, TP	Eutrophic	1992		
Burlington	Indian Mills	42.2	0.06	19.9	Algae	Eutrophic	1989		
Burlington	Mirror	129	0.05	31.41	Algae	Eutrophic	1988		YES
Burlington	Oswego	90	0.03	2.43	Macrophytes	Eutrophic	1992		
Burlington	Pakim	8	0.02	12	Algae	Eutrophic	1991		
Burlington	Presidential	52	0.04	38.36	Algae	Eutrophic	1989		YES
Burlington	Smithville	40	0.16	123.4	Algae, Macrophytes	Eutrophic	1989		
Burlington	Strawbridge	25	0.13	41.9	Algae, TP	Eutrophic	1983		
Burlington	Sylvan	5	0.07	10.32	Algae, TP	Eutrophic	1994	LBA	YES
Camden	Cooper River Lake	150	0.25	82.31	Algae	Eutrophic	1989		
Camden	Haddon	15.1	2.3		TP	Eutrophic	1985		
Camden	Kirkwood	32.5	0.38	160.7	Algae, TP	Eutrophic	1983		
Camden	Laurel	11	0.31	106.8	Algae	Eutrophic	1988		
Camden	New Brooklyn	40	0.35	18.9	Algae, Macrophytes	Eutrophic	1983		
Cape May	Dennisville	100	0.1	73.69	Algae, TP	Eutrophic	1988		
Cape May	East Creek	62	0.04		Macrophytes	Eutrophic	1989		
Cape May	Lily	13	0.07	24.9	Algae, Macrophytes	Eutrophic	1983		
Cape May	Nummi	26	0.03		Macrophytes	Eutrophic	1989		YES
Cape May	Tuckahoe	11	0.02	5.97	N/A	Mesotrophic	1992		
Cumberland	Bostwick	32	0.06	125.6	Algae, Macrophytes	Eutrophic	1988		
Cumberland	Burnt Mill	14.6	0.04	6.93	Macrophytes, TP	Eutrophic	1991		
Cumberland	Clark's Pond	97	0.01	1.85	Macrophytes	Eutrophic	1979		YES
Cumberland	Giampietro	9	0.02	60	Algae, Macrophytes	Eutrophic	1987		
Cumberland	Mary Elmer	62	0.12	14.2	Algae, Macrophytes	Eutrophic	1983		
Cumberland	Menantico Pond	150	0.1	7.89	TP	Eutrophic	1992		

Table A4.3.1-1: Lake Trophic Status Assessment Results

County	Lake	Surface Area (Acres)	Total Phosphorus (mg/l)	Chlorophyll a (mg/m3)	Trophic Indicator	Trophic Status	Report Date	Remediation Project (1)	Lake Beach (2)
Cumberland	Shaws Mill	25.1	0.02	2.66	Macrophytes	Eutrophic	1991		
Cumberland	Sunset	88	0.25	130	Algae, TP	Eutrophic	1983		YES
Essex	Branchbrook Park	31.74	0.05	43	Algae, Macrophytes	Eutrophic	1979		
Essex	Verona Park	12.35	0.09	35.3	Algae, TP	Eutrophic	1983		
Essex	Weequahic	80	0.07	52.59	Algae, TP	Eutrophic	1989		
Gloucester	Alcyon	30	0.04	10	Algae, TP	Eutrophic	1982	CLP	
Gloucester	Bell	3	0.04	82	Algae	Eutrophic	1988		YES
Gloucester	Bethel	10	0.03	11.2	Algae, TP	Eutrophic	1983		
Gloucester	Blackwood	25.2	0.12	0.4	Macrophytes, TP	Eutrophic	1990		
Gloucester	Greenwich	19	0.06	14.28	Algae	Eutrophic	1989		
Gloucester	Grenloch	8.5	0.25	14	Algae, TP	Eutrophic	1992	LBA	
Gloucester	Harrisonville	30	0.03	3.69	Macrophytes, TP	Eutrophic	1992	LBA	
Gloucester	Iona	60	0.07	8.06	Macrophytes	Eutrophic	1989		YES
Gloucester	Malaga	44.9	0.02	10.12	Macrophytes, Algae	Eutrophic	1992		YES
Gloucester	Narriticon	37	0.17	73.76	Algae	Eutrophic	1989		
Gloucester	Wilson	58	0.02	23.36	Algae, Macrophytes	Eutrophic	1988		YES
Gloucester	Woodbury	45	0.16	103.2	Algae, TP	Eutrophic	1983	CLP	
Hudson	Lincoln Park Lake	15	0.07	258.1	Algae, TP	Eutrophic	1983		
Hudson	North Hudson Park	19	0.49	85.4	Algae, TP	Eutrophic	1983		
Hunterdon	Amwell	10	0.46	163.1	Algae, TP	Eutrophic	1992		
Hunterdon	Round Valley Rec Area	20	0.02	17.84	Macrophytes, Algae	Eutrophic	1991	LBA	YES
Mercer	Carnegie	222	0.07	10	Algae, TP	Eutrophic	1977		
Mercer	Etra	19	0.03	11.63	Macrophytes, Algae	Eutrophic	1991	CLP	
Mercer	Mercer County Park	270	0.08	51.52	Algae	Eutrophic	1989		
Mercer	Rosedale	38	0.1	31.96	Algae	Eutrophic	1989		
Mercer	Spring Lake	15	0.14	58.4	Macrophytes, Algae	Eutrophic	1983		
Middlesex	Brainerd	15	0.1	49.1	Algae, Macrophytes	Eutrophic	1989		
Middlesex	Davidson's Mill	24	0.13	26.5	Macrophytes, Algae	Eutrophic	1983		
Middlesex	Devoe	58.7	0.14	12.5	Macrophytes, Algae	Eutrophic	1983		
Middlesex	Farrington	290	0.06	19.97	Algae, Macrophytes	Eutrophic	1989		
Middlesex	Hooks Creek	40	0.02	8.21	Macrophytes	Eutrophic	1992	LBA	
Middlesex	Manalapan	40	0.14	12.5	Macrophytes, Algae	Eutrophic	1983		
Middlesex	New Market	15	0.14	74.96	Algae, Macrophytes	Eutrophic	1988		
Monmouth	Allentown	26.5	0.03	13.37	Algae	Eutrophic	1991	CLP	

County	Lake	Surface Area (Acres)	Total Phosphorus (mg/l)	Chlorophyll a (mg/m3)	Trophic Indicator	Trophic Status	Report Date	Remediation Project (1)	Lake Beach (2)
Monmouth	Assunpink	200	0.04	87.56	Algae, Macrophytes	Eutrophic	1991		
Monmouth	Como	34	0.16	64.36	Algae, Macrophytes	Eutrophic	1988	LBA	
Monmouth	Deal	144	0.12	120	Algae, Macrophytes	Eutrophic	1994	CLP, LBA	
Monmouth	Franklin	12	0.02	39.9	Algae	Eutrophic	1987		
Monmouth	Imlaystown	28	0.33	9	Macrophytes, TP	Eutrophic	1983		
Monmouth	Mac's Pond	1	0.05	396	Algae	Eutrophic	1989		
Monmouth	Rising Sun	12	0.02	16.78	Algae	Eutrophic	1991		
Monmouth	Silver Lake	15	0.13	100.63	Algae, Macrophytes	Eutrophic	1991		
Monmouth	Spring	23	0.14	58.4	Algae, Macrophytes	Eutrophic	1983		
Monmouth	Stone Tavern	52	0.29	53.63	Algae, TP	Eutrophic	1992		
Monmouth	Topanemus	52	0.03	12	Macrophytes, Algae	Eutrophic	1983		
Monmouth	Turkey Swamp	18	0.14	180.5	Algae	Eutrophic	1988		
Monmouth	Weamaconk	12	0.15	3.5	Macrophytes, TP	Eutrophic	1993		
Monmouth	Wreck	32	0.03	22.05	Algae	Eutrophic	1988	LBA	
Morris	Ames	14	0.08	97.71	Algae, Macrophytes	Eutrophic	1989		
Morris	Hopatcong	2658.1	0.08	97.71	Macrophytes, Algae	Eutrophic	1989	CLP, LBA	YES
Morris	Mt. Hope Pond	17	0.05	19.25	Algae, Macrophytes	Eutrophic	1989		YES
Morris	Saxton	6	0.07	4.33	Macrophytes	Eutrophic	1988		
Morris	Sunrise	7	0.02	11.54	Algae	Eutrophic	1988		YES
Ocean	Carasaljo	67	0.04	18.97	Algae, Macrophytes	Eutrophic	1989		YES
Ocean	Manahawkin	45.5	0.04	4	Macrophytes	Eutrophic	1983	CLP	YES
Ocean	Oakford	25	0.27	16.34	Algae, TP	Eutrophic	1991		
Ocean	Prospertown	100	0.04	8.71	TP	Eutrophic	1988		
Ocean	Shenandoah	101	0.04	37.27	Macrophytes, Algae	Eutrophic	1992		
Ocean	Success	19	0.34	2.83	Macrophytes	Eutrophic	1992		
Ocean	Turnmill	100	0.02	4.37		Mesotrophic	1991		
Ocean	Wells Mill	22	0.03	1.88	Macrophytes	Eutrophic	1988		
Passaic	Greenwood	720	0.02	3.7	Macrophytes	Eutrophic	1992	CLP, LBA	YES
Passaic	Shepherd	74	0.02	12.46	Algae, Macrophytes	Eutrophic	1989		YES
Salem	Foxmill	16	0.12	55.14	Algae	Eutrophic	1988		
Salem	Memorial	20	0.12	45.6	Algae, TP	Eutrophic	1983		
Salem	Parvin	95	0.04	30.12	Algae, TP	Eutrophic	1992		YES
Salem	Rainbow	79.5	0.07	32	Algae, TP	Eutrophic	1979		
Salem	Thundergust	12	0.03	121.5	Algae	Eutrophic	1991		

County	Lake	Surface Area (Acres)	Total Phosphorus (mg/l)	Chlorophyll a (mg/m3)	Trophic Indicator	Trophic Status	Report Date	Remediation Project (1)	Lake Beach (2)
Somerset	Watchung	15	0.08	10.95	Algae, Macrophytes	Eutrophic	1988		
Sussex	Clove	35	0.1	10.5	Algae, TP	Eutrophic	1983		
Sussex	Cranberry	296	0.07	6.82	Macrophytes, TP	Eutrophic	1989	CLP, LBA	YES
Sussex	Marcia	19.2	0.03	8.29	TP	Eutrophic	1991		YES
Sussex	Musconetcong	321	0.04	14	Macrophytes, Algae	Eutrophic	1993	CLP, LBA	
Sussex	Sawmill	20	0.03	20.41	Macrophytes, Algae	Eutrophic	1992		
Sussex	Steenykill	37	0.14	3.67	Macrophytes, TP	Eutrophic	1992		
Sussex	Stony	15.5	0.14	7.28	Macrophytes, TP	Eutrophic	1992		YES
Sussex	Swartswood	505	0.06	33.8	Algae, Macrophytes	Eutrophic	1988	CLP, LBA	YES
Sussex	Wawayanda	240	0.02	3.96	Macrophytes	Eutrophic	1991		YES
Union	Echo	21.99	0.09	39.3	Algae, TP	Eutrophic	1983		
Union	Surprise	25	0.07	0.78	Macrophytes, TP	Eutrophic	1988		
Warren	Columbia	30	0.07	16.54	Algae, Macrophytes	Eutrophic	1988		
Warren	Ghost	7	0.06	3.51	Macrophytes, TP	Eutrophic	1992	LBA	
Notes									
1. Remediation project funding source									
CLP: Clean Lakes Program Remediation Project, see Table A4.3.3-1 for more information on these projects									
LBA: Lakes Bond Act Remediation Project, see Table A4.3.3-2 for more information on these projects									
2. Lakes Beaches - see Table A4.2.2-1 for additional information on these beaches									

Table A4.3.3-2: FY96 Lakes Bond Act Projects

County	Lake Name	Ownership	Grant	Match	Phase I	Phase II
Atlantic	Hammonton	Public	$232,500.00	$77,500.00	No	Yes
Burlington	Absegami	State	$75,000.00	$0.00	Yes	No
Burlington	Sylvan	Public	$924,473.00	$308,157.67	No	Yes
Gloucester	Grenloch	Public	$47,500.00	$47,500.00	Yes	No
Gloucester	Harrisonville	State	$33,950.00	$0.00	Yes	No
Hunterdon	Round Valley	State	$25,000.00	$0.00	Yes	No
Middlesex	Hooks Creek	State	$54,000.00	$0.00	Yes	No
Monmouth	Como	Public	$42,500.00	$42,500.00	Yes	No
Monmouth	Deal	Public	$350,000.00	$117,000.00	No	Yes
Monmouth	Wreck	Public	$42,500.00	$42,500.00	Yes	No
Morris	Hopatcong	State	$480,000.00	$0.00	No	Yes
Morris	Hopatcong	Public	$50,625.00	$16,875.00	No	Yes
Morris	Swannanoa	Private	$375,000.00	$125,000.00	No	Yes
Ocean	Pine	Public	$42,500.00	$42,500.00	Yes	No
Passaic	Greenwood	Public	$246,000.00	$83,000.00	No	Yes
Passaic	Upper Greenwood	Private	$375,000.00	$125,000.00	No	Yes
Sussex	Cranberry	Public	$234,100.00	$78,080.00	No	Yes
Sussex	Mohawk	Private	$750,000.00	$250,000.00	No	Yes
Sussex	Musconetcong	State	$150,000.00	$0.00	No	Yes
Sussex	Swartswood	Public	$104,202.00	$51,673.00	No	Yes
Sussex	Swartswood	State	$72,650.00	$0.00	No	Yes
Warren	Ghost	State	$35,000.00	$0.00	Yes	No
	Budd	Public	$207,500.00	$69,166.67	No	Yes
	Fletcher	Public	$42,500.00	$42,500.00	Yes	No
	Poricy	Public	$7,500.00	$7,500.00	Yes	No

Table A5.2.2-1a Recreational designated Use Attainment in NJ Estuaries and Tidal Rivers (1995-97)

Waterbody	# FC Samples	Geometric Mean	%>400	Use Attainment
Absecon Bay	81	10.1	2.5%	Full
Barnegat Bay & Tribs	174	7.4	0.6%	Full
Cape May	24	30.1	8.3%	Full
Corson Inlet	12	4.2	0.0%	Full
Delaware Bay	37	5.1	0.0%	Assessed by DRBC
Great Bay	66	5.5	0.0%	Full
Great Egg Harbor Inlet Area	42	10.5	4.8%	Full
Great Egg Harbor River	33	44.2	9.1%	Full
Hereford Inlet Area	29	5.6	0.0%	Full
Little Egg Harbor	20	4.3	0.0%	Full
Manasquan River	6	5.7	0.0%	Full
Maurice River & Cove	12	134.9	16.7%	Partial
Mullica River	28	10.7	0.0%	Full
Navesink River	24	15.6	8.3%	Full
Raritan Bay	26	3.8	0.0%	Full
Shark River	25	44.4	8.0%	Full
Shrewsbury River	16	7.6	0.0%	Full
Total	**655**			

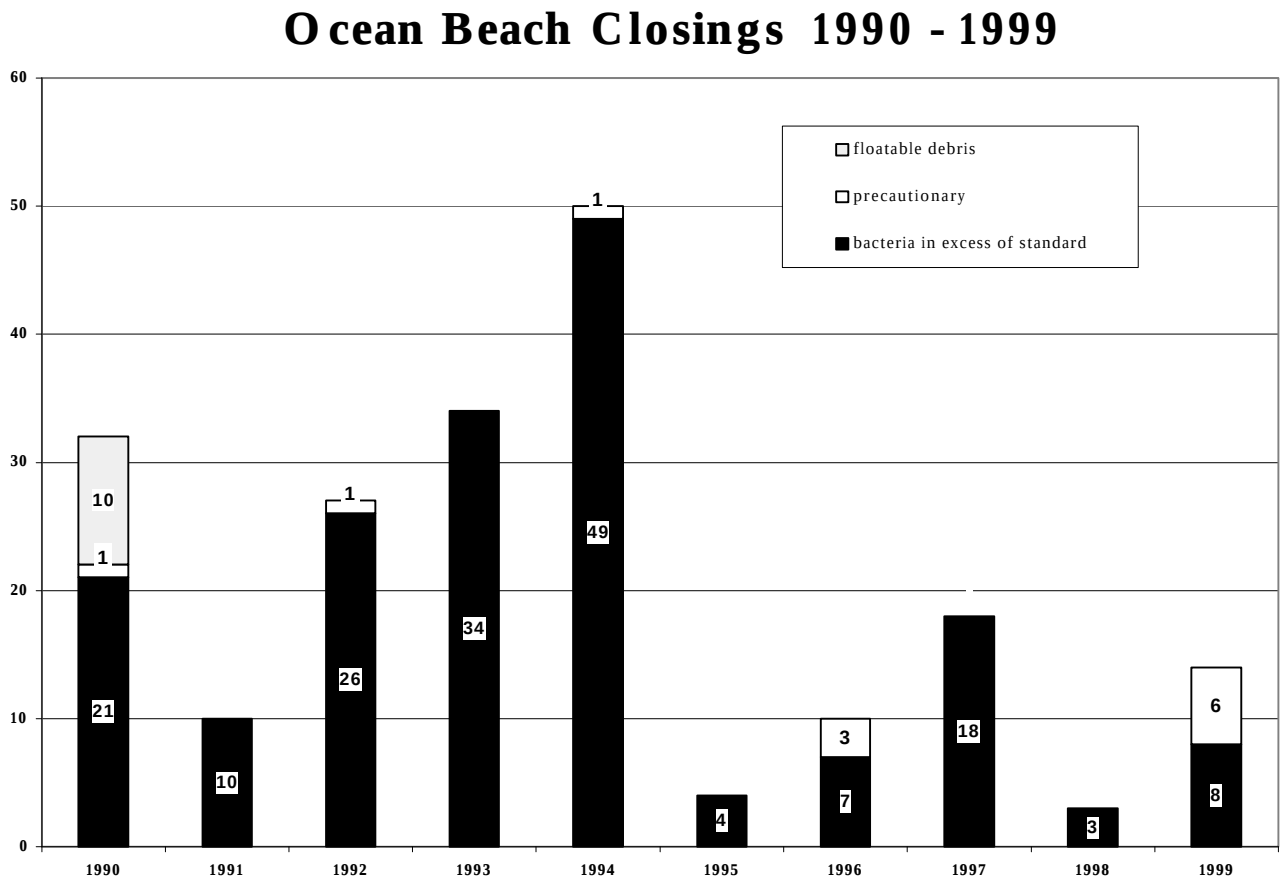
Table A5.2.2-1b: Recreational Designated Use Attainment in NJ Ocean Waters (1997-98)

Ocean	# FC Samples	Geometric Mean Range	% of Geometric means >50	Use Attainment
1997	452	1.0-4.5	100.0%	Full
1998	547	1.0-9.1	100.0%	Full

Appendix A5.2.2-2: Indicator of Ocean and Bay Beach Closings

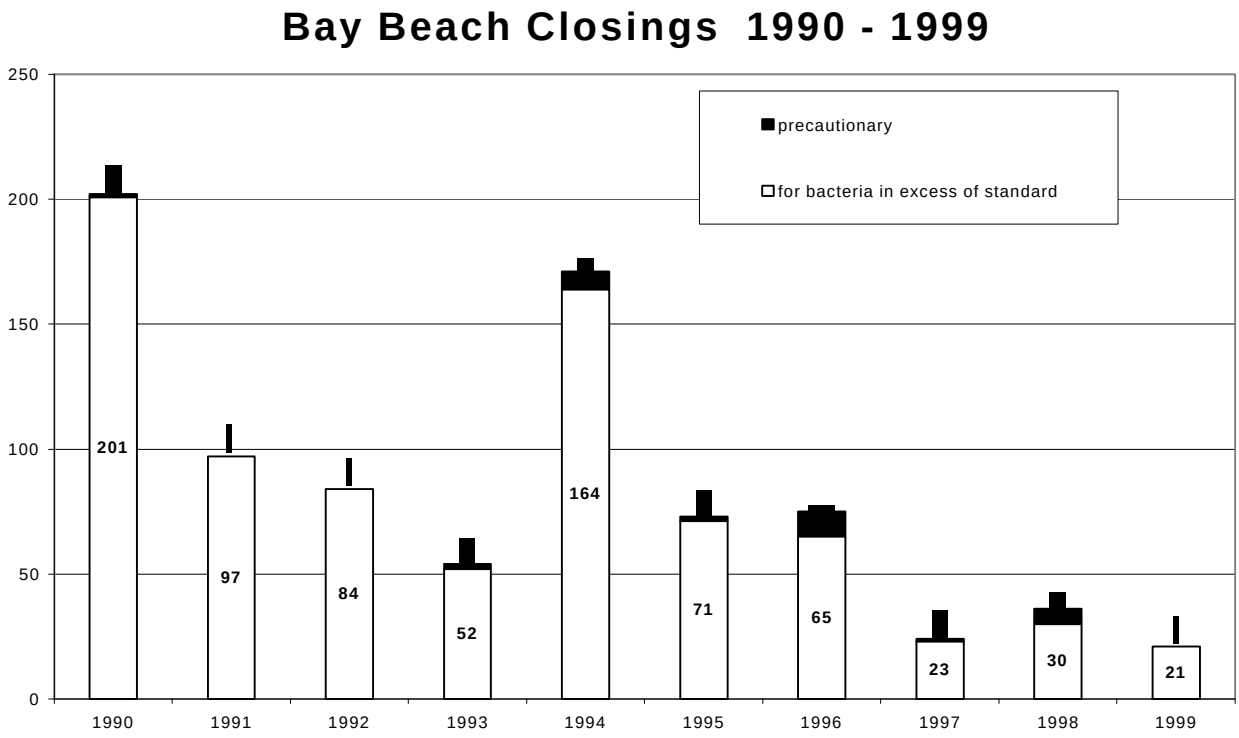
Milestone: ***By 2005 100% of New Jersey's coastal recreational beach waters will be safe for swimming***
Indicator: Ocean and bay beach closings; number of miles of ocean and bay bathing beaches attaining recreational designated uses
Type of Indicator: Condition

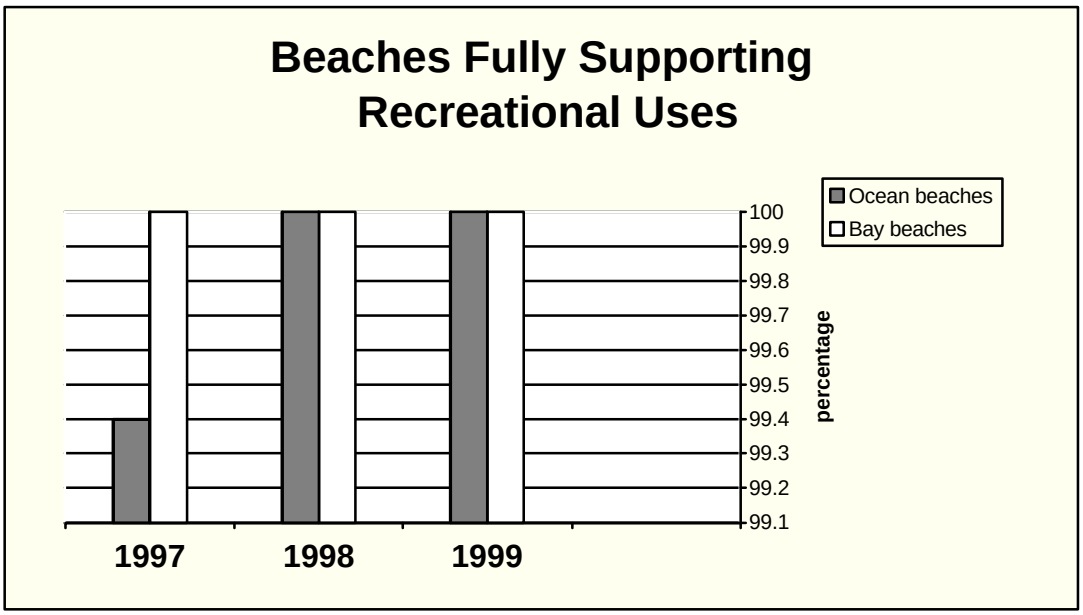
In 1997 and 1998 New Jersey experienced the lowest number of ocean beach closings since the beginning of the Cooperative Coastal Monitoring Program. One hundred percent of ocean and bay beaches fully supported recreational uses in 1997. In 1998, 127 miles (100%) and 3.9 of 4 miles (99.3%) of bay beaches fully supported recreational use.



Bay Beach Closings

Note: All closures due to bacteria, none due to floatable material.





Data Description

NJDEP uses fecal coliform concentrations to detect the presence of sewage and/or nonpoint source pollution at recreational beaches. The New Jersey Department of Health and Senior Services adopted a primary contact standard of 200 fecal organisms in 100 milliliters of water. When fecal coliform concentrations exceed this standard, the waters are considered unsafe for swimming and are closed. Trends in fecal coliform concentrations are used to identify locations where water quality is improving, declining or remaining stable and the effectiveness of remediation actions. Recreational designated use attainment provides a measure of miles supporting recreational uses of the beaches, based on the frequency of closings during the 100 day beach season. The CCMP evaluates water quality for swimming using data collected during the summer.

Status Information

Data collected in 1997 and 1998 were compared to the fecal coliform criteria. During this period, all 179 (100%) ocean stations met the standard. In 1997 all 138 bay beaches also met the standard. In 1998 137 of the 138 bay beaches (99.3%) met the standard. This information is based on weekly sampling at each station during each season, at least 5000 to 6000 sampling events.

In order to link indicators, core performance measures and Water Quality Inventory Reporting, these results are also provided in terms of recreational designated use attainment. Recreational designated use for New Jersey beaches has been defined by adapting EPA's Water Quality Inventory Report Guidance as follows: for 100 beach days between Memorial Day and Labor Day, 0-10% beach days closed – full support; 11-25% beach days closed – partial support; greater than 25% beach days closed – no support.

In 1998, 100% of New Jersey's 179 ocean beaches (127 miles) fully supported recreational designated uses. There are an estimated 3.92 miles of bay beaches: each of 138 bay beaches was estimated to be 150 feet of beachfront. In 1998, 3.9 of 4 estimated bay beach miles (99.3%) fully supported recreational use.

Trends Information

Between 1988 and 1998 the CCMP has recorded a significant decrease in the number and duration of ocean and bay beach closing days. In 1988 a record high 784 ocean beach closing days occurred due to exceedances of the primary contact standard for bacteria at bathing beaches. In addition, 19 closings were required due to washups of floatable debris. By 1998, ocean beach closings had dropped significantly with only three closings due to high bacteria. No beaches have been closed due to floatable debris in coastal waters since 1990.

A similar trend has been evident at bay beaches. In 1989, 232 bay beaches were closed due to exceedances in the primary contact standard for bacteria at bathing beaches. From 1990 to 1998 the number of bay beach closings ranged from 202 in 1990 to 36 in 1998.

Data Characteristics

Local and State environmental health agencies that participate in the Cooperative Coastal Monitoring Program (CCMP) perform sanitary surveys of beach areas and monitor concentrations of bacteria in nearshore coastal and estuarine waters to assess the acceptability of these waters for recreational bathing. These activities and the resulting data are used to respond to immediate public health

concerns associated with recreational water quality and to eliminate the sources of fecal contamination that impact coastal waters. As part of this program, NJDEP routinely inspects the 17 wastewater treatment facilities that discharge to the ocean. NJDEP also performs daily aerial surveillance of New Jersey nearshore coastal waters and the Hudson-Raritan estuaries to observe changing coastal water quality conditions and potential pollution sources.

The State Sanitary Code N.J.A.C. 8:26 and the NJDEP *Field Sampling Procedures Manual* prescribe the sampling techniques and beach opening and closing procedures the agencies use for the Cooperative Coastal Monitoring Program. The agencies perform routine sampling from mid-May through mid-September on Mondays. Samples are analyzed for fecal coliform concentrations using NJDEP-certified laboratories including those of the utilities authorities. MPN or membrane filter methods provide results within 24 hours of sampling. In 1998, as in a number of previous years, samples were collected and analyzed for enterococci from a subset of ocean and bay stations in all of the coastal counties as the state prepares for further federal direction in beach management.

The recreational bathing standard for all waters in New Jersey is 200 fecal coliforms per 100 ml of sample, and closings are based on two consecutive single samples. If the results from the first sampling of the week are within the standard, sampling is complete until the following week. If a sample from a station exceeds the standard, the water at that station is immediately resampled, and adjacent beaches are sampled to determine the extent of the pollution. A sanitary survey of the area is also conducted. A second consecutive fecal coliform concentration exceeding the standard or the identification of a pollution source requires closing of the beach. Health officials retain the discretion to close beaches for any public health reason, with or without water quality data.

In 1997 and 1998, the program included 179 ocean water quality monitoring stations, covering 127 miles of ocean beach and 138 bay monitoring stations, covering about 4 miles of bay beaches. Most ocean stations are sampled to evaluate the water quality at several lifeguarded beaches in an "area" rather than just one lifeguarded beach. These areas consist of contiguous, similar beaches with no permanent pollution sources. Individual beaches with permanent sources are assigned monitoring stations. A monitoring station is assigned to each recreational bay beach because of their locations on noncontiguous shorelines. To estimate bay beach miles, each of 138 bay beaches was estimated to be 50 yards long, for a total of about 4 miles. These estimates will be improved in the future.

Data Strengths and Limitations

Fecal coliform data have been collected consistently since 1986, providing a rich source of information. Trained personnel collect all samples using standard procedures. Samples are analyzed at certified laboratories. Analysis methods and detection limits for this parameter have remained consistent since the beginning of the CCMP.

The fecal coliform data do not provide direct measure of the threat to human health from pathogenic contamination. These data indicate the presence of fecal material in water. Fecal coliform bacteria are generally not a threat to human health, but other pathogens contained in human and animal fecal material do threaten human health. These pathogens may or may not be present with the fecal coliform bacteria. However, it is time consuming, expensive and not possible to test for all pathogenic organisms in water. EPA is conducting research to evaluate other indicator organisms that would provide a better assessment of the threat to human health from exposure to pathogens while swimming.

Discussion

The ubiquitous nature of fecal coliform bacteria highlights the importance of swimming only in designated bathing areas, which are tested regularly by local or county health agencies.

Water quality at locations monitored by county health departments is excellent, as shown by low beach closing rates and almost full designated use attainment. The geometric means of fecal coliform concentrations at ocean monitoring points is on Figure 3 below. These values have remained relatively consistent. Slight differences may be due to increased rainfall in certain years.

Closures due to floatables have not occurred in recent years due to removal of floating and shoreline debris. The Army Corp of Engineers removed 21,046,000 pounds of floatable debris from the New York Harbor in 1997 and 1998. The Clean Shores program removed 10,800,000 pounds of debris from New Jersey shorelines.

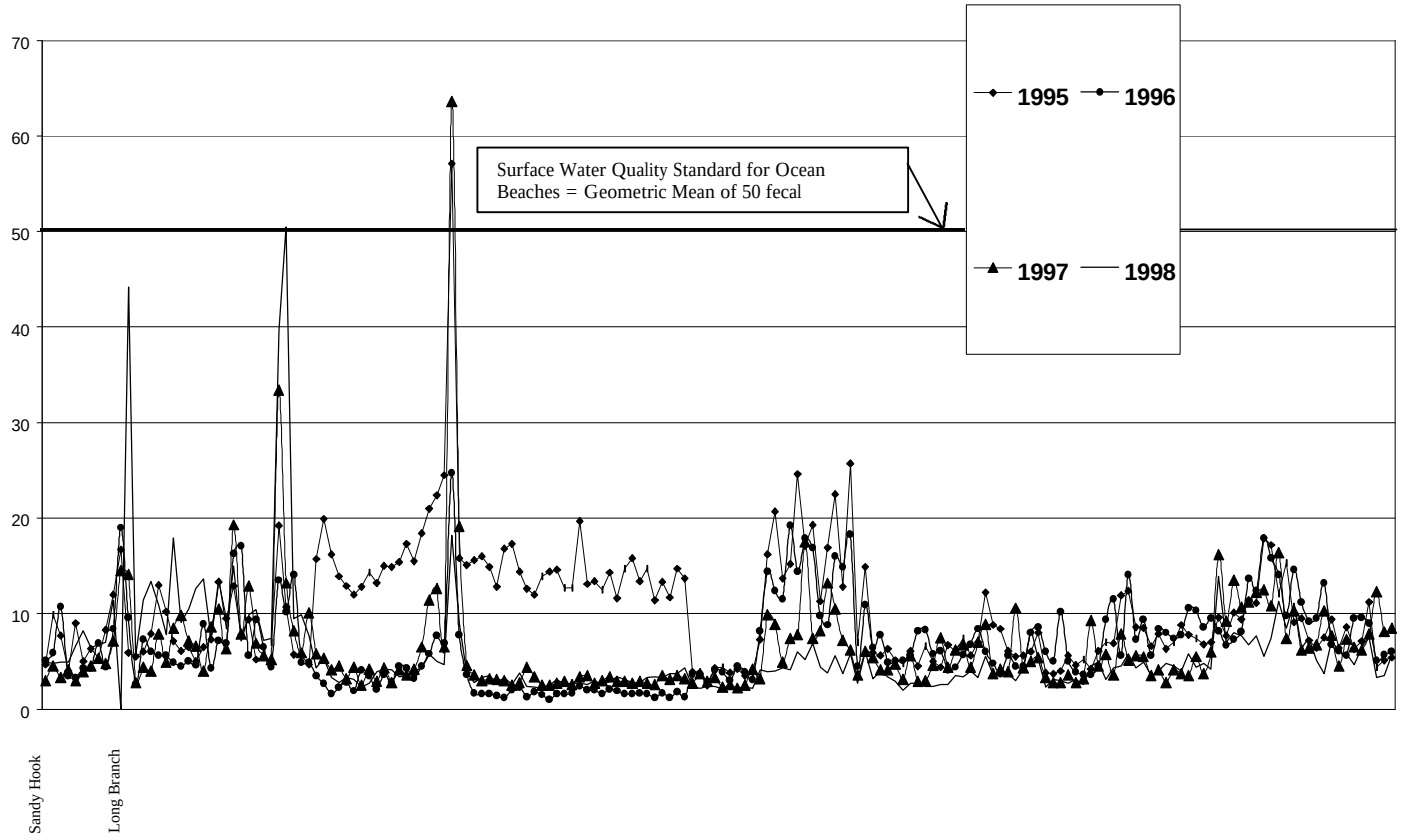
At locations where periodic episodes of fecal coliform contamination are evident, the sources of contamination are generally known or can be identified by conducting a sanitary survey. Both point and nonpoint sources of pollution may contribute to fecal contamination and through implementation of watershed management, possible specific nonpoint source problems may be identified.

Nonpoint sources are considered to be the major source of fecal coliform pollution. Nonpoint sources include municipal stormwater, which is released to the ocean and bays from over 7000 outfalls, combined sewer overflows, and domestic and wild animal populations.

Sewage effluent is disinfected so that effluent concentrations are 200 organisms per 100 milliliters or less. The municipal utilities authorities, which manage the sewage treatment facilities and their ocean discharges, are an integral part of the overall monitoring program in New Jersey, and they are key to the improvement in and the current good quality of the state's coastal waters. However, occasional failures of collection systems and even rarer instances of treatment system failures occur, resulting in beach closings.

To implement the more comprehensive approach to the improvement of New Jersey's coastal water quality which the reduction of nonpoint sources of bacteria require, NJDEP is working with private and public sectors to promote watershed management. The water quality data and beach closing numbers, therefore, will be used as indicators of the success of the strategies implemented to resolve remaining water quality problems of various origins.

Geometric Means of Fecal Coliform at 179 Ocean Sampling Stations
1995 - 1998



Appendix A5.2.3-1: Beach Closing Action Plan

Division of Watershed Management
Atlantic Coastal Bureau
Cooperative Coastal Monitoring Program

Milestone: By 2005, 100 percent of New Jersey's coastal recreational beaches will be safe for swimming.

The main strategies to be employed include public education regarding individual responsibility to minimize impacts on lake and coastal waters, infrastructure improvements for combined sewers and municipal sewerage facilities, and programs to address municipal stormwater and animal waste runoff.

In the past decade ocean beach closings reached a high of 50 closings in 1994 and a low of 3 closings in 1998. Bay beach closings went from a high of 202 in 1990 to a low of 21 in 1999. Beach closings are usually associated with the amount of rainfall and the resulting stormwater discharges along the coast during the bathing season. Other sources of contaminated stormwater include interconnections and cross connections of stormwater and sanitary sewer lines, irregular schedule of street sweeping and maintenance and pet waste. This Beach Closing Action Plan will address those sources of contamination and will include an educational component to inform the public of everyday actions that can reduce contamination in coastal waters.

Atlantic City – NJDEP water enforcement will instruct county and local health departments and other responsible parties to enact an inspection schedule for stormwater collection systems and catch basin clean outs and to maintain a schedule for street sweeping. NJDEP will use Sewage Infrastructure Improvement Act (SIIA) funds as necessary to pay for camera work to inspect sewer lines for broken pipes, illegal connections and other sources of contamination. The city will be required to maintain beachfront access ports to the stormwater system. The health department must also present a plan for inspection of laterals and grease traps. These requirements may be used to satisfy penalties tied to an existing settlement of a violation with the city for a sewage spill at the public works garage. NJDEP's Water Compliance and Enforcement (WCE) staff will supervise the inspection and maintenance schedules.

Wreck Pond, Spring Lake - Sources of pollution to the pond include stormwater discharges directly to the pond, a large migratory and non-migratory bird population, the local street debris disposal pile, pet waste and lawn fertilization. All of these factors contribute to the eutrofication of the pond and to the elevated levels of fecal coliform bacteria discharged to the ocean during rain events. NJDEP will work with the Freehold Soil Conservation District, the Monmouth County Mosquito Control Commission and the National Resource Conservation Service on a plan to dredge Wreck Pond and restore the stream bank to make the pond less attractive to bird populations. NJDEP will also include the Wreck Pond Watershed Association to get input on the pond restoration from citizens and local officials.

NJDEP will create a long-term plan to evaluate impacts of dredging in Wreck Pond and changes in water quality at Brown Avenue beach to assess the potential of improving other coastal lakes with future dredging projects. Sylvan Lake in Bradley Beach and Deal and Wesley Lakes in Asbury Park and Fletcher Lake in Ocean Grove will all be included in an ongoing coastal lake inspection program. These coastal lakes have the potential to discharge stormwater to the ocean with elevated levels of bacteria which could result in ocean beach closings. Regular inspection, cleaning and maintenance of stormwater collection systems and catch basins around coastal lakes will be conducted and supervised by WCE staff.

South Bath Avenue, Long Branch – There have been two beach closings at South Bath Avenue in the past decade. Although the actual number of beach closings is low, the potential for water quality problems at the bathing beach is high. South Bath Avenue's recurrent problems with contaminated stormwater will be addressed in a similar manner as other coastal areas. A regular schedule of stormwater system inspection, cleaning and maintenance will be implemented and supervised by WCE staff. Camera work may be necessary to identify whether there are existing sanitary system/stormwater system interconnections or cross connections.

NJDEP will use SIIA money as necessary to facilitate camera work of stormwater collection systems in problem areas. SIIA money may be used to purchase cameras for each of the coastal counties.

Regular stormwater system inspection requirements will be incorporated into either WCE schedule or through water enforcement to a CEHA agency. Since years of coastal sewage treatment plant inspections have seldom revealed violations that would result in beach closings, NJDEP will consider shifting the focus away from biweekly coastal Sewage Treatment Plant (STP) inspections to use those same resources inspecting stormwater collection systems.

Several problem storm drains in Ocean County are under the jurisdiction of the Department of Transportation (DOT). NJDEP will work with DOT to identify storm drains that occasionally get clogged with sand and need regular maintenance. This maintenance would alleviate the bacteria problems in some of the bay beaches in Ocean County. NJDEP could use T21 money and work in partnership with DOT on environmental restoration projects for state roads and storm drains.

Bay beaches with high numbers of closings due to contaminated stormwater, such as Hancock Avenue in Seaside Heights, Beachwood Beach in Beachwood, Windward Beach in Brick, Money Island and Shelter Cove beaches in Dover and Station Road and Avon Road beaches in Pine Beach, will be addressed the same way as ocean beaches. Stormwater systems will be inspected and a schedule of cleaning will be implemented and supervised by water enforcement staff.

NJDEP will work with the Monmouth County Health Department to reevaluate L Street Beach in Belmar to determine whether automatic beach closing after rainfall is still necessary.

NJDEP will work with watershed associations to notify coastal municipalities that domestic pets and the feeding of wild birds are also sources of bacteria impacting bathing beaches and that "pooper scooper" and "no feeding the ducks" ordinances need to be strictly enforced. Educational signs can be placed along waterways impacting bathing beaches.

The above actions will be part of a long-term plan to reduce beach closings and will first be implemented in areas identified as having a potential for discharging stormwater with elevated levels of bacteria. Tools and actions developed for those areas will be used to address potential problems in other coastal municipalities. The stormwater collection system and catch basin maintenance program will then be extended to include all 94 coastal municipalities. Storm drain sampling will be conducted as necessary to evaluate the effectiveness of regular street sweeping, storm drain and catch basin maintenance. NJDEP's Division of Watershed Management (DWM) expects that a regular schedule of street sweeping and storm drain inspections and cleanings should considerably reduce the number of necessary closings due to high bacteria.

Status Report for the Beach Closing Action Plan

Routine Storm Water Inspections: As of July 1, 2000, inspections have been completed in the following municipalities: Absecon, Atlantic City, Avalon, Brigantine, Cape May City, Cape May Point, Long Port, Lower Township, Margate, North Wildwood, Ocean City, Pleasantville, Sea Isle City, Somers Point, Stone Harbor, Ventnor, W. Cape May, W. Wildwood, Wildwood Crest, Wildwood, Spring Lake, Sea Girt, Bradley Beach, Avon by the Sea, Ocean Grove, Asbury Park, Long Branch, Belmar, Loch Arbour, Allenhurst, Seaside, Brick, Beachwood, Dover, Pine Beach.

The inspections revealed that the most common violation was not having updated Storm Water Infrastructure maps.

Atlantic City: Inspections were conducted on March 2, 2000. The reports found that numerous inlets contained trash and debris, some trash cans on the boardwalk had no covers, tools used to inspect storm sewers were inadequate (sledgehammers), and the city's storm sewer crew was too small (5 people). A follow up letter was sent to the city explaining the need to develop an annual inspection and cleaning schedule for storm sewers and that the grease traps needed to be inspected and cleaned two times per year. On March 30, 2000 Southern Water Enforcement met with the city's engineer, health department representatives and administrator's office. They discussed inspecting/cleaning of all grease traps and how the $13,000 Watershed grant should be spent. Everyone was also kept up to speed on the SIIA and where they should go from there. Suggestions were also made to educate the city's storm sewer crew on proper procedures. A separate meeting was held with the Atlantic City Sewerage Company the same day discussing the same agenda.

Point Pleasant/Bayhead: The contract for the pre-dredging diagnostic feasibility studies for Lake Louise, Lake of the Lilies and Twilight Lake are being processed by the Department's Contract Administration Office.

Wreck Pond, Spring Lake: Inspections in Spring Lake are completed. Nothing out of the ordinary was found. One stormwater discharge was found to have a significant flow rate, even without a recent rainfall. The source of this is being investigated. Inspections in Sea Girt will be done within the next week. A meeting with local officials is scheduled for the beginning of July to discuss dredging issues for Wreck Pond.

South Bath Avenue, Long Branch: Turner Shell is working with the Long Branch Health Officer compiling contract documents. The contract has been sent to the Long Branch Health Department and is awaiting final signatures.

The contract with Monmouth University and the NJ Marine Sciences Consortium for DNA analysis of fecal coliform bacteria is on schedule for completion by July 15, 2000. The contract is awaiting final signatures.

Figure A5.1 Estuary and Coastal Area of Assessment for Aquatic Life

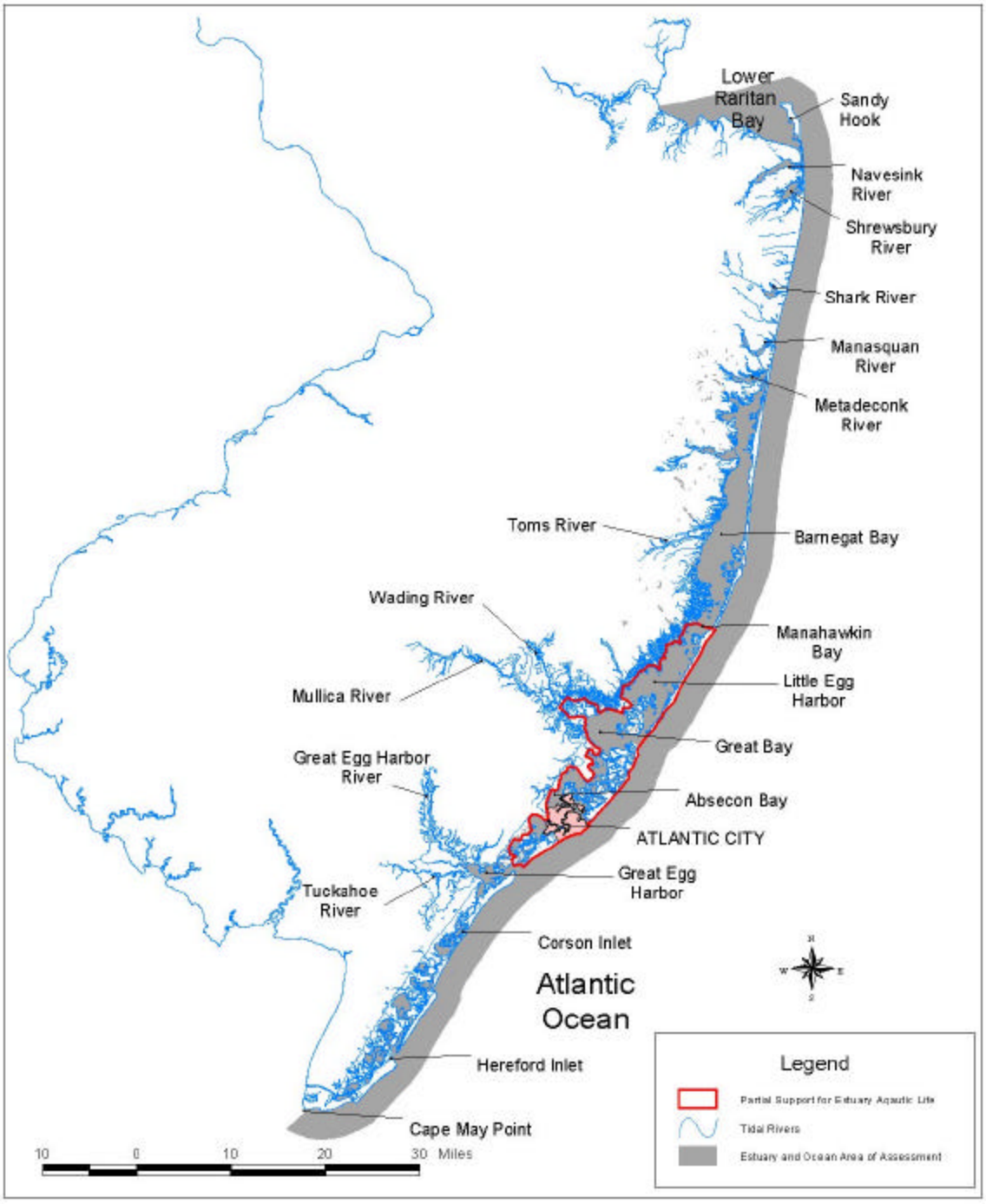


Figure A5.1.1 Estuary Monitoring Network in New Jersey

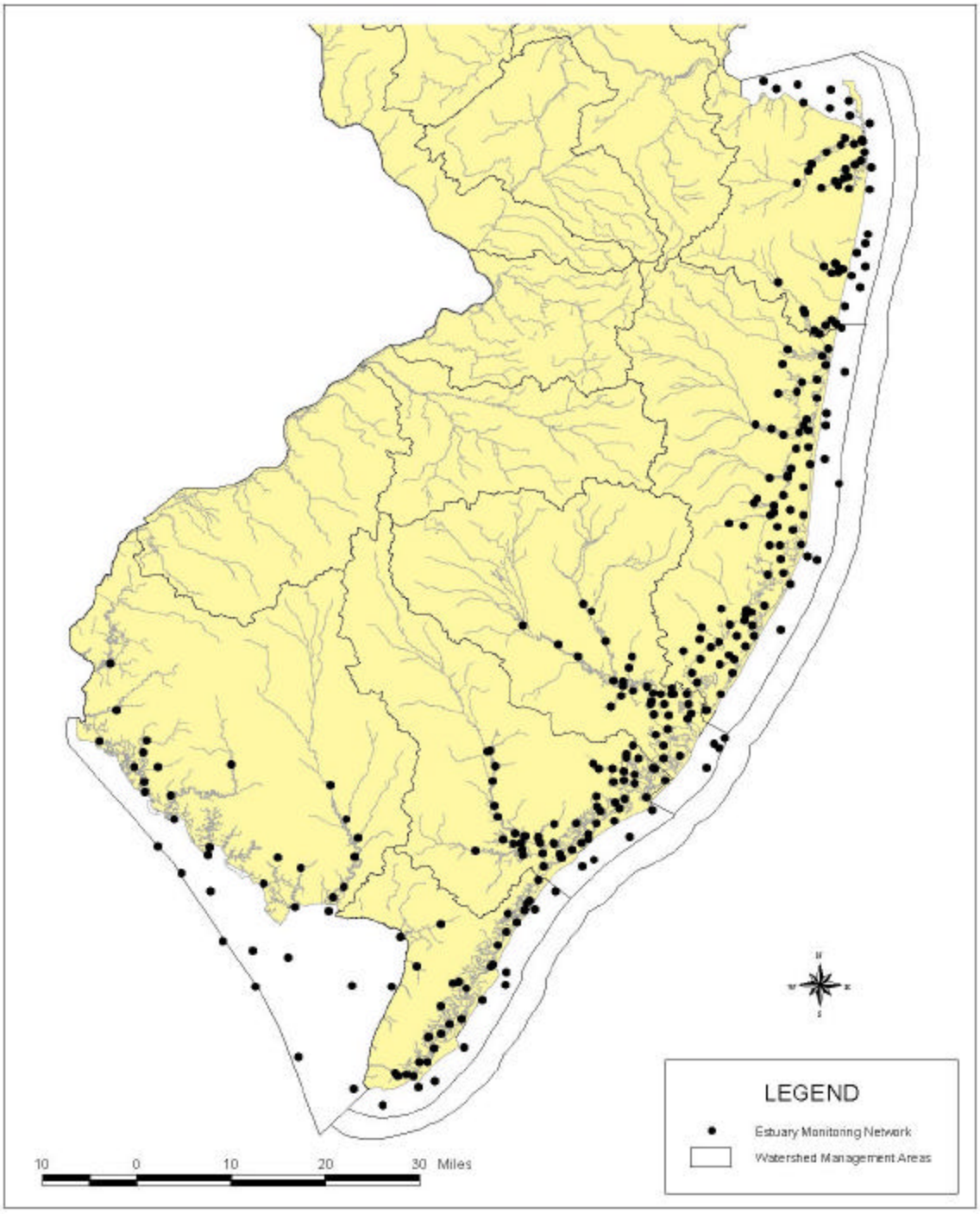


Figure A5-2 Estuary and Coastal Area of Assessment for Recreational Use

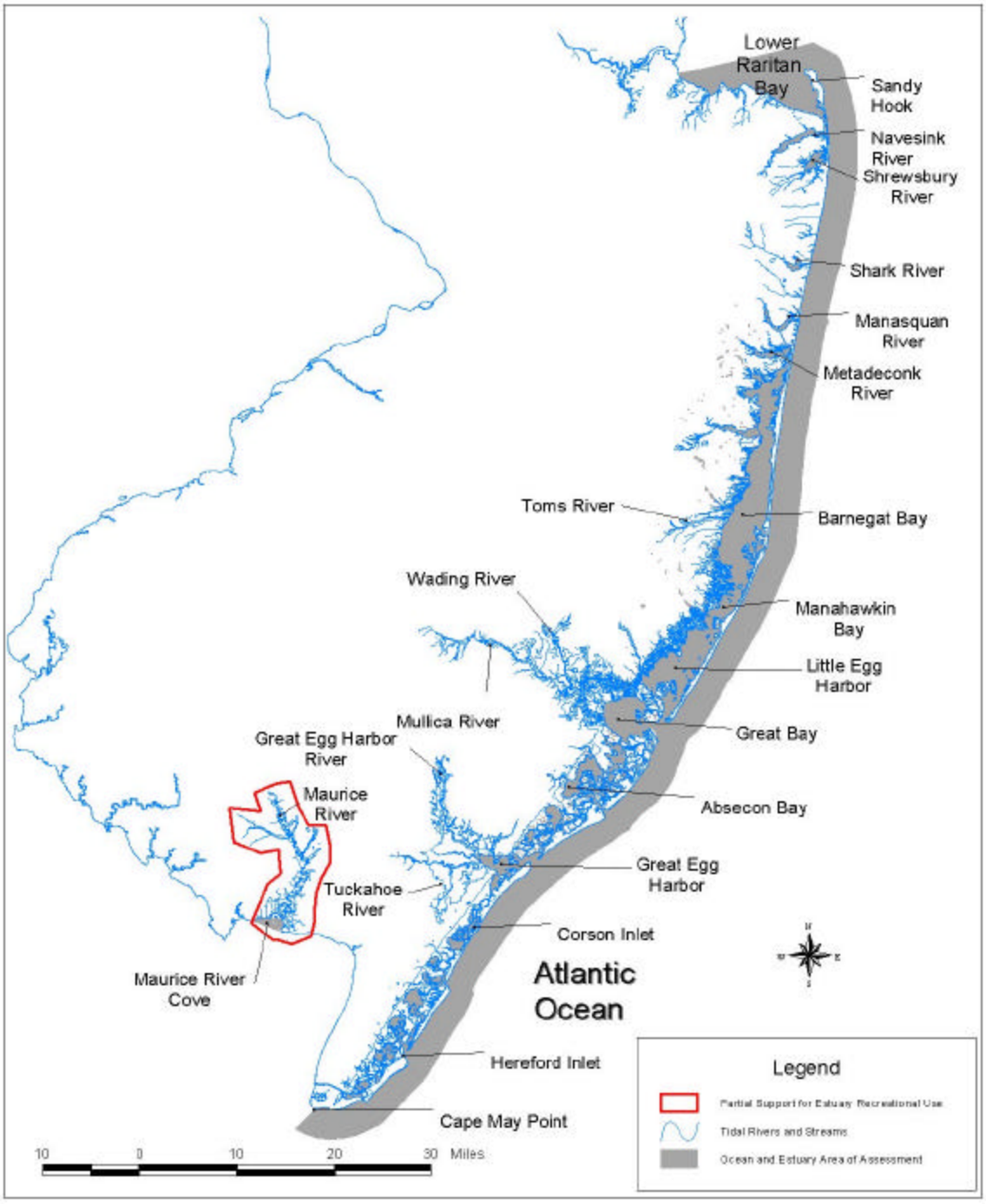


Figure A5.2.3-1 Stormwater Outfalls in Asbury Park Area, New Jersey

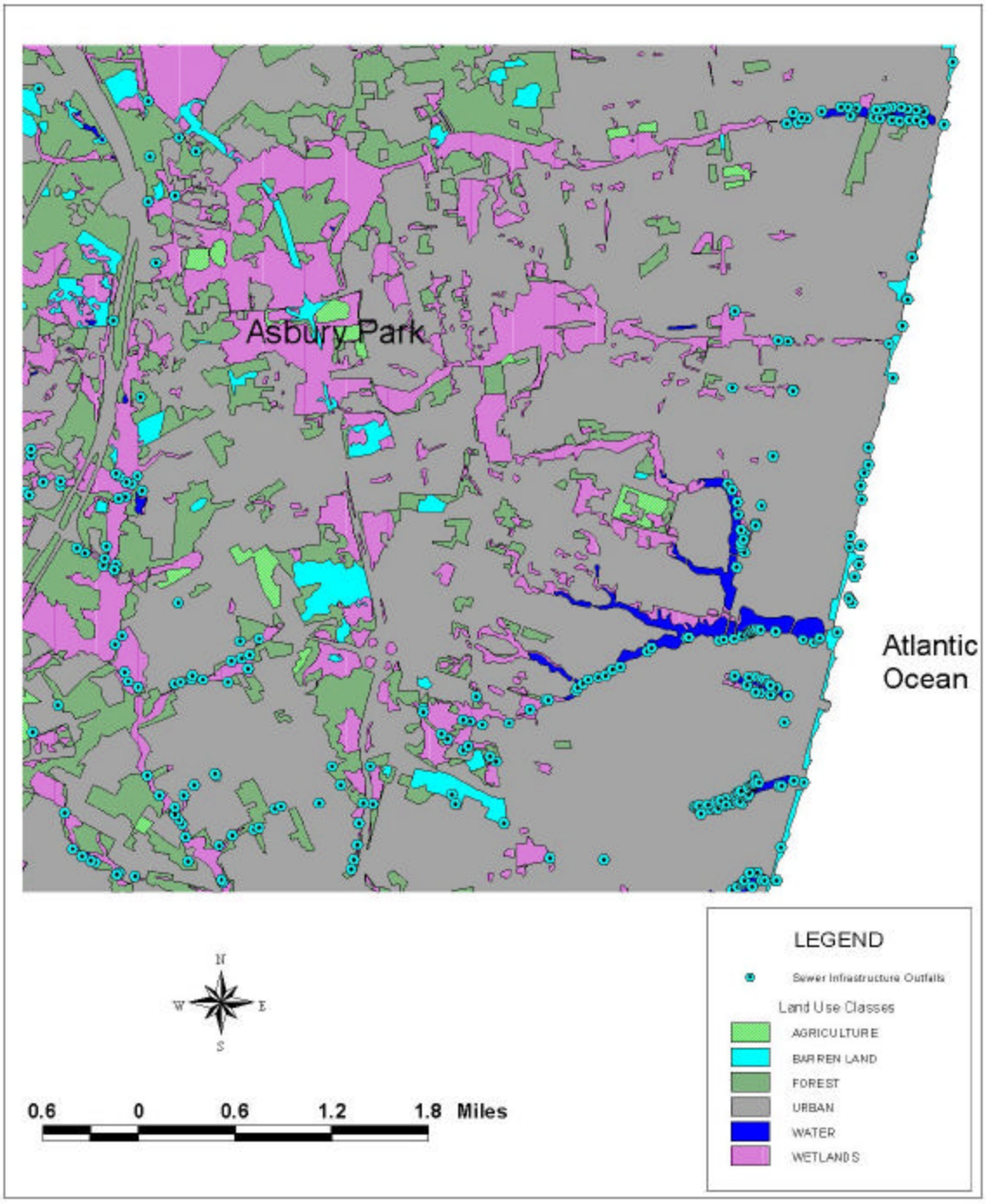
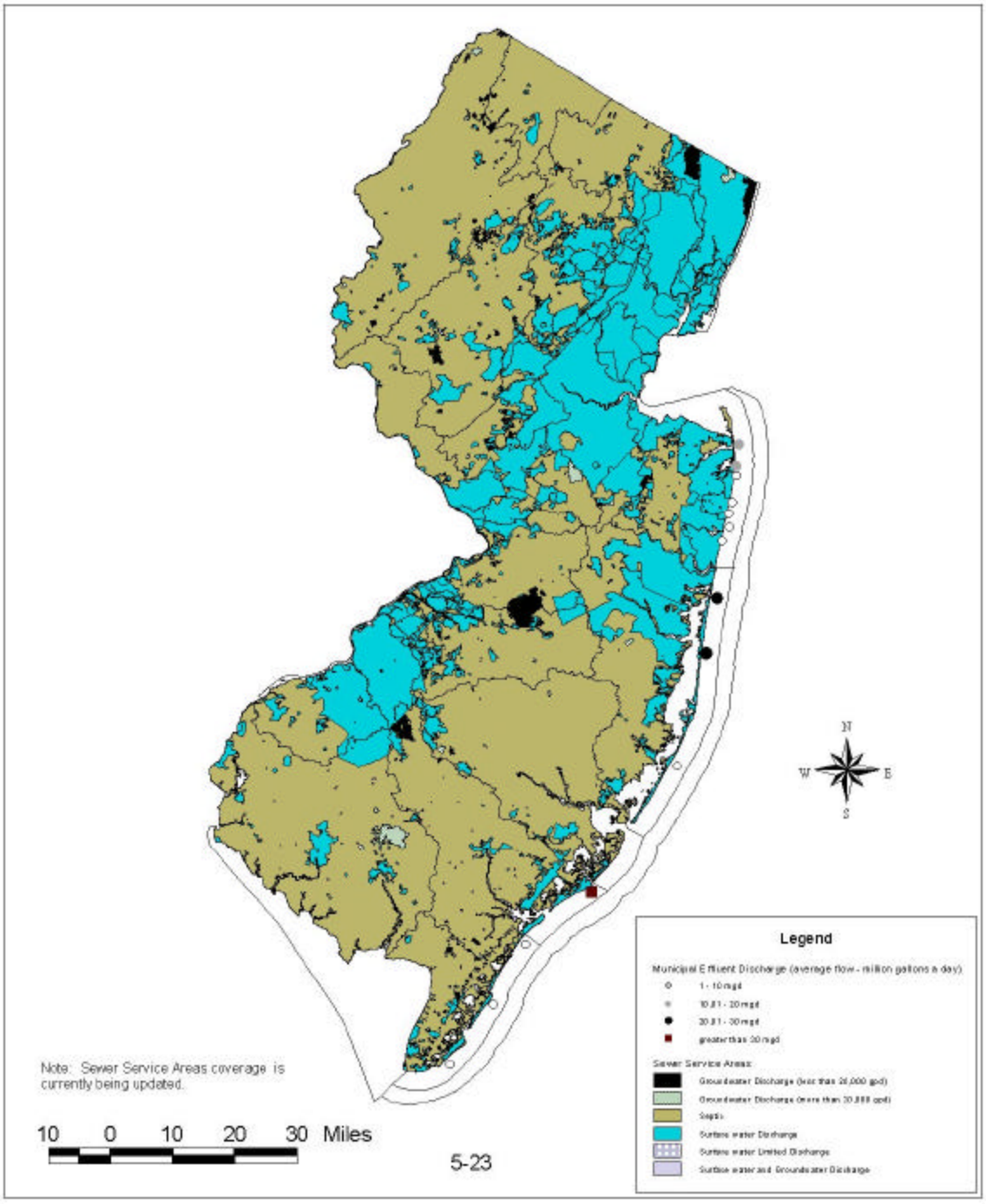


Figure A5.2.3-2 Sewer Service Areas and Municipal Effluent Discharges to Ocean Waters



Chapter 6 Wetlands Assessment Appendix

Milestone: Achieve no net loss of wetlands by year 2005 and implement effective techniques for increased creation of wetlands.

Indicator: Status and trends of wetlands impacts authorized by NJDEP

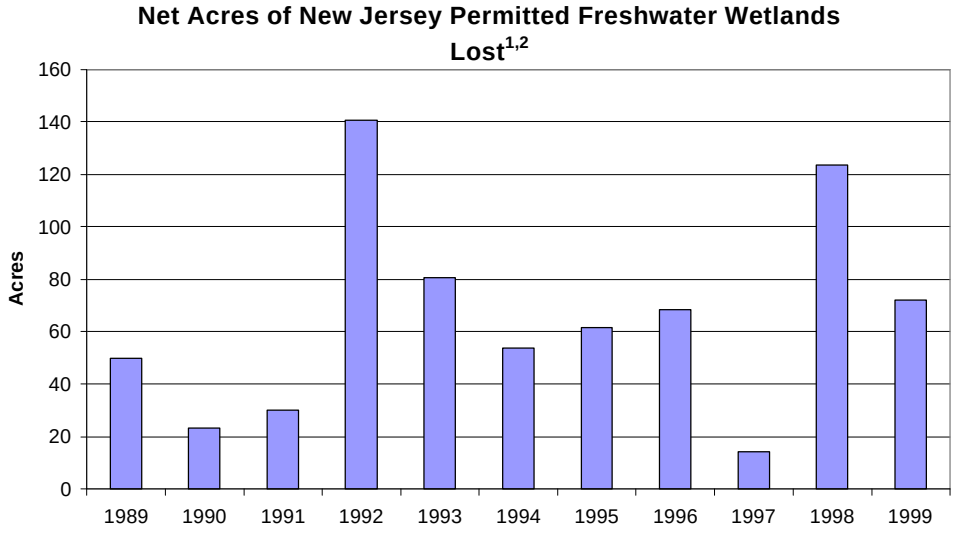
Type of Indicator: Cause

Indicator: Status and trends of restoration/creation/enhancement projects.

Type of Indicator: Response

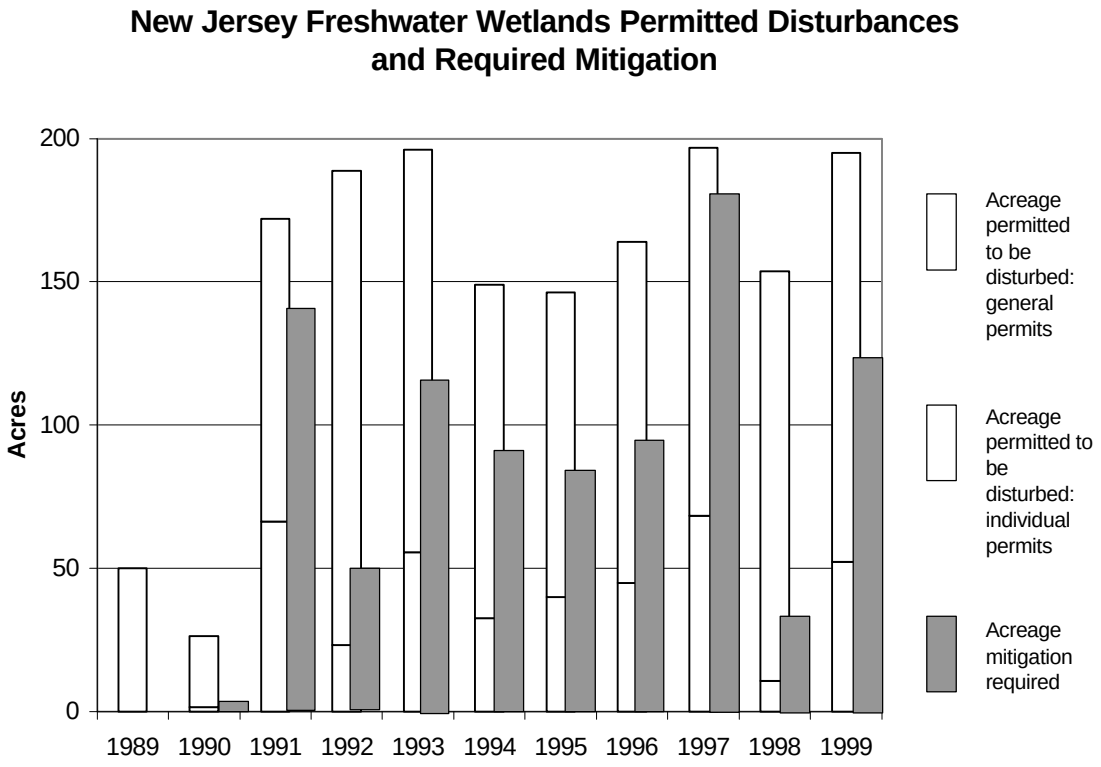
Permitted wetlands disturbances in relation to wetland mitigation required is an indirect measure of the net change in impacted wetlands acreage in New Jersey. From July 1, 1988 to June 30, 1999, 1,638.12 acres of NJ freshwater wetlands were permitted to be disturbed, while a total of 920.12 acres of compensatory mitigation were required, resulting in an estimated permitted net loss of 718 acres of freshwater wetlands over this eleven year period.

From 1992 to 1998, an estimated 204.18 acres of NJ coastal wetlands were permitted to be disturbed. Required mitigation for this disturbance consisted of approximately 17.5 acres of creation and 8,849 acres of enhancement (return of natural tidal flow to former salt hay farms). While there has been a net loss of coastal wetlands, there is projected to be an increase in the function and value of approximately 8,900 acres of coastal wetlands where enhancement and restoration projects are underway.



1 Acres lost equals sum of acres disturbed pursuant to both individual and general permits minus acreage of compensatory mitigation required

2 Data include repeat disturbances/impacts for certain activities and/or temporary disturbances which do not necessarily constitute new or additional wetlands losses.



Data Description

In the last eleven years, NJDEP permitted the disturbance of 49.93 to 196.9 acres of freshwater wetlands annually, with a mitigation requirement of 0 to 182.51 acres, annually. Assuming the 1986 freshwater wetland baseline of 739,160 acres (NJDEP Bureau of Geographic Information and Analysis), the permit data indicate approximately 0.22% of NJ freshwater wetlands have been permitted for disturbance resulting in a permit-estimated net loss of 0.09% of freshwater wetlands over this eleven year period.

For the period between January 1, 1992 to June 30, 1998, an estimated 8.74 acres of coastal wetlands were permitted to be disturbed for construction projects with 17.5 acres of compensatory mitigation required. During the same period, there was an additional loss of 195.44 acres of coastal wetlands to create channels for restoring tidal flow and construction of dikes to protect remaining structures. These activities were part of an overall project to return tidal flow to approximately 8,900 acres of diked coastal wetlands (former salt hay farms). This project was required to meet a NJPDES permit condition to enhance fish spawning habitat in the Delaware Bay Estuary.

Wetlands provide critical habitat for wildlife; filter surface water runoff; provide for flood control, and provide aquifer recharge functions. Permitted disturbances affect the ability of

wetlands to perform these important ecological functions. Compensatory mitigation is the creation, enhancement, or restoration of wetlands of equal ecological value to replace the loss of wetland habitat and function because of permitted activities.

Data Characteristics

The number of acres permitted for disturbance are determined by NJDEP's Land Use Regulation Program in response to an application for said disturbances. Compensatory mitigation is not required for General Permit projects such as minor road crossings or filling of isolated wetlands, ditches, and swales ($\leq$ 1 acre). General Permits for activities involving investigation, cleanup or removal of hazardous substances require mitigation. Individual Permits are required for proposed activities that exceed the minimum requirements of a General Permit. Individual Permit projects usually require compensatory mitigation at a ratio of 2 acres mitigation for every wetland acre disturbed. Permitted coastal wetland projects in the coastal area usually require compensatory mitigation at a ratio of 2:1. Mitigation for both coastal and freshwater wetlands were estimated by examining the mitigation data base maintained by the Land Use Regulatory Program.

The data presented within are available through the NJDEP Land Use Regulation Program and can be obtained by calling (609) 292-0060.

Data Strengths and Limitations

The data are valuable in that they track totals of wetland acreage permitted disturbance from the effective date of the New Jersey Freshwater Wetlands Protection Act (1988) through New Jersey's assumption of the 404 Program of the Federal Clean Water Act (1993). The data continue to improve in tracking yearly status and trends over time as New Jersey began assumption for the freshwater wetlands program after 1993.

Key limitations to the data include verifying the actual disturbances and respective mitigation. Permittees do not necessarily conduct the regulated activity, even if they have a permit to do so. In some cases, permits are required for repeat disturbances to the same site (for repair, rehabilitation, replacement, maintenance or reconstruction of any previously authorized currently serviceable structure or fill lawfully existing prior to 7/1/88) and/or temporary disturbances, which do not necessarily constitute new or additional wetlands losses. Therefore, the actual acreage disturbed may indeed be less than reported herein. Conversely, without field verification and delineation, activities may have taken place which affect greater acreage than permitted, either through greater acreage disturbed, unintended secondary hydrologic impacts, and/or failure to properly mitigate. The mitigation data base is currently being updated to include additional information. A field research project was initiated in July 1999 to verify mitigation acreage and success statewide. The results of these efforts will affect the estimated mitigation acreages provided herein.

Data on the impacts to wetlands as a result of exemptions specified in the New Jersey Freshwater Wetlands Protection Act are not included in this indicator. Regulatory authority for wetlands permits within the Hackensack Meadowlands is under the jurisdiction of the U.S. Army Corps of Engineers and therefore, data for permitted wetlands activities within the Hackensack

Meadowlands are not accounted for. While New Jersey does retain authority for wetlands impacts under Section 401 of the Clean Water Act, in practice NJDEP defers to the HMDC and their consistency finding with New Jersey's Coastal Zone Management Plan. NJDEP will work with HMDC to include these data in the next iteration of indicator reporting. Other exemptions not reported include: ongoing farming activities such as construction or maintenance of farm ponds or irrigation ditches and maintenance of farm or forest roads; projects for which preliminary site plan or subdivision applications received preliminary approvals prior to the effective date of the Act (7/1/88); projects for which preliminary site plan or subdivision applications were submitted prior to June 8, 1987 (at which time Governor Kean issued a moratorium on construction in wetlands until FWWPA signed); and permit applications that were approved by the Army Corps of Engineers prior to the effective date of the Act.

In addition to the causes listed above, the loss of wetlands due to illegal activities is not addressed in this indicator.

Discussion

In order to understand the NJDEP data, it is important to recognize that New Jersey's wetlands have been drained and filled since settlement by Europeans began in the 1600s (Fretwell et al. 1996). Dahl (1990) estimated that NJ lost 39% of its wetlands between the 1870s and 1970s; while Tiner (1985) estimated that NJ may have lost at least 20% of its wetlands resources since the mid-1900s. In response to these dramatic losses, New Jersey passed its own Freshwater Wetlands Protection Act in 1987, considered to be one of the most, if not the most, stringent wetland laws in the nation. This Act provided NJDEP with regulatory powers beyond that of Federal law (Torok et al. 1996).

Approximately 19% of New Jersey's land base is wetlands. Based upon 1986 aerial photography, NJ has 739,160 acres of freshwater wetlands which compose approximately 15% of New Jersey's 4,984,338 acres of land. Based upon these same data (NJDEP Bureau of Geographic Information Analysis), there are approximately 209,269 acres of tidal wetlands in New Jersey or approximately 4% of New Jersey lands. NJDEP will have more accurate information on total wetlands acreage in New Jersey based upon 1995/97 aerial photography (photo-interpreted to Land Use/Land Cover classification) by Fall 2000. [Note, however, that direct comparison of permit data with any losses indicated by the Land Use/Land Cover data is inappropriate because of differences in the time frames for which the data are recorded; lack of data on activities exempted from the the NJ Freshwater Wetlands Protection Act; and lack of data on violations.]

The current indication is that the overall trend is to permit wetland disturbances in New Jersey with a net loss of wetland acreage. This paradox results from a lack of regulatory authority to require compensatory mitigation for every type of disturbance. More accurate numbers regarding mitigation site acreages and evaluation of mitigation site success should provide better understanding of the accuracy of this indicator. NJDEP is investigating the availability and applicability of new housing starts and new construction as an additional cause indicator to provide a more complete picture of the status and trends with respect to wetlands resources for New Jersey.

Implementation of NJDEP's *Strategic Plan 1998-2001* strategies for increasing and enhancing wetland acreage by 2005 is intended to improve NJDEP's ability to meet wetlands goals. These wetlands strategies include 1) *accelerate use of credits held by the Wetlands Mitigation Bank*; 2) *continue to require mitigation in Individual Permits and expand mitigation requirements into certain General Permits*; and 3) *Coordinate with other state and federal agencies to acquire funding to create and enhance wetlands in areas impacted by agricultural, transportation and other development activities.*

References

Anderson, J.R. E.E. Hardy, J.T. Roach, and R.E. Witmer. 1976. A Land Use and Land Cover Classification System for Use with Remote Sensor Data. Geological Survey Professional Paper 964. Washington, D.C.: U.S. Government Printing Office. 28 pp.

Dahl, T.E. 1990. Wetlands - losses in the United States 1780s to 1980s. Washington, D.C.: US Fish and Wildlife Service, Report to Congress, 13 pp.

Fretwell, J.D., J.S. Williams, and P.J. Redman. 1996. National Water Summary on Wetland Resources. U.S. Geological Survey Water-Supply Paper 2425. P.279-284.

Tiner, R.W., Jr. 1985. Wetland of New Jersey. U.S. Fish and Wildlife Service, National Wetlands Inventory, Newton Corner, MA. 117 pp.

Torok, L.S., S. Lockwood, and D. Fanz. 1996. Review and comparison of wetland impacts and mitigation requirements between New Jersey, USA, Freshwater Wetlands Protection Act and Section 404 of the Clean Water Act. Environmental Management 20 (5):741-752.

Last revised: 12 July 2000

Figure 6.1 Tidal and Freshwater Wetlands in New Jersey

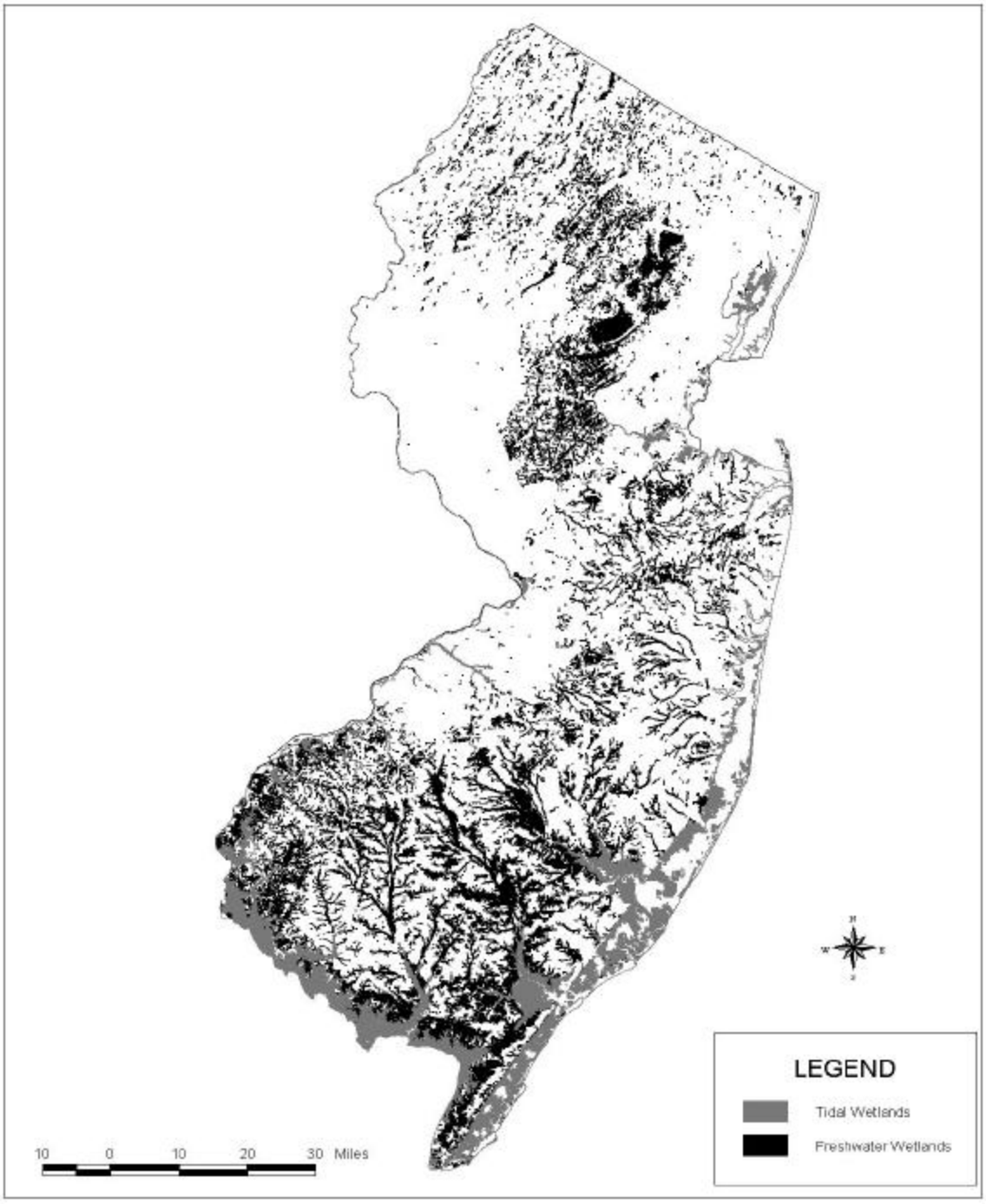


Table A7.2.3-1 Factors Contributing to Harvest Limitation

NOAA Nautical Chart #/ Growing Water	Area (acres)	Harvest Classification		Major Contributing Factors			Factors Contributing to Harvest Limitation												Overall Potential for Improvement	On-going Restoration Effort
							Point Sources						Nonpoint Sources							
		Classification	Basis for Limitation	Point Sources	Nonpoint Sources	Upstream	Industrial Facilities	Wastwater Treatment Plants	Combined Sewer Overflows	Direct Discharges	Marinas	Boating	Industrial Wsteater Treatment Systems	Urban Runoff	Feedlot Runoff	Agricultural Runoff	Wildlife	Upstream		
Hudson River/Raritan Bay (M060)																				
12324A Lower Navesink River	1,017	R	WQ		●	●								➤				➤	High	●
12324A Shrewsbury River	2,375	R	WQ		●									■		√			Medium	●
12324A Upper Navesink River	1,314	R	WQ	●	●						➤			➤		➤			Medium	●
12327 Compton Creek	19	P	WQ		●						√			➤					Low	
12327 Eastern Raritan Bay	12,775	R	WQ		●	●					√	√		➤				➤	Medium	●
12327 Flynns Knoll	5,225	P	WQ			●												■	Medium	
12327 Municipal Yacht Basin	161	P	WQAD	●							■	■		√					Low	
12327 Pews Creek	7	P	WQ		●						√			➤					Low	
12327 Raritan and Newark Bays	14,041	P	NS																Medium	
12327 Sandy Hook Bay	7,403	R	WQ		●						√			➤			√		High	
12327 Union and Belvedere Beaches	630	P	WQ	●	●	●	■							➤				➤	Low	
12327 Ware Creek	6	P	WQ		●						√			➤					Low	
12327 Western Raritan Bay	5,331	P	WQ	●	●	●		■	➤					➤				➤	Medium	
12332 Raritan River	1,941	P	NS																Low	
12343 Hudson River	4,251	P	NS																Low	
Barnegat Bay (M070)																				
12316A Ballanger Creek	37	CA	WQ		●								√				■		Medium	
12316A Big Thorofare	113	R	WQ	●	●						➤	➤		➤					Low	
12316A Great Bay	11,695	A	NA																	
12316A Headley's Pond	22	R	WQ		●									√			■		Low	
12316A Inner Tuckerton Cove	34	R	WQ	●	●	●					➤	➤		➤				➤	Low	
12316A Judies Creek	8	CA	WQ		●									√			■		Low	
12316A Landing Creek	24	CA	WQ		●												■		Low	
12316A Little Egg Harbor	17,828	A	NA																	
12316A Long Beach Island South	412	CA	WQ	●	●						➤	➤		➤					Medium	
12316A Lower Mullica River	1,305	A	NA																	
12316A Middle Mulica River	486	CA	WQ		●												➤	√	Low	
Barnegat Bay (M070) (cont.)																				
12316A Mott Creek	179	R	WQ		●							√	■				√		Low	●
12316A Osborne Island	217	P	WQ	●							■	■							Low	

NOAA Nautical Chart #/ Growing Water	Area (acres)	Harvest Classification		Major Contributing Factors			Factors Contributing to Harvest Limitation												Overall Potential for Improvement	On-going Restoration Effort
							Point Sources						Nonpoint Sources							
		Classification	Basis for Limitation	Point Sources	Nonpoint Sources	Upstream	Industrial Facilities	Wastwater Treatment Plants	Combined Sewer Overflows	Direct Discharges	Marinas	Boating	Industrial Wsteater Treatment Systems	Urban Runoff	Feedlot Runoff	Agricultural Runoff	Wildlife	Upstream		
12316A Outer Tuckerton Cove	38	CA	WQ			●												■	Low	
12316A Oyster Creek	10	R	WQ	●	●														Low	
12316A Parker Run	18	R	WQ	●	●														Medium	●
12316A Roundabout Creek	27	CA	WQ		●									√			■		Medium	
12316A Tuckerton Creek	72	P	WQ	●	●														Medium	
12316A Upper Ballanger Creek	32	R	WQ		●								√				■		Low	
12316A Upper Mullica River	1,089	R	WQ		●						√							√	Low	
12316A Upper Parker Run	16	P	WQ	●	●									■					Low	●
12316A Upper Roundabout Creek	8	R	WQ		●									√			■		Low	
12316A Winter Creek	8	R	WQ		●									√					Medium	
12324A Beaverdam Creek	296	P	WQ		●						√	√							Low	
12324A Lower Metedeconk River	586	R	WQ		●						√								Medium	
12324A Manasquan River	840	R	WQ		●	●					√								Medium	●
12324A Point Pleasure Canal	39	P	WQ		●														Low	
12324A Upper Manasquan River	429	P	WQ		●	●					√								Low	●
12324A Upper Metedeconk River	1,060	P	WQ		●						√	√							Low	
12324B1 Applegate Cove	98	R	WQ	●	●									■					Medium	
12324B1 Barnegat Bay	25,460	A	NA																	
12324B1 Barnegat Beach	237	R	WQ	●	●									■					Medium	●
12324B1 Barnegat Light	93	R	WQ	●	●												√		Low	●
12324B1Barnegat Marina	27	P	WQ	●								■							Low	●
12324B1Bascule Bridge Marina	34	P	WQ	●							■	■							Low	
12324B1 Bay Seaside Park	2,670	CA	WQ		●									■					Medium	●
12324B1 Berkeley Shores	138	P	AD	●							■	■							Low	
12324B1 Cedar Beach	344	CA	WQ	●	●														Medium	●
12324B1 Cedar Creek	309	R	WQ	●	●														Medium	●
12324B1Chadwick Beach	113	P	WQ	●	●														Low	
12324B1Cherry Quay	25	P	WQ	●							■	■							Low	
Barnegat Bay (M070) (cont.)																				
12324B1 Clamming and Maple Creeks	340	R	WQ	●	●														Medium	●
12324B1 Clamming Creek	8	P	WQ	●							■	■								
12324B1 Double Creek	228	R	WQ	●	●												√		Low	●
12324B1 East of Clam Island	179	R	WQ		●							√							Low	●
12324B1 Forked River Boat Harbor	85	P	WQAD	●							■	■							Low	
12324B1 Forked River North Branch	94	P	WQ	●	●												√		Low	
12324B1 Forked River South Branch	128	R	WQ	●	●												√		Low	

Table A7.2.3-1: Factors Contributing to Shellfish Harvest Limitation

NOAA Nautical Chart #/ Growing Water	Area (acres)	Harvest Classification		Major Contributing Factors			Factors Contributing to Harvest Limitation												Overall Potential for Improvement	On-going Restoration Effort
							Point Sources						Nonpoint Sources							
		Classification	Basis for Limitation	Point Sources	Nonpoint Sources	Upstream	Industrial Facilities	Wastwater Treatment Plants	Combined Sewer Overflows	Direct Discharges	Marinas	Boating	Industrial Wsteater Treatment Systems	Urban Runoff	Feedlot Runoff	Agricultural Runoff	Wildlife	Upstream		
12324B1 Glen Cove	27	P	WQ	•							■	■								
12324B1 Goodluck Point	38	P	WQ	•	•									■					Low	•
12324B1 Goose Creek	461	R	AD	•	•									■					Medium	
12324B1 Goose Creek Marinas	49	P	WQAD	•							■	■							Low	
12324B1 Green Island	104	P	WQ	•							■	■							Low	
12324B1 Havens Point Marina	89	P	WQAD	•	•												√		Medium	
12324B1 Island Beach	1,304	R	WQ	•	•							■		■					Medium	
12324B1 Kettle Creek	809	R	WQ	•	•									■					Medium	
12324B1 Lanoka Harbor	25	P	WQAD	•							■	■							Low	
12324B1 Laurel Harbor	63	P	WQ		•														Low	•
12324B1 Mantoloking	188	R	WQ	•	•								√	■					Medium	•
12324B1 Mantoloking Shores	86	P	WQ	•	•														Low	
12324B1 Middle Sedge	261	CA	WQ	•	•														Medium	
12324B1 North Barnegat Bay	3,846	A	NA																	
12324B1 North Long Beach Island	670	CA	WQ	•	•												√		Low	
12324B1 North Silver Bay Marina	6	P	WQAD	•							■	■								
12324B1 Oyster Creek	66	R	WQ	•	•												√		Low	•
12324B1 Pebble Beach	99	P	WQ	•	•												√		Low	
12324B1 Sands Point Harbor	10	P	AD	•							■	■							Low	
12324B1 Seaweed Point	145	CA	WQ	•	•														Medium	
12324B1 Shelter Cove	12	P	WQ	•	•									■					Low	
Barnegat Bay (M070) (cont.)																				
12324B1 Shore Acres	42	P	AD	•							■	■							Low	
12324B1 Silver Bay	815	R	WQ	•	•									■					Medium	
12324B1 Sloop Creek	178	R	WQ	•	•									■					Medium	
12324B1 South Branch Kettle Creek	20	P	AD	•							■	■							Low	
12324B1 South Cedar Creek	14	P	AD	•							■	■							Low	
12324B1 South Silver Bay Marina	37	P	WQAD	•							■	■							Low	
12324B1 Stouts Creek	166	P	WQ	•	•														Low	
12324B1 Toms River	1,963	P	WQ	•	•									■				√	Low	•
12324B1 Waretown Creek	47	P	WQ	•							■	■							Low	
12324B1 West Barnegat Bay	1,457	CA	WQ	•	•						■	■							Medium	•
12324B1 West Silver Bay Marina	10	P	WQAD	•							■	■							Low	
12324B2 Beach Heaven West	279	P	WQ	•	•														Low	•
12324B2 Cedar Run	216	R	WQ	•	•														Medium	•
12324B2 Central Long Beach Island	1,494	CA	WQ	•	•									■				√	Low	•

Table A7.2.3-1: Factors Contributing to Shellfish Harvest Limitation

NOAA Nautical Chart #/ Growing Water	Area (acres)	Harvest Classification		Major Contributing Factors			Factors Contributing to Harvest Limitation												Overall Potential for Improvement	On-going Restoration Effort
							Point Sources						Nonpoint Sources							
		Classification	Basis for Limitation	Point Sources	Nonpoint Sources	Upstream	Industrial Facilities	Wastwater Treatment Plants	Combined Sewer Overflows	Direct Discharges	Marinas	Boating	Industrial Wsteater Treatment Systems	Urban Runoff	Feedlot Runoff	Agricultural Runoff	Wildlife	Upstream		
12324B2 Channel Creek	18	R	WQ		•												■		Low	
12324B2 Creek above Oyster Point	22	R	WQ	•	•												■		Low	•
12324B2 Dinner Point Creek	78	R	WQ		•												■		Low	•
12324B2 Manahawkin Bay	2,055	A	NA																	
12324B2 Mill Creek Thorofare	61	R	WQ	•	•									■			√		Low	•
12324B2 North Thorofare Island	73	CA	WQ	•	•									■			√		Low	•
12324B2 Off Beach Haven West	199	R	WQ	•	•														Low	•
12324B2 South Thorofare Island	91	CA	WQ	•	•									■			√		Low	•
12324B2 Westecunk Creek	113	R	WQ	•	•									■					Low	•
New Jersey Inland Bays (M080)																				
12316A Absecon Bay	2,288	CA	WQ		•	•													Medium	•
12316A Absecon Channel South	176	R	WQ		•	•													Low	
12316A Absecon Creek	215	P	WQ	•	•														Low	
12316A Anchorage Point	11	P	WQ	•	•								■						Low	•
New Jersey Inland Bays (M080) (cont.)																				
12316B2 Halfmile Point Marsh	79	CA	WQ		•								√						Low	•
12316B2 Ingram Thorofare	128	R	WQ	•	•														Low	
12316B2 Jarvis Sound	386	R	WQ		•	•													Medium	
12316B2 Jenkins Sound	1,106	CA	WQ	•	•	•											√		Low	•
12316B2 Jones Creek	81	P	WQ		•												■		Medium	
12316B2 Ludlam Beach	60	R	WQ		•						√	√							Low	
12316B2 Muddy Hole	31	R	WQ	•															Medium	
12316B2 Old Turtle Thoro	112	P	WQ		•														Medium	
12316B2 Old Turtle Thoro South	45	CA	WQ		•														Medium	
12316B2 Oldman Creek	467	P	WQ	•	•														Low	
12316B2 Reubens Thorofare	1,046	P	WQ	•	•														Medium	
12316B2 Richardson Sound	481	A	NA																	
12316B2 Scotch Bonnet	216	P	WQ	•							■	■							Low	
12316B2 Shellbed Landing	44	P	WQ	•							■	■							High	
12316B2 Stites Sound	722	A	NA																	
12316B2 Stone Harbor	189	P	WQ	•	•														Low	
12316B2 Taylor Sound	102	R	WQ		•	•													Medium	
12316B2 Tempe Creek	31	P	WQ		•														Medium	
12316B2 Townsend Channel	67	A	NA																	
12316B2 West Wildwood	195	CA	WQ	•		•													Medium	
12316B2 Wildwood	298	P	WQ	•	•														Low	

Table A7.2.3-1: Factors Contributing to Shellfish Harvest Limitation

NOAA Nautical Chart #/ Growing Water	Area (acres)	Harvest Classification		Major Contributing Factors			Factors Contributing to Harvest Limitation												Overall Potential for Improvement	On-going Restoration Effort
							Point Sources						Nonpoint Sources							
		Classification	Basis for Limitation	Point Sources	Nonpoint Sources	Upstream	Industrial Facilities	Wastwater Treatment Plants	Combined Sewer Overflows	Direct Discharges	Marinas	Boating	Industrial Wsteater Treatment Systems	Urban Runoff	Feedlot Runoff	Agricultural Runoff	Wildlife	Upstream		
Delaware Bay (M090)																				
12304 Arnold Point Shoal	4,778	A	NA																	•
12304 Back Creek	705	CA	WQ										√				√		Low	
12304 Bacons Neck	31	R	WQ														√		Low	
12304 Bay Side	6	R	WQ										√				√		Low	
12304 Beadon Creek	21	R	WQ														√		Low	
12304 Bidwell Creek	32	CA	WQ								√	√	√				√	√	Medium	
Delaware Bay (M090) (cont.)																				
12304 Cape May	557	R	WQ									√							Low	
12304 Cedar Creek	67	CA	WQ			•											√		Medium	•
12304 Cherry Tree Creek	11	R	WQ														√		Low	
12304 Cohansey Cove	1,328	R	WQ			•											√		Low	
12304 Cahansey River	2,289	P	WQ	•	•		√				√	√	√			√	√		Low	
12304 Delaware Bay	208,848	A	NA																	•
12304 Dennis Creeks	950	P	WQ		•												√		Low	
12304 Dividing Creek	523	CA	WQ														√	√	Low	
12304 Dyer Cove	537	R	WQ		•												√		Medium	•
12304 Fortescue Cove	482	CA	WQ		•							√					√		Medium	
12304 Fortescue Creek	809	R	WQ		•						√	√					√		Low	•
12304 Lower Maurice River	1,296	R	WQ								√	√	√				√	√	Low	
12304 Maurice River Cove	3,014	CA	WQ		•												√	√	Medium	•
12304 Nantuxent Cove	1,731	CA	WQ		•						√	√					√	√	Low	•
12304 Nantuxent Creek	440	R	WQ														√		Low	
12304 Newport Neck	8	R	WQ										√						Medium	
12304 Oranoaken Creek	352	CA	WQ														√		Low	
12304 Oyster Gut	26	CA	WQ														√		Low	
12304 Riggins Ditch	169	P	WQ	•													√		Low	
12304 Stow Creek	847	R	WQ	•	•						√	√				√	√		Low	
12304 Straight Creek	201	R	WQ														√		Low	
12304 Upper Bidwell Creek	136	P	WQ											√			√		Low	
12304 Upper Cedar Creek	155	P	WQ		•								■				√		Medium	•
12304 Upper Dividing Creek	128	R	WQ		•						√	√					√		Low	
12304 Upper Maurice River	2,041	P	WQ	•	•						√	√				√	√		Low	
12311 Artificial Island	1,824	P	NS																Low	

Table A7.2.3-1: Factors Contributing to Shellfish Harvest Limitation

NOAA Nautical Chart #/ Growing Water	Area (acres)	Harvest Classification		Major Contributing Factors			Factors Contributing to Harvest Limitation												Overall Potential for Improvement	On-going Restoration Effort
							Point Sources						Nonpoint Sources							
		Classification	Basis for Limitation	Point Sources	Nonpoint Sources	Upstream	Industrial Facilities	Wastwater Treatment Plants	Combined Sewer Overflows	Direct Discharges	Marinas	Boating	Industrial Wsteater Treatment Systems	Urban Runoff	Feedlot Runoff	Agricultural Runoff	Wildlife	Upstream		
12311 Cherry Tree Creek to Artificial Island	10,210	R	WQ				√										√	√	Low	
12311 Lower Deep Creek	21	R	WQ														√		Low	
Delaware Bay (M090) (cont.)																				
12311 Mad Horse Creek	463	R	WQ														√		Low	
12311 Miles Creek	2	P	WQ																	
12311 New Jersey Delaware Tributaries	6,435	P	NS																Low	
12311 Penn Grove to Cherry Tree Creek	456	A	NA																	
12312 New Jersey Delaware Tributaries	7,764	P	WQNS																	

Legend

Classification	Basis for Limitation	Factors Contributing to Harvest
A - Approved	AD - Adminstrative	Level of impact
CA - Conditionally Approved	CN - Concervation	■ - High - Medium - Low
R - Restricted	WQ - Water Quality	+ - Actual Contributor/ Not Rated
CR - Conditionally Restricted	NR - Not Reported	√ - Potential Contributing Factor
P - Prohibited	NS - Not Surveyed	
U - Unclassified	NA - Not Applicable	

*Factor Definitions

Table A7.2.3-1: Factors Contributing to Shellfish Harvest Limitation

Point Sources

Industrial facilities
Routine and accidental discharges from production/ malfunctioning
Manufacturing processes and on-site sewage treatment.

Wastewater treatment plants
Routine and accidental sewage discharge from public and leachate, animal
Private WWTPs with varying treatment.
lawns, and other

Combined sewer overflows
Discharge of untreated sewage/ stormwater when sewage of animal
System capacity is exceeded in heavy rainfall.
feeding areas.

Direct discharges
Untreated sewage discharge directly to receiving of animal
Waters by residences, seasonal camps, etc.
pasture lands.

Marinas
Periodic discharge of untreated or partially treated wastes from high
Sewage from berthed vessels.
waterfowl, etc.).

Boating

Nonpoint Sources

Individual wastewater treatment ststem
Discharge of partially treated sewage from

on-site septic systems.

Urban runoff
Precipitation-related discharges of septic

wastes, etc. from impervious surfaces,

urban land uses.

Feedlot runoff
Primarily precipitation-related discharges

Wastes from concentrated livestock

Agricultural runoff
Precipitation and irrigation-related runoff

wastes and pesticides from crop and

Wildlife
Precipitation-related runoff of animal

Wildlife concentration areas (e.g.

Upstream Sources

Table A7.2.3-1: Factors Contributing to Shellfish Harvest Limitation

Periodic discharge of untreated or partially treated sources

Sewage from vessels underway or anchored offshore.

Stream-borne contaminants from unspecified

Upstream of shellfish growing waters.

Glossary

(A) **Approved Waters -** Growing waters from which shellfish may be harvested for direct Marketing. Fecal coliform median or geometric mean most probable number (MPN) Does not exceed per 100 ml, and not more than 10 percent of the samples exceed An MPN of 43 per 100 ml, for a 5 - tube decimal test.

(CA) **Conditionally Approved Waters -** Growing waters meeting approved classification standards under predictable conditions. These waters are open to harvest when water quality standards are met, and are closed at other times. Fecal coliform standards are the same as for Approved.

(R) **Restricted Waters -** Growing waters from which shellfish may be harvested only if they are relayed or depurated before direct marketing. Fecal coliform median or geometric mean MPN does not exceed 88 per 100 ml, and not more than 10 percent of the samples exceed and MPN of 260 per 100 ml for a 5-tube decimal dilution test.

(CR) **Conditionally Restricted -** Growing waters do not meet the criteria for restricted waters if subjected to intermittent microbiological pollution, but may be harvested if shellfish are subjected to a suitable purification process. Fecal coliform standards same as for Restricted.

(P) **Prohibited Waters -** Growing waters which shellfish may not be harvested for marketing Under any conditions.

(U) **Unclassified Waters -** Growing waters that are part of a state's shellfish program but Are inactive, i.e., there is no harvesting and the state does not conduct any water quality Monitoring or maintain a sanitary survey.

Part IV: Groundwater Assessment

1. Groundwater Quality

The Department in cooperation with the USGS has established a new shallow ground water monitoring network designed to monitor water at or near the water-table. Such ground water is often the most immediately vulnerable portion of the entire ground water system to pollution. This network was discussed in the 1998 305(b) Report to which the reader is referred for details.

Ground water quality data and a brief discussion of recent finding based upon data collected in this new network will be presented in the USGS Water Year Report for 1999 (USGS, 1999. Data presented will be based upon results obtained from 30 shallow wells sampled in 1999; 28 of which are located in the Lower Delaware Region of the state and randomly distributed throughout WMAs #17, 18, 19 and 20. The 2 remaining wells are located in the Atlantic Coastal Region, one well in WMA #15 and one in #16.

2. Sources of Groundwater Contamination

2.1 Classification Exception Area (CEA) Delineations

For the past 25 years NJDEP's Site Remediation Program (SRP) has been identifying the presence of ground-water pollution at contaminated sites. In the past 5 years, where appropriate, the areal extent and depth of the contamination has been defined and a Classification Exception Area (CEA) has been established. A CEA is defined as that portion of a Classified groundwater use area where the "groundwater use" is restricted based on the class of the ground water in the surrounding aquifer.

New Jersey classifies ground water based on quality and/or aquifer properties (N.J.A.C. 7:9-6.5). There are three ground-water classes: GW I, GW II and GW III.

<u>Class GW I</u> is ground water that maintains areas of special ecological resources. These are defined as the watershed of streams classified as FW1, ground water under Natural Areas as designated by the Department pursuant to N.J.A.C. 7:2-11 and ground water in the Cohansey and Kirkwood aquifers under the New Jersey Pinelands.

<u>Class GW II</u> ground waters have a designated use potable ground waters with conventional water supply treatment. Class GW II-A refers to water that is now potable. Class GW II-B refers to water that could meet potable standards with conventional treatment. In general, all ground water in New Jersey outside of defined GW I areas is assumed to be of GW II-A status unless shown otherwise by site-specific sampling

<u>Class GW-III</u> ground waters are not suitable for potable water use due to natural hydrogeologic characteristics or natural water quality. Class GW III-A indicates an aquitard that cannot supply economically significant volumes of water and is outside of all GW I areas. Class GW III-B ground water consists of all geologic formations or units which contain ground water having natural concentrations or regional concentrations (through the action of salt-water intrusion) exceeding

3,000 mg/l chloride or 5,000 mg/l total dissolved solids, or where the natural quality of ground water is otherwise not suitable for conversion to potable uses.

To date, about 1,400 CEA's have been approved with about 300 new ones being identified each year. About 90% of these have been mapped in the NJDEP Geographic Information System (GIS). The NJDEP is developing a strategy for using this information in the well permitting process and the Source Water Protection Program. Public access is planned for this information through interactive mapping applications on the INTERNET. CEA's tend to be very small spatially and do not, as a group, cover an appreciable percentage of the State.

There are over 6,000 contaminated sites in New Jersey that have confirmed groundwater contamination with listed hazardous substances. In the future many more sites will receive a CEA designation and be mapped into the GIS. In the interim, detailed groundwater and soil contamination information is being collected digitally for all known contaminated sites in NJ, and a key element of these data sets include the well or soil sampling locations.

Detailed guidance on how New Jersey defines CEAs in on the internet at:
http://www.state.nj.us/dep/srp/dl/ceaguid2.doc

2.2 Ground Water Impact Areas

For the past 20 years NJDEP has been identifying large areas (regional) of groundwater contamination. These groundwater impact areas (GWIAs) are defined as an area where five or more domestic wells in a small area have water exceeding drinking water standards. Usually these cannot be linked to a specific source or responsible party. Typically the determination of areal extent and depth of ground-water contamination has been less rigorous than that delineated in a site investigation but is usually based on the results of home potable well sampling and is mapped based on the lot and blocks of properties affected. At the present time SRP is engaged in an effort to reevaluate the groundwater quality conditions in these areas, and it will be several years before the activity is complete. As with CEAs, GWIAs have been mapped into the NJDEP's Geographic Information System (GIS) computer network.

More information on GWIAs is on the internet at
http://www.state.nj.us/dep/srp/publications/site_status/1999/html/99intro15.htm

2.3 Well Restriction Areas (WRAs)

The following is from the CEA guidance document cited above in 2.1.

> "Pursuant to N.J.A.C. 7:9-6.6(d), the Department is obligated to restrict or require the restriction of potable ground water uses within any CEA where there is or will be an exceedence of the Primary Drinking Water Standards (N.J.A.C. 7:10). Therefore, when contaminant concentrations in a CEA exceed Maximum Contaminant Levels (MCLs), and designated aquifer use based on classification includes potable use, the Department will identify the CEA as a Well Restriction Area (WRA). The WRA functions as the institutional control by which potable use restriction can be effected.

> "The Department ordinarily will not prohibit installation of wells in WRAs but will identify any special installation and construction requirements (for example, installation of double-cased wells below the first confining layer) through the well permit program administered by the Bureau of Water Allocation. Prohibition of well installation may be warranted if installation and pumping of a proposed well would negatively impact an approved remediation. For example, well installation may be prohibited if use of a proposed industrial supply well would draw a portion of a contaminant plume into its cone of influence and alter the configuration of the plume, potentially contaminating a previously clean portion of the aquifer. Although WRAs will be the mechanism by which the Department primarily will protect potable users, restrictions on installation and use of other types of wells (e.g., irrigation, industrial, recovery) also can be required."

There are 98 identified well restriction areas in New Jersey. These cover less than 5% of the state. All have been mapped into the NJDEP's Geographic Information System (GIS) computer network.

2.4 CEA, GWIA and WRA relationship

The relationship between CEAs, GWIAs and WRAs is not straightforward. In general, all CEAs are also WRAs. CEAs are identified with a suspected (or proven) responsible party. The converse is not true; there are WRAs which are not part of a CEA. GWIA's tend to be larger with perhaps multiple potential responsible parties, or perhaps no identified polluter. A GWIA may include one or more CEAs or WRAs, or it may not.

2.5 Pilot Study: GIS-Based Trackdown of Pollution Sources from Known Contaminated Sites to the New York–New Jersey Harbor Estuary

To investigate the potential for uncontrolled/unmeasured toxic substance discharges from contaminated sites to groundwater and subsequently to surface waters, NJDEP's Division of Science Research and Technology (DSRT) and SRP have been awarded a Performance Partnership Grant from EPA Region 2 to perform a Pilot Study towards developing a Geographic Information System (GIS) -based, source trackdown tool. The tool will be used to identify and prioritize pollution sources from known contaminated sites and to assess the potential for contaminant movement into the waters, sediments and biota of the New York–New Jersey Harbor, hence the Pilot Study is being performed under the auspices of the Harbor Estuary Program (HEP).

NJDEP's 1996 Known Contaminated Sites list (KCSL) contains approximately 9,000 sites statewide, of which 1,400 potential sites and landfills were identified as meeting the criteria for inclusion (i.e., in proximity to water and a potential contaminant source). Since 1997 the technical rules for site remediation require that all hazardous site investigations in the State (i.e., public and private) must deliver investigative data in a NJDEP defined electronic (digital) format. Preliminary analysis of the data reveals that the majority of this information is spatially accurate and contains a wealth of detail about the spatial distribution and concentration of different contaminants in groundwater and soils.

Inclusion of digital data will provide a new, more accessible dimension to identifying contaminated sites posing the greatest threat to the Estuary. In the Pilot, digital data will be analyzed and manipulated through EQuIS, the SRP's data management system. EQUIS is designed to enable the importation of site data to the NJDEP's GIS for visualization, distribution and further analysis. Data will be summarized and displayed cartographically using a GIS technology and digital environmental data collected as part of NJDEP's Site Remediation Programs (SRP) remedial investigation and clean up process (pursuant to NJAC 7:26E).

2.6 Arsenic in Ground Water of New Jersey

The current federal maximum contaminant level (MCL) for arsenic in drinking waters is 50 micrograms per liter (ug/l), or parts per billion (ppb). During USEPA's extended review, the Commissioner of NJDEP has recommended that New Jersey propose and adopt a state MCL of 10 ppb for arsenic in finished drinking water.

In 1999, a review of arsenic in ground-water data for New Jersey had been conducted. Data from the Ambient Ground Water Quality Network in the Valley and Ridge, Highlands and Piedmont Physiographic Provinces (see Fig IV-2.4-1) (Serfes, 1994; Serfes, in press), coupled with data in the Coastal Plain (Kozinski et al, 1995; Fusillo et al, 1984) revealed that ground water in the Piedmont generally has higher arsenic concentrations than in the other physiographic provinces in New Jersey. This finding was also supported by Public Water Supply data provided by the Department's Bureau of Safe Drinking Water. The data showed that 6 percent of the wells sampled in the Piedmont had arsenic concentrations greater than 10 ppb while only 0.5 percent in the Coastal Plain exceeded 10 ppb. No wells sampled in the other 2 provinces exceeded 10 ppb. A study is being conducted by the Department's Geological Survey to determine the sources, mobilization, transport and fate of the arsenic in the western Piedmont where the highest concentrations are found.

Results from reconnaissance sampling in the western Piedmont indicate that up to 15 percent of the 92 wells sampled have concentrations exceeding the NJDEP recommended MCL of 10 ppb. The highest concentrations are found in the Passaic, part of the Jurassic-Triassic Brunswick formation illustrated in Figure IV-2.4-2, and in the Triassic Lockatong Formations (Fig IV-2.4-2). The lowest levels are in the Triassic Stockton Formation and Jurassic Diabase. Based on the chemistry of several rock samples and the location of the highest arsenic concentrations, it is believed that the arsenic is mainly natural in origin and associated with dark fine grained lucustrine sedimentary rocks of the Passaic and Lockatong Formations. Further work is being conducted which may lead to drilling and corrective practices that could reduce exposure to arsenic.

A homeowner's guide to arsenic in private well water has been developed by the NJDEP and is available from the Department's Bureau of Safe Drinking Water by calling (609) 292-5550 or via the NJDEP's website at: *http://www.state.nj.us/dep/dsr/arsenic/guide.htm.*

2.7 Mercury in Ground Water of New Jersey

The drinking water standard for mercury is 2 ppb. Since 1982 the NJDEP has been investigating exceedences of mercury in the ground water of southern New Jersey. Greater concentrations have been observed in hundreds of private wells tapping the Kirkwood-Cohansey aquifer.

However, there were thousands of wells with no mercury contamination and the pattern of contamination did not immediately point to an obvious source. In February 1992, the NJDEP and USGS issued a press release recommending all owners of a domestic well pulling water from the Kirkwood-Cohansey aquifer to test their water for mercury.

The New Jersey Geological Survey determined that this mercury was unlikely to be naturally occurring (Dooley, 1992). A thorough study by the US Geological Survey (USGS) (Barringer and others, 1997) also concludes that the mercury in these wells is unlikely to be: naturally occurring in the aquifer; introduced by fixtures in the households; ascribable to nearby landfill and/or pollution sites; or the result of sampling and/or laboratory error. Additionally, atmospheric deposition appears to be a minimal source of mercury in the ground water. The most likely sources of mercury in the shallow ground waters of southern New Jersey are historical land application of pesticides containing mercury. In 1998 the NJDEP requested the USGS start a more detailed study of land use impacts on mercury in ground water and the impacts of mercury-contaminated ground water on surface water

In 1998, NJDEP Commissioner Robert C. Shinn signed an administrative order which created the New Jersey Mercury Task Force. Its charge is to review current science on the impacts of mercury pollution; determine impacts on New Jersey's ecosystems and on human health; inventory and assess current sources; review current policies for mercury management; and develop a mercury reduction plan for New Jersey. More information on the Mercury Task Force is available on the NJDEP Division of Science, Research and Technology website at:
http://www.state.nj.us/dep/dsr/mercury_task_force.htm

2.8 Domestic Well Quality

In New Jersey Ocean County has had a program in effect since 1987 that requires the sampling of domestic well quality whenever a home is sold or a lease for more than 6 months is signed. These data have remained in Ocean County and have not been used by the NJDEP for any systematic investigation of ground-water quality. This is partially due to non-reporting of the aquifer which supplies water to the tested well. In 2000 there were about 70,000 entries in this system.

In March 2001 the New Jersey legislature passed the "Private Well Testing Act" which mandates testing of water quality every time a house with a domestic well is sold. Homes which are leased must also be tested within 18 months of this bill becoming effective then at least once every 5 years thereafter. This bill was signed into law on March 23, 2001.

The parameters to be tested for are bacteria (total coliform), nitrates, iron, manganese. pH, volatile organic compounds with MCLs, lead, and radium (using the 48-hour gross alpha test). The NJDEP may add additional items to this list in areas where concerns exist. Possible additions include arsenic and mercury. The NJDEP may also designate certain areas where some parameters do not need to be tested for. All testing is to be done by certified labs. A copy of each analysis must be submitted to the NJDEP to help ground-water studies. The legislature appropriated $1 million for the NJDEP and local health departments to implement this act.

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Figure I-1 New Jersey Geography

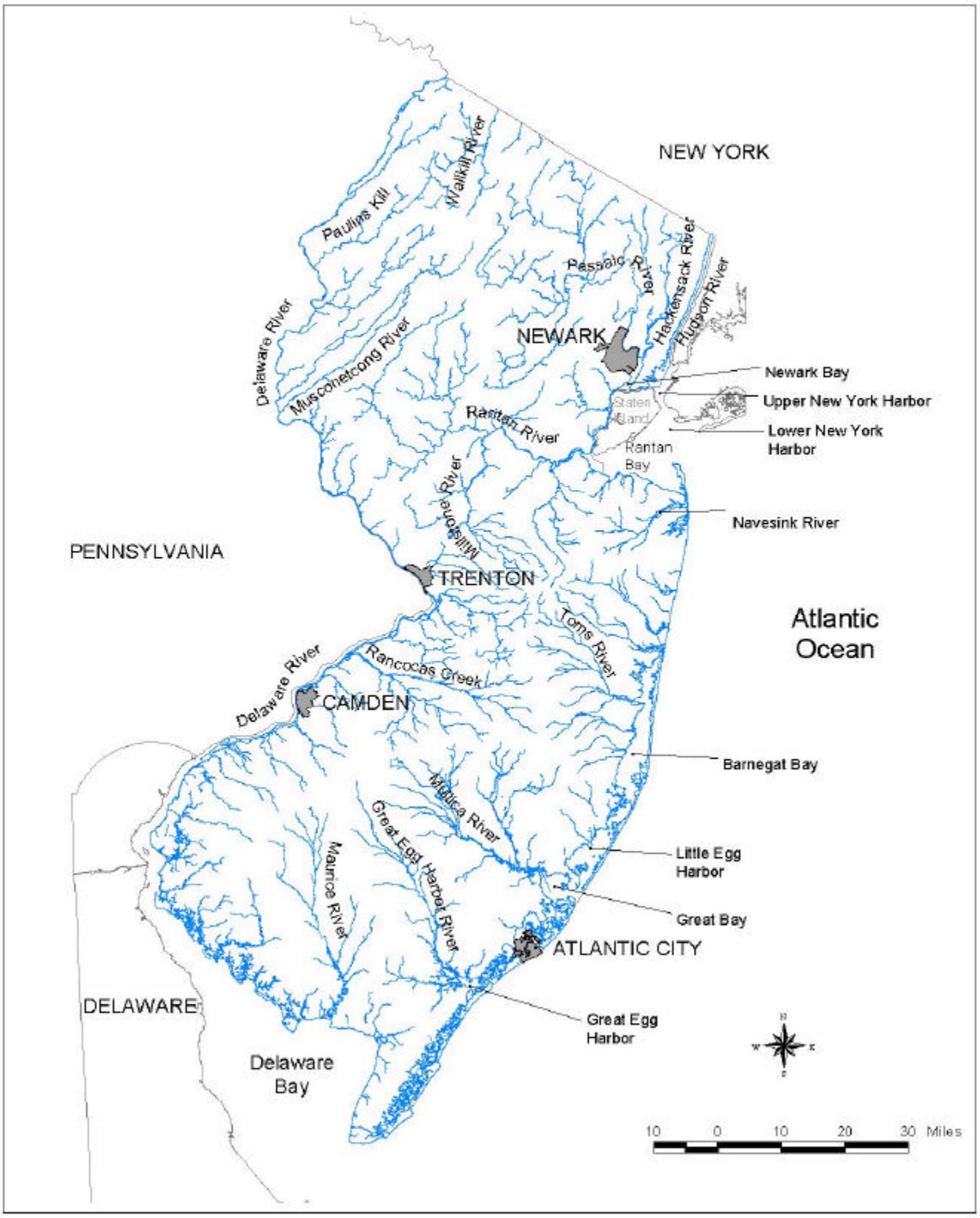


Figure AII-1 New Jersey Watershed Regions and Management Areas

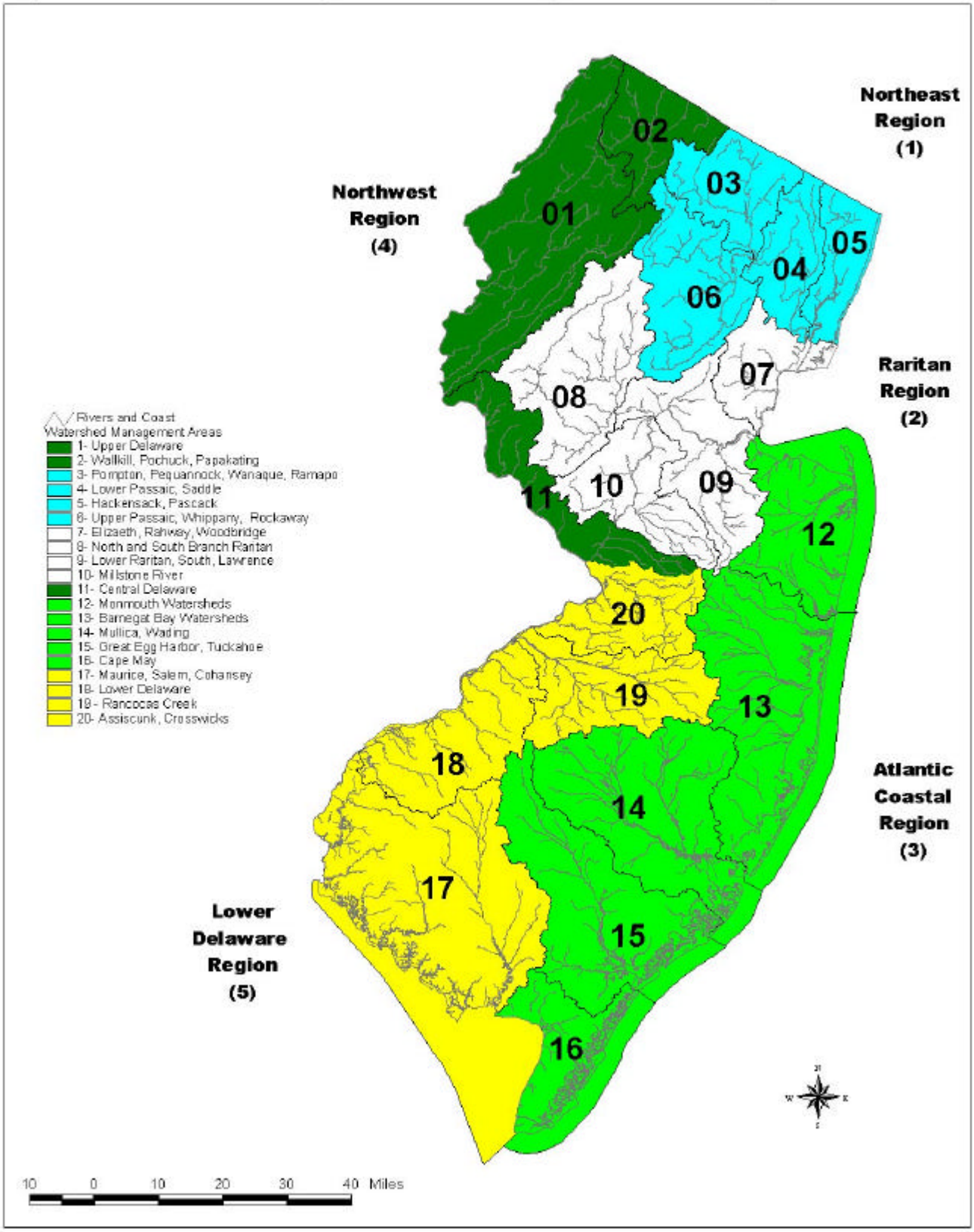


Figure II-2 New Jersey Watersheds (HUC 11)

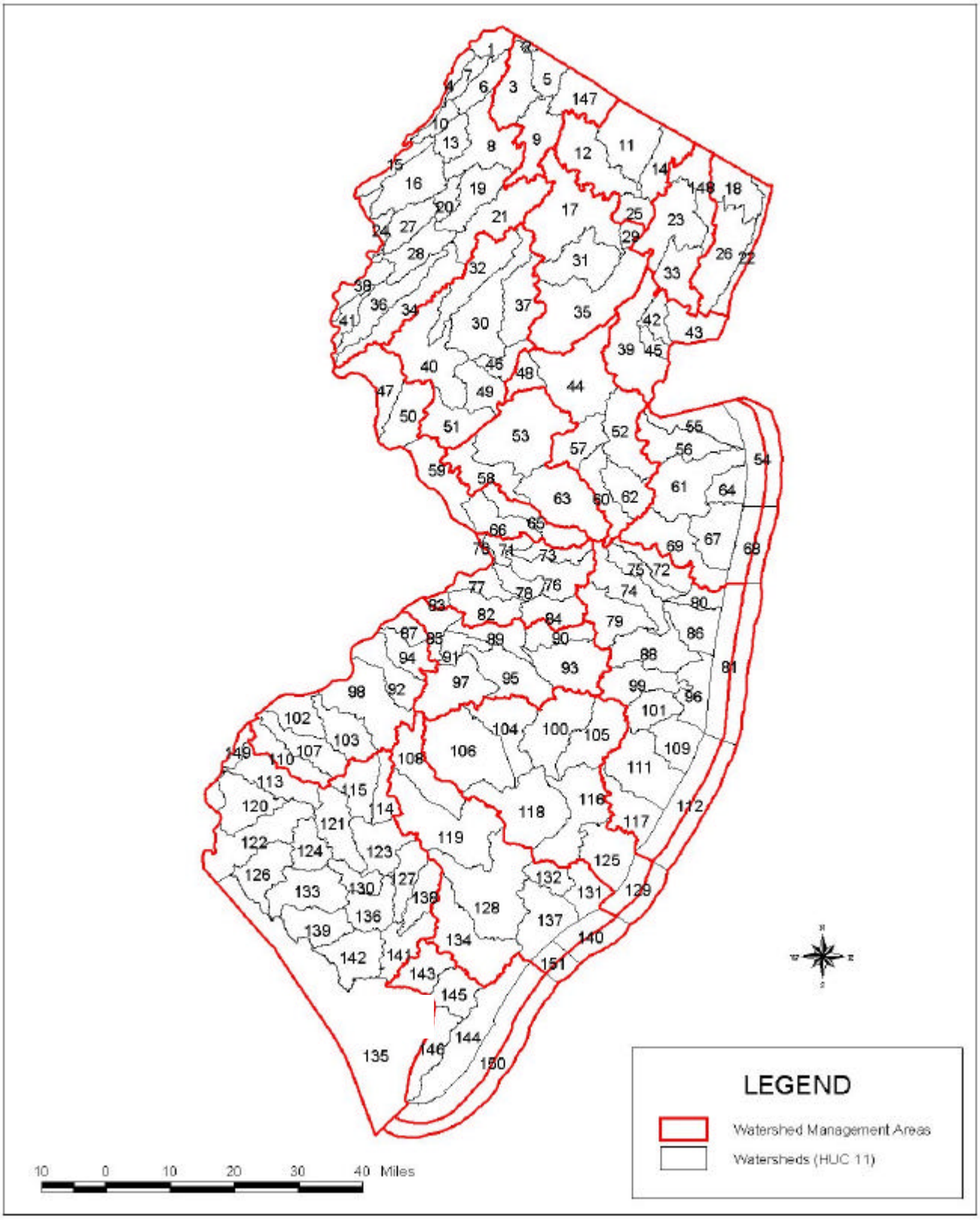


Figure A3.1.2-1 Ambient Surface Water Monitoring Network in New Jersey

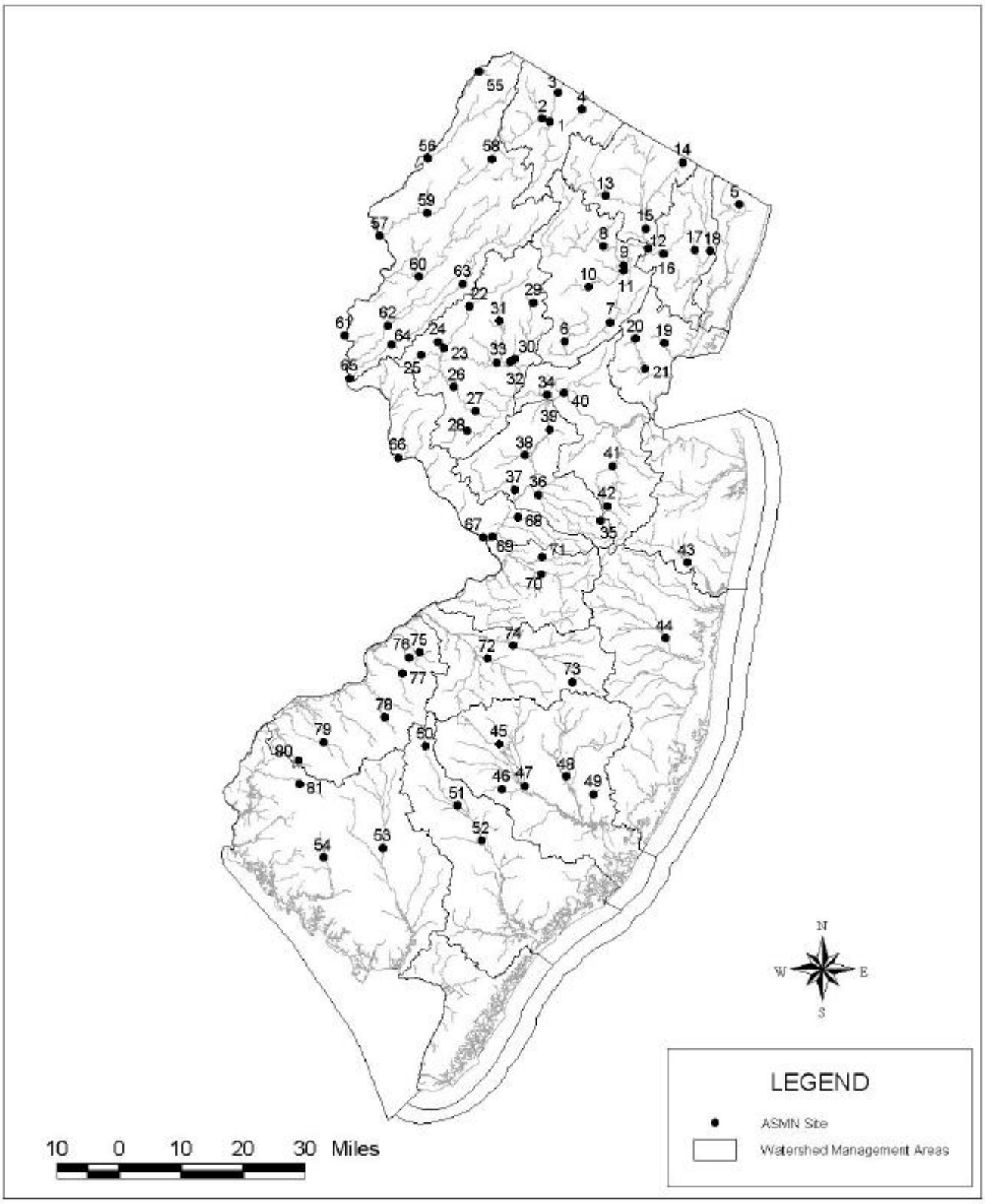
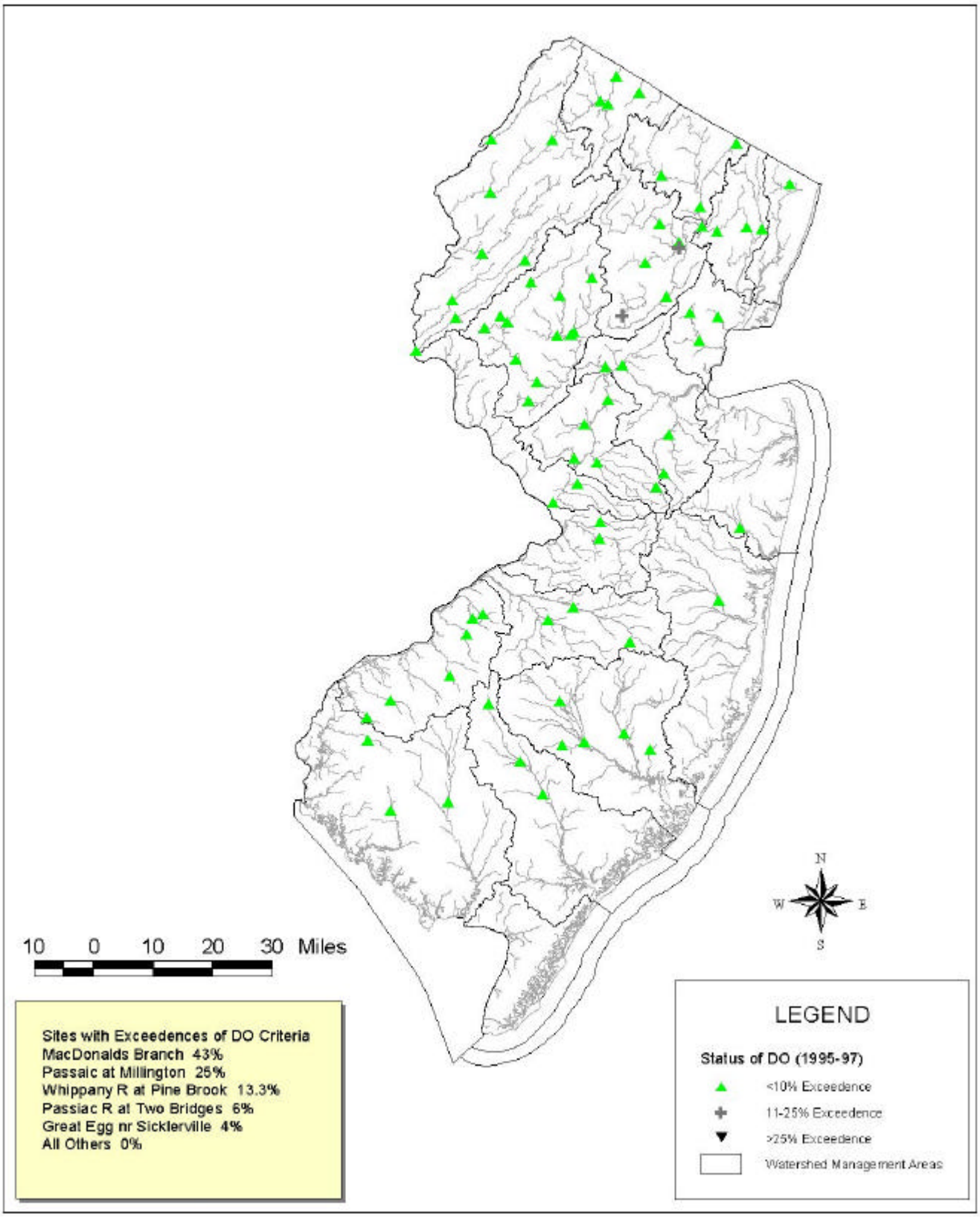


Figure A3.1.3-1 Dissolved Oxygen Water Quality Assessment



Figures A3.1.3-2 Total Phosphorus Water Quality Assessment

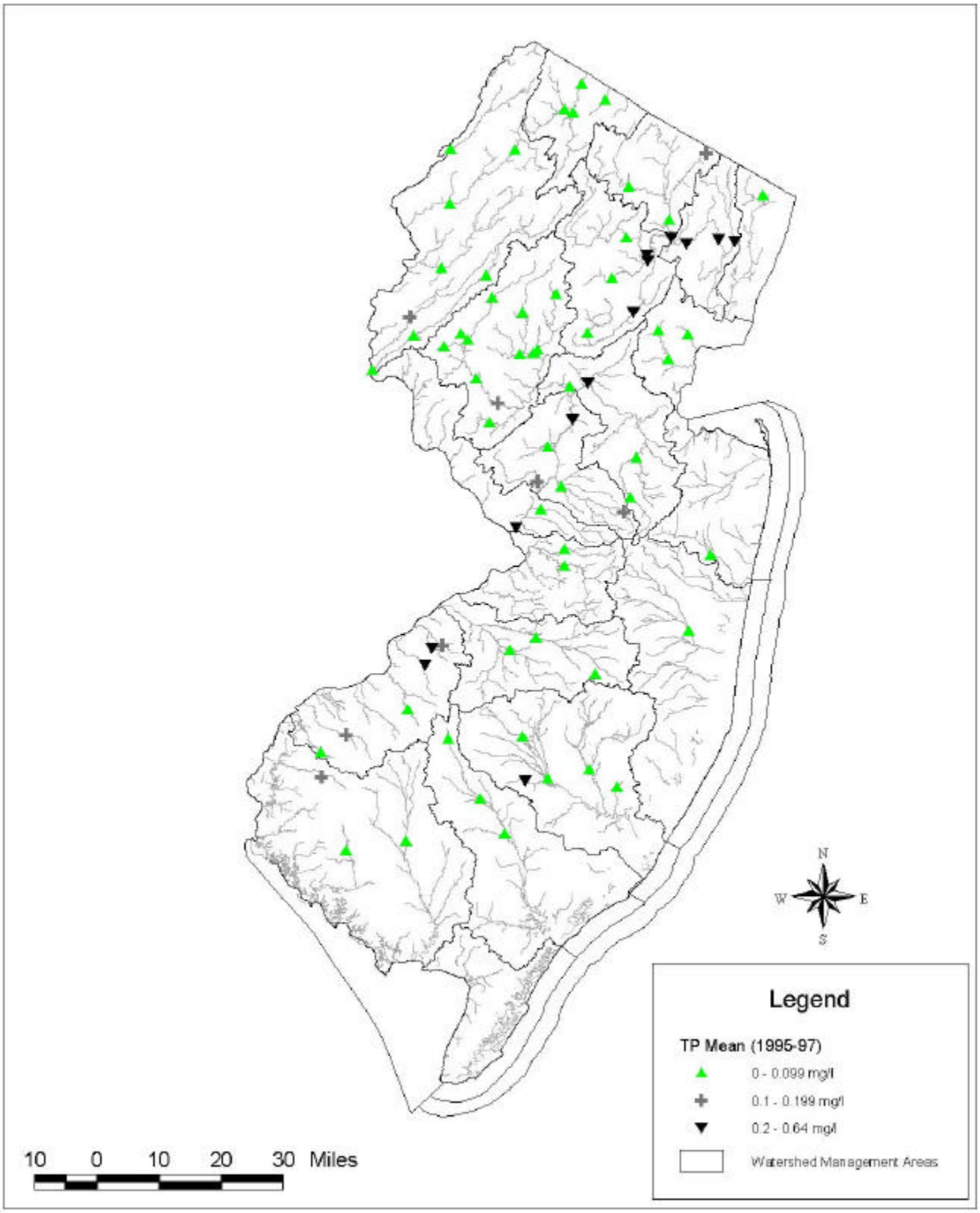


Figure A3.1.4-1 Total Phosphorus in Bottom Sediments

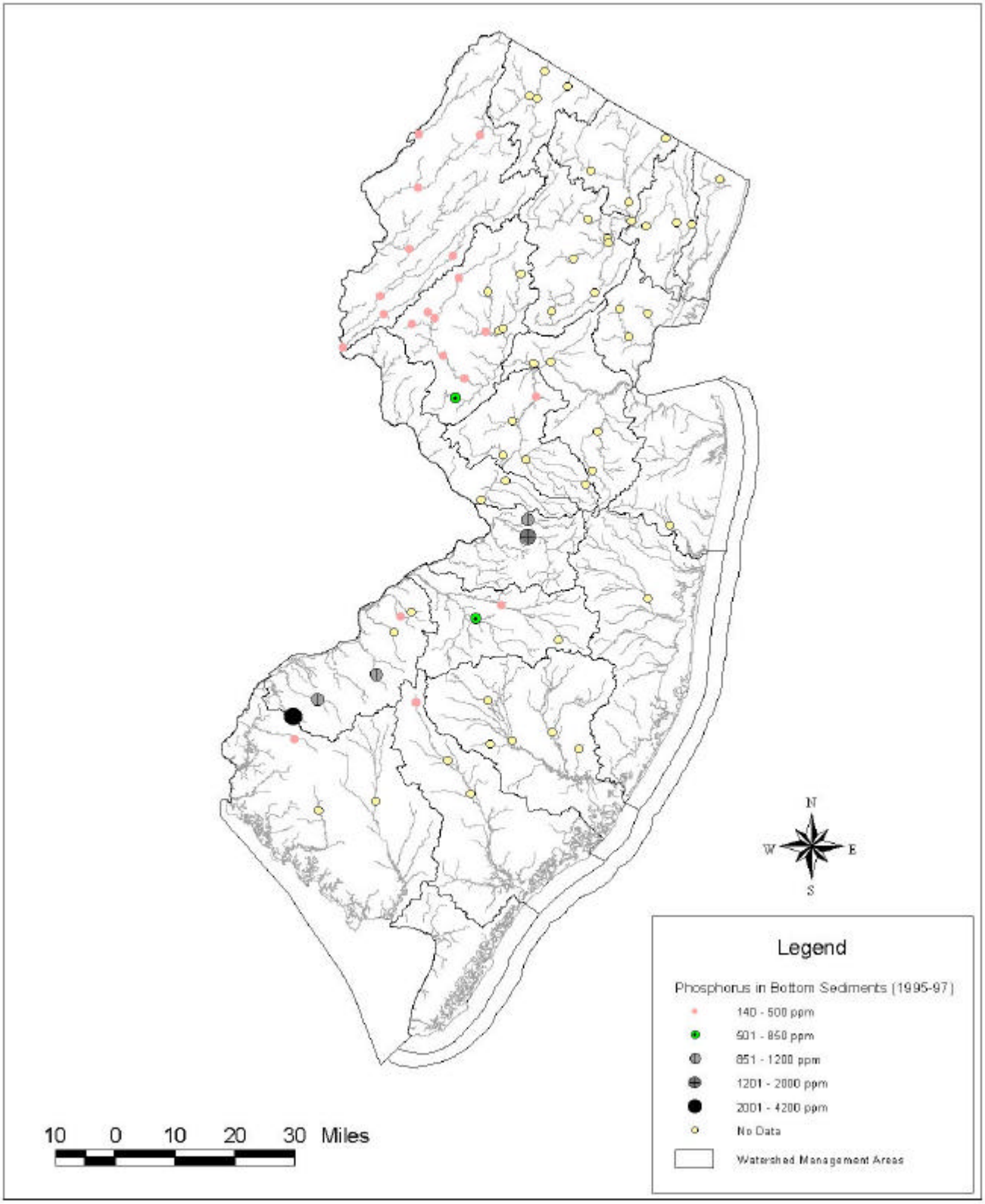


Figure A3.1.4-2 Point Source and Nonpoint Source Contributions of Total Phosphorus

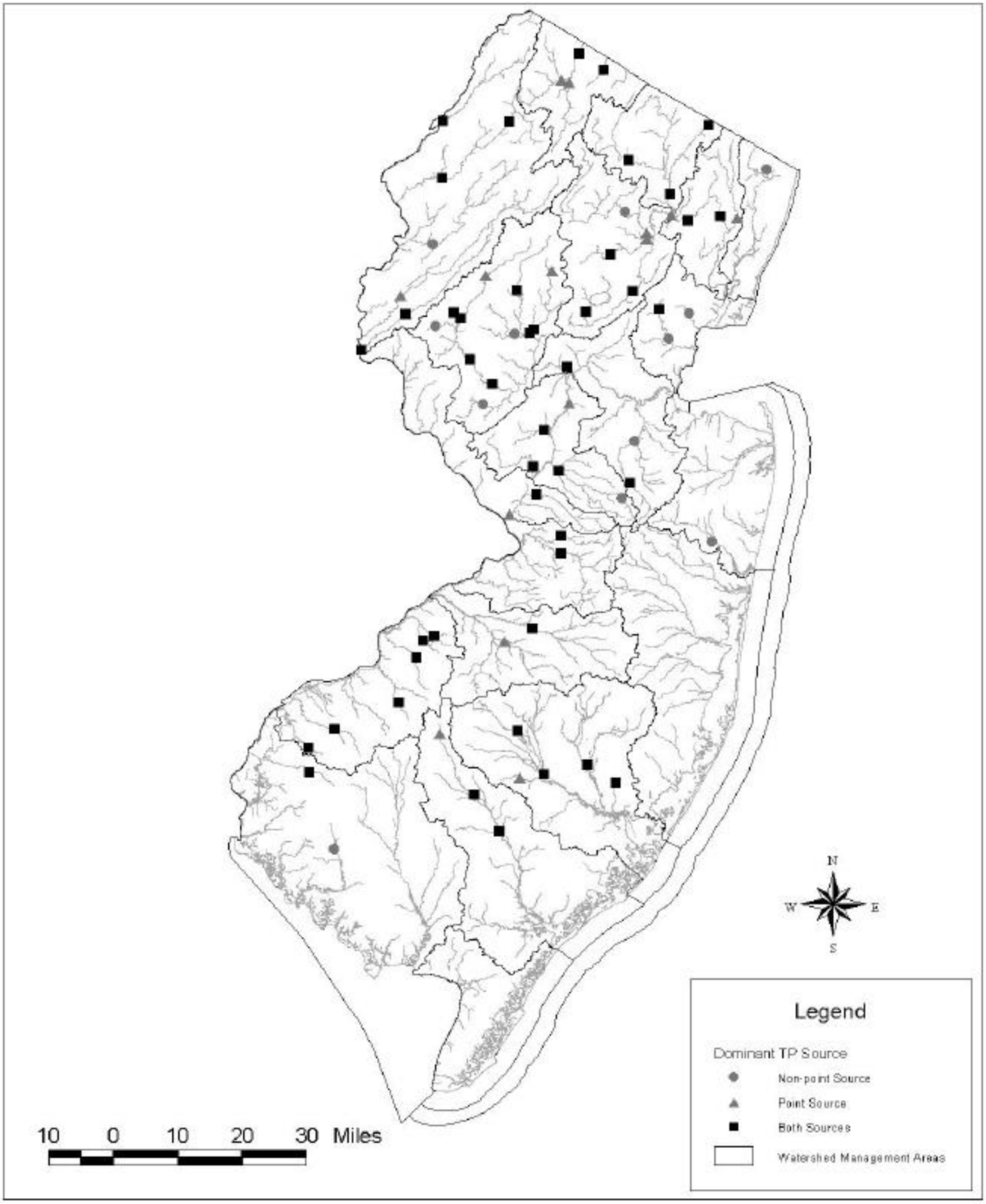


Figure A3.2.1-1 Ambient Biomonitoring Network in Watershed Management Areas 1, 2, and 11

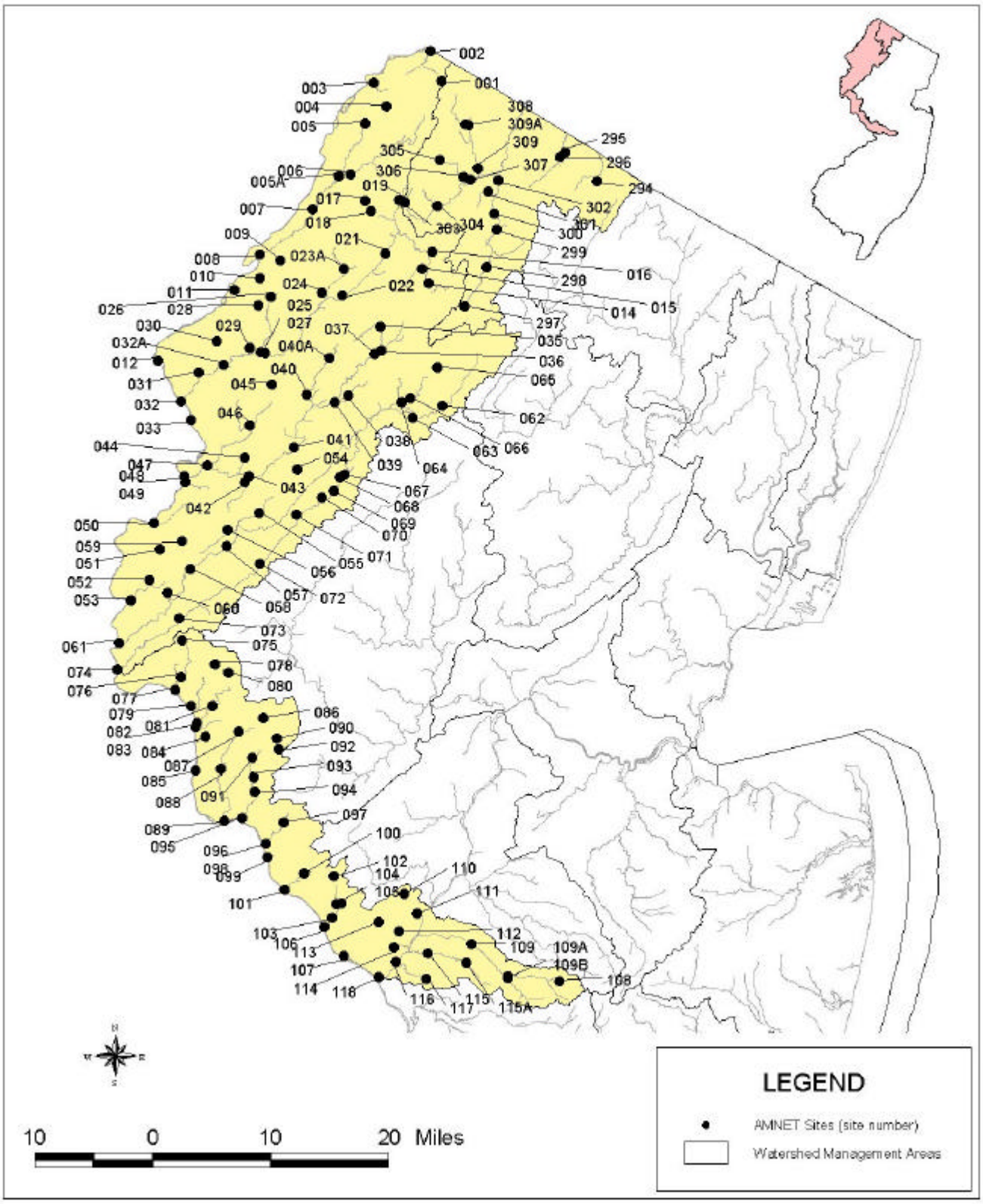


Figure A3.2.2-2 Aquatic Life Support Assessment in Watershed Management Areas 1, 2, and 11

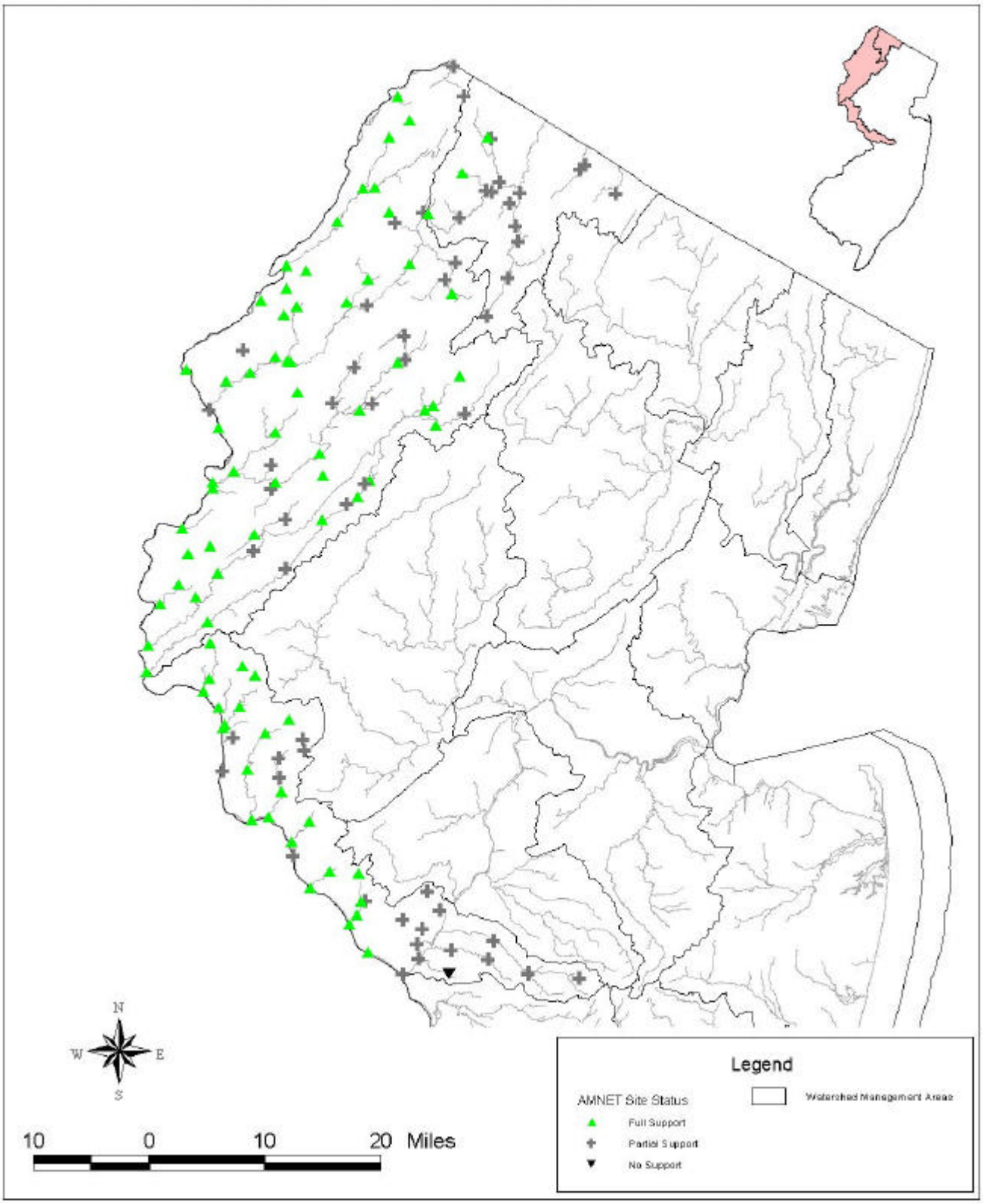


Figure A3.3.2-1 Fecal Coliform Assessment (Recreational Use) in Rivers and Streams

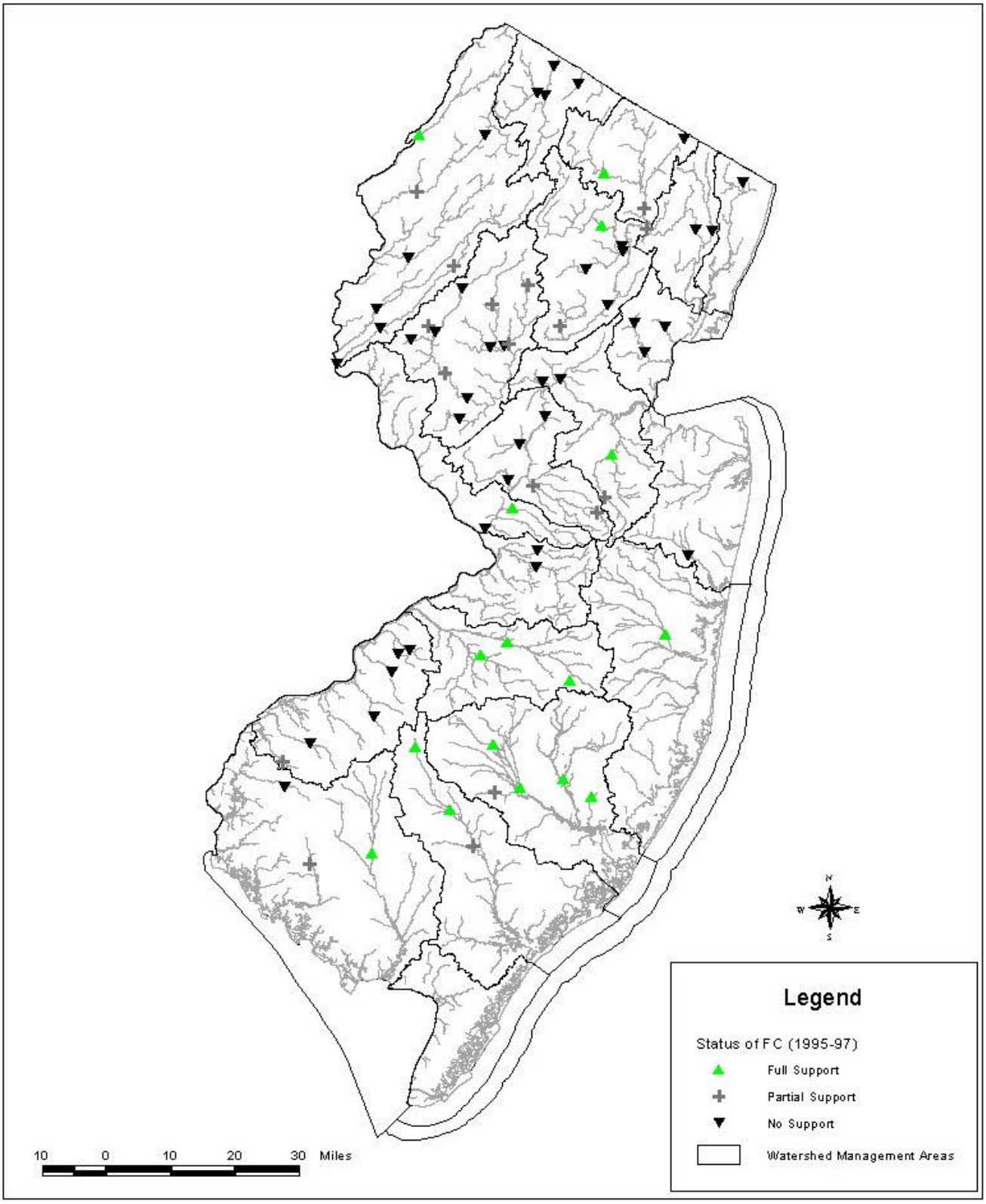


Figure A3.3.3-1 Surface Water Chemical Monitoring Network Locations Near Combined Sewer Overflow Outfalls in New Jersey

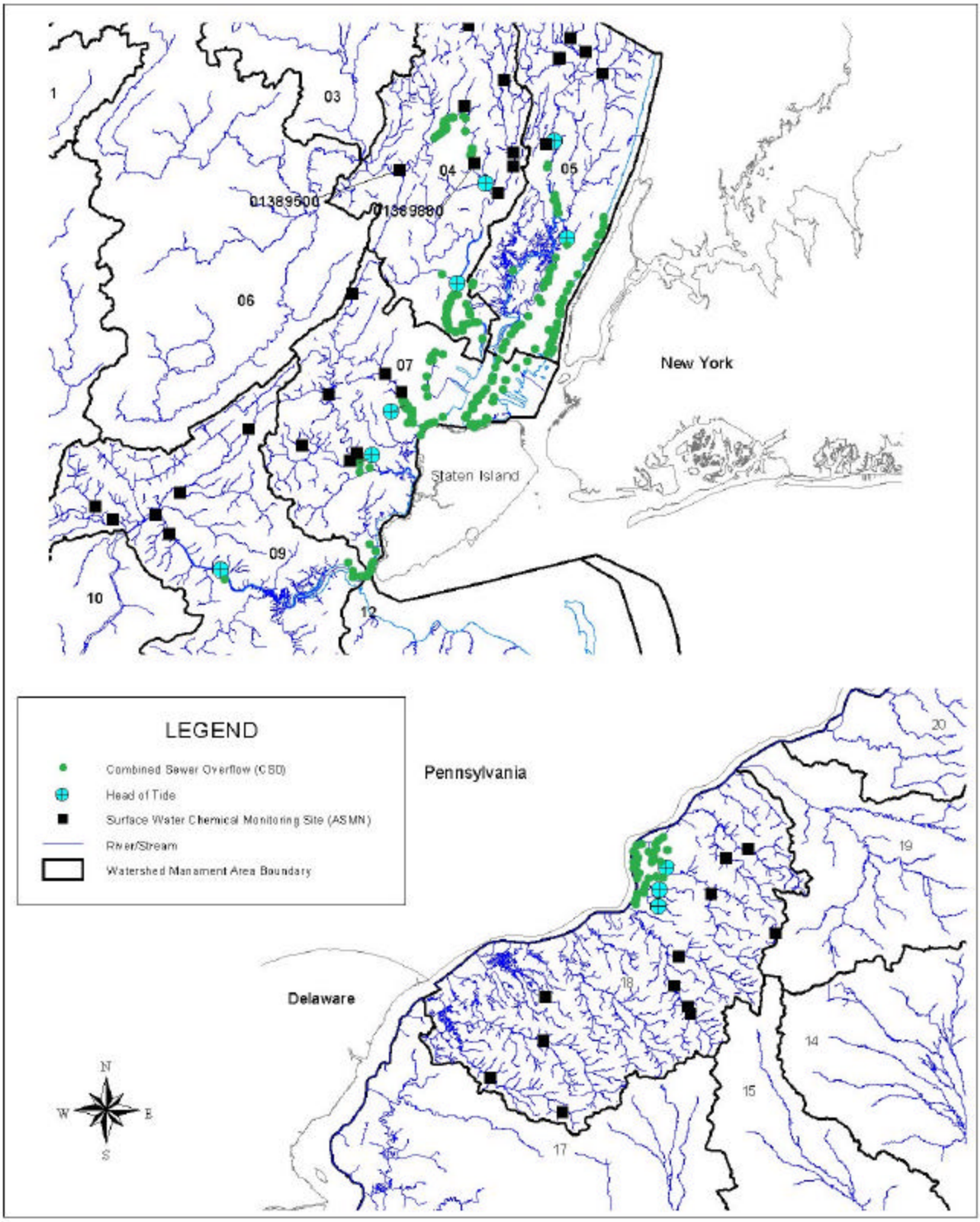


Figure A3.4-1 Potable Surface Water Supply Intakes and Reserviors in New Jersey

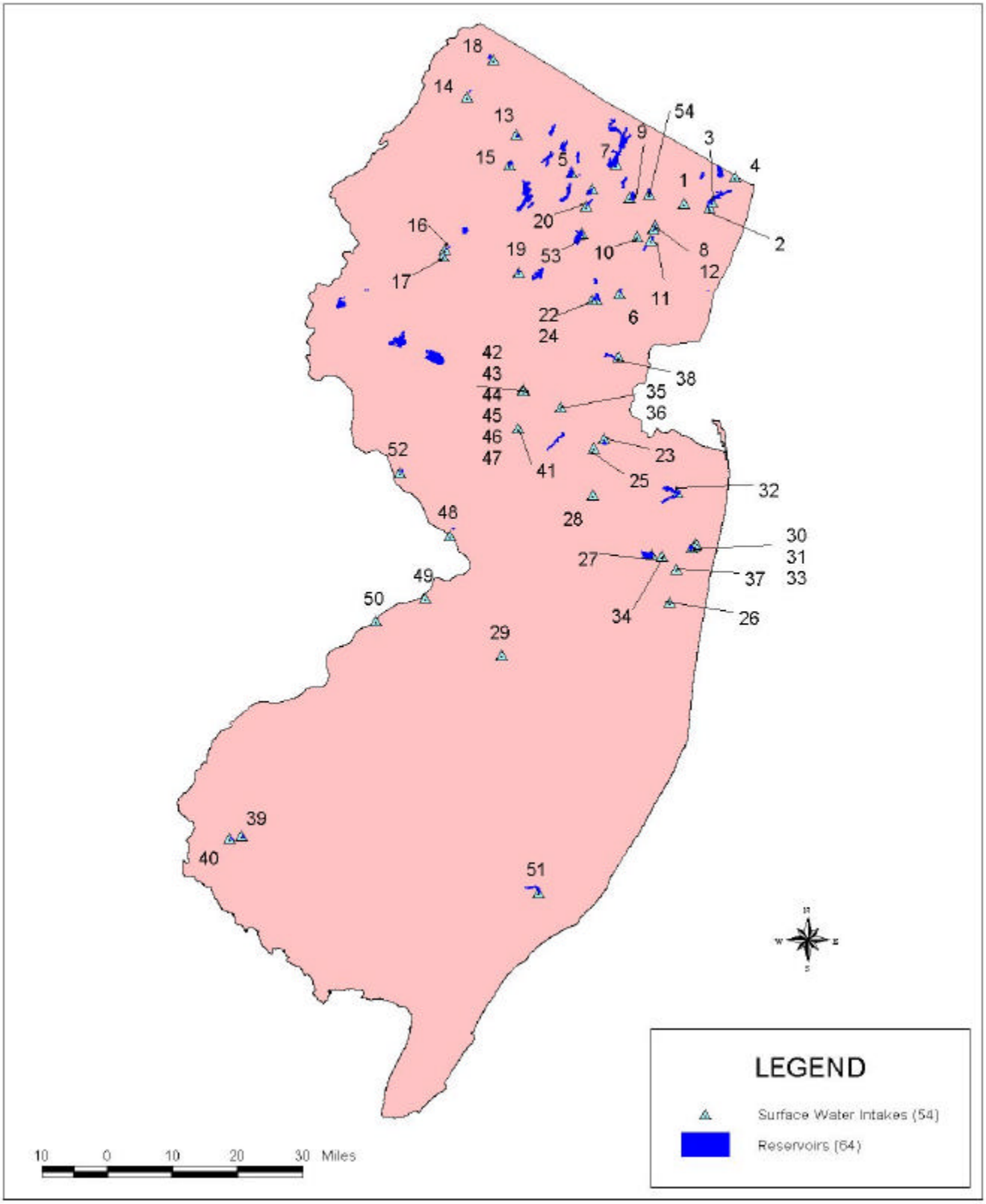


Figure A3.4.2-1 Average Nitrate Concentrations at ASMN Locations in New Jersey

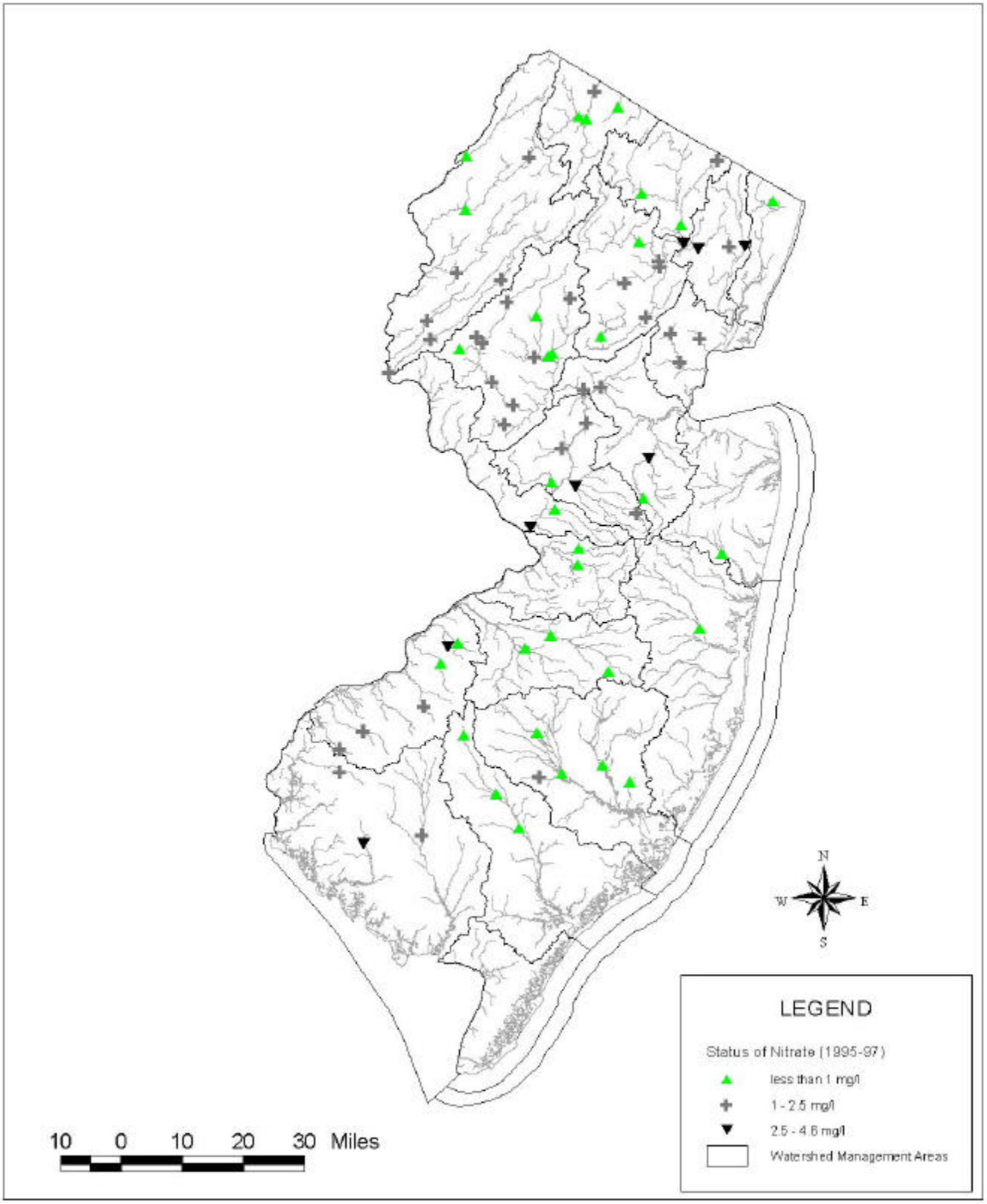


Figure A3.4.6-1 Drinking Water Intake and Pollution Sources in the Rahway Watershed

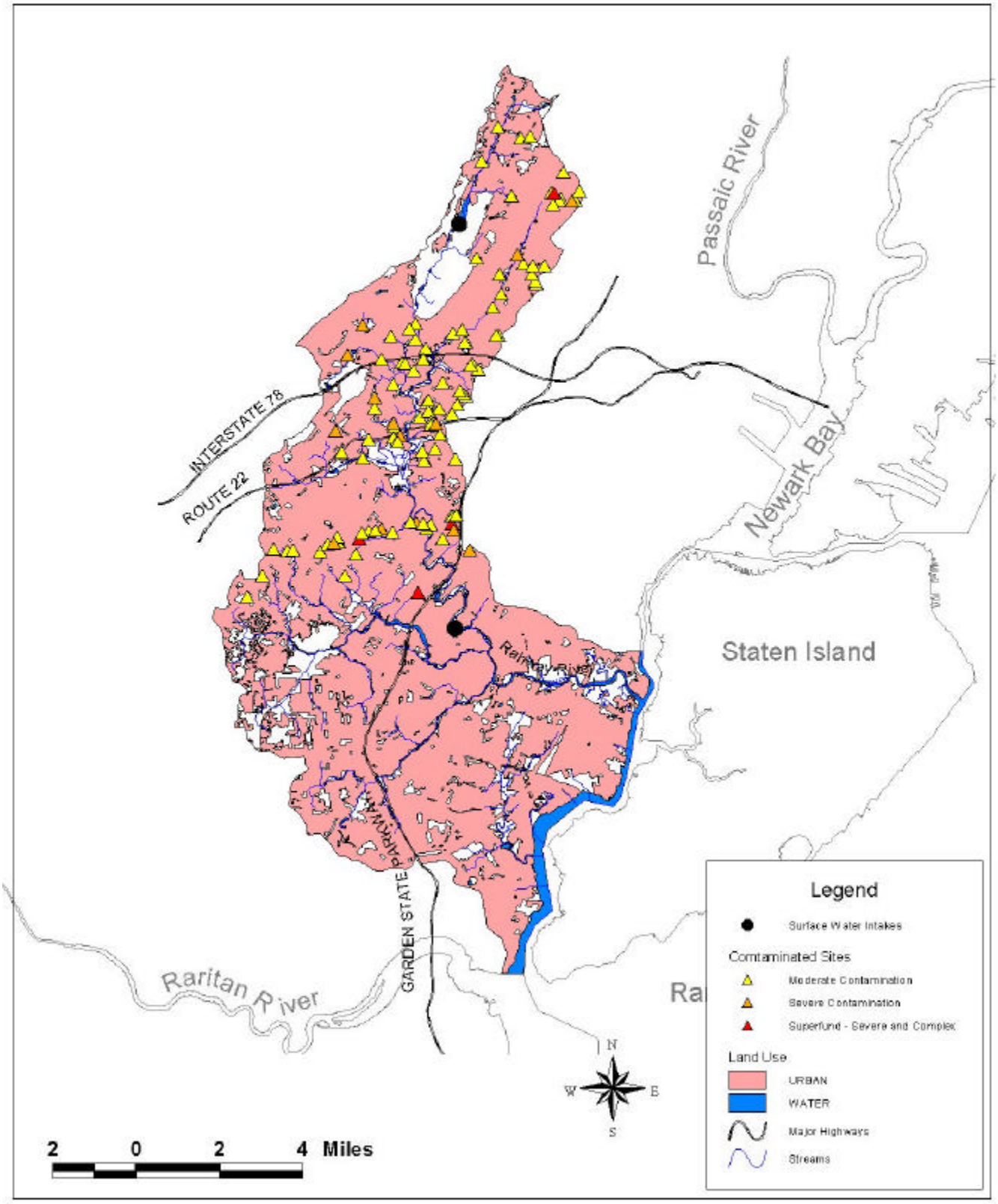


Figure A3.6.2-1 Industrial Water Suppy Designated Use Assessment

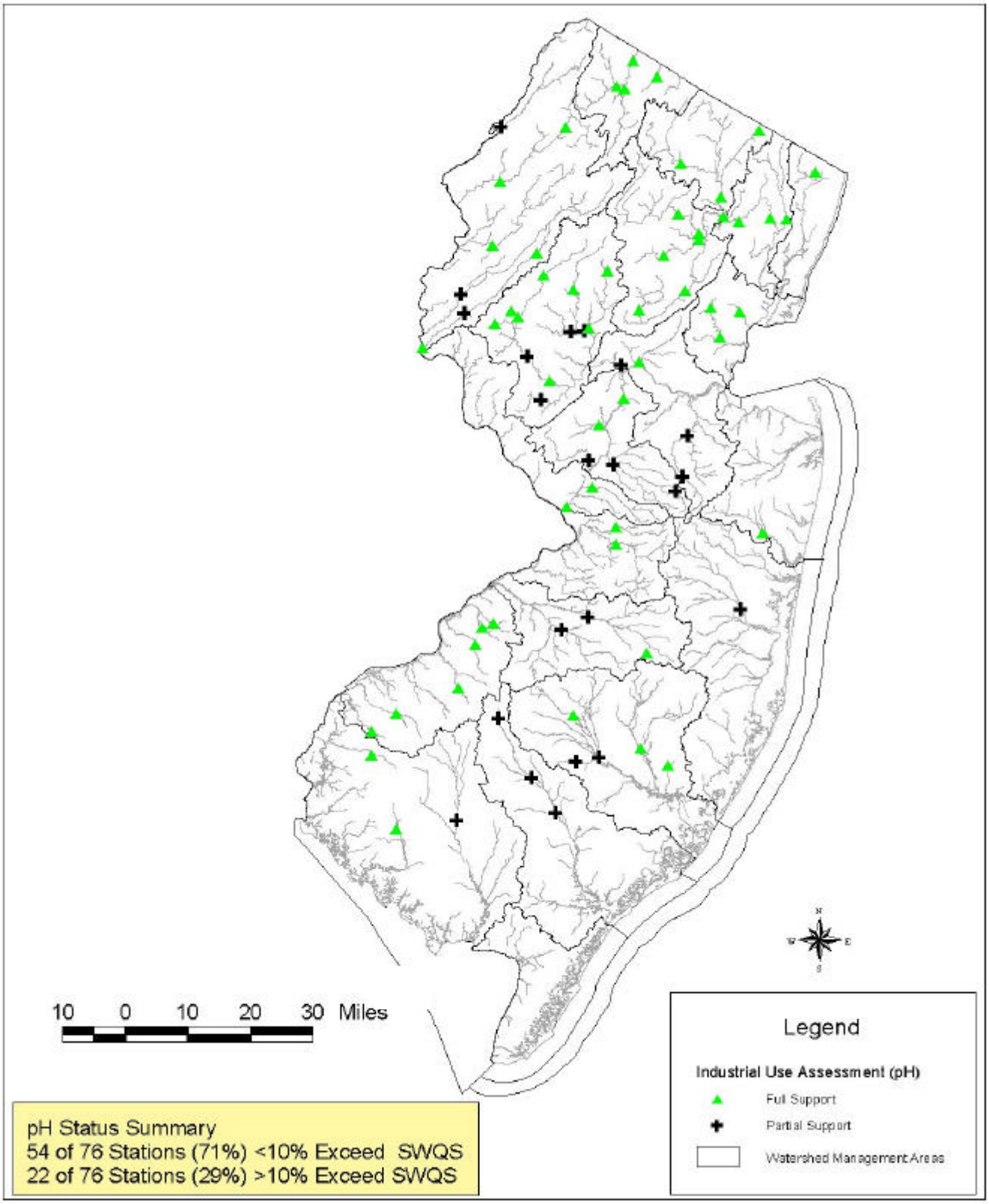


Figure A4.2.2-1 Recreational Lake Beach Water Quality in 1999 (Partial List)

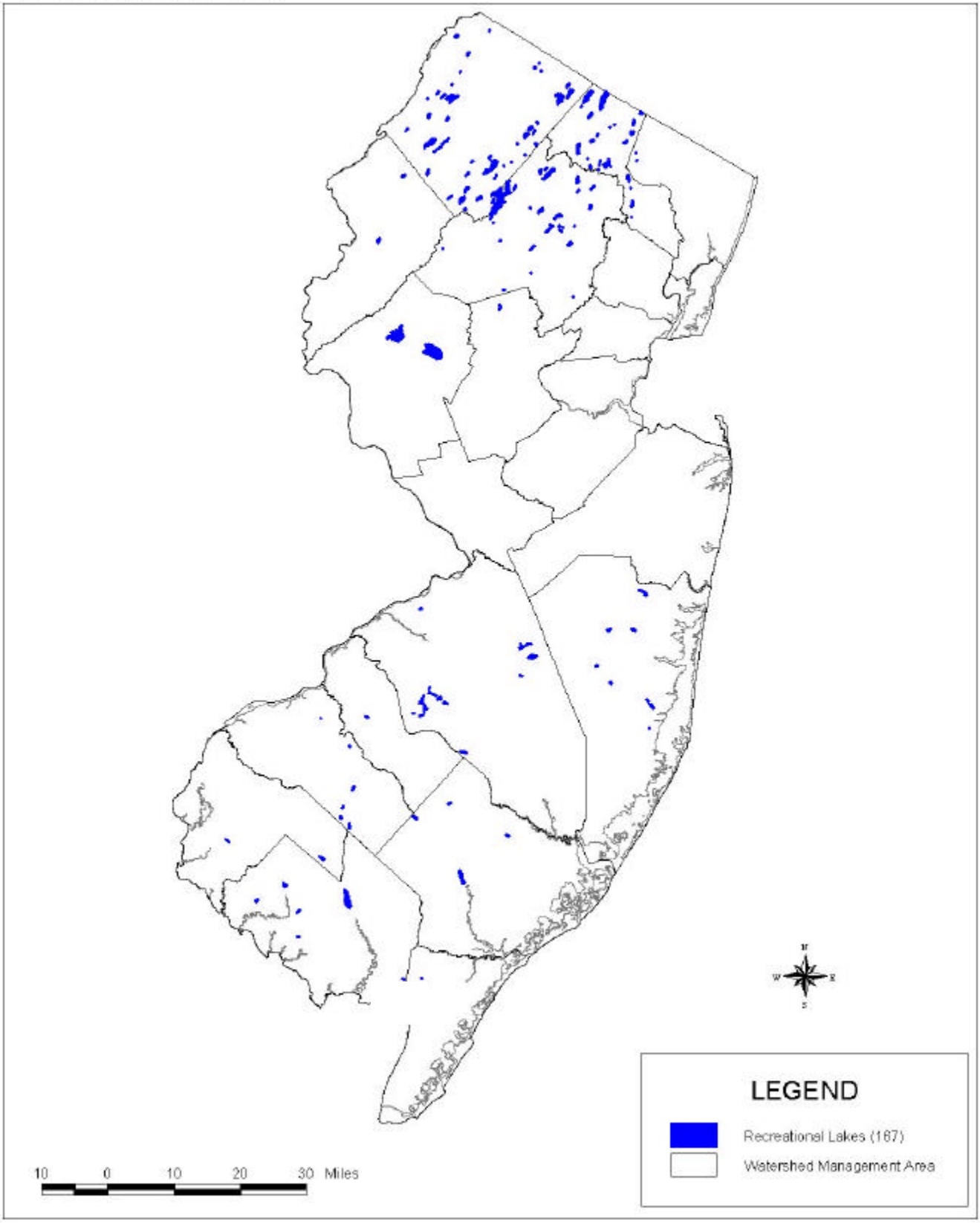


Figure A5.1-1 Estuary and Coastal Area of Assessment for Aquatic Life

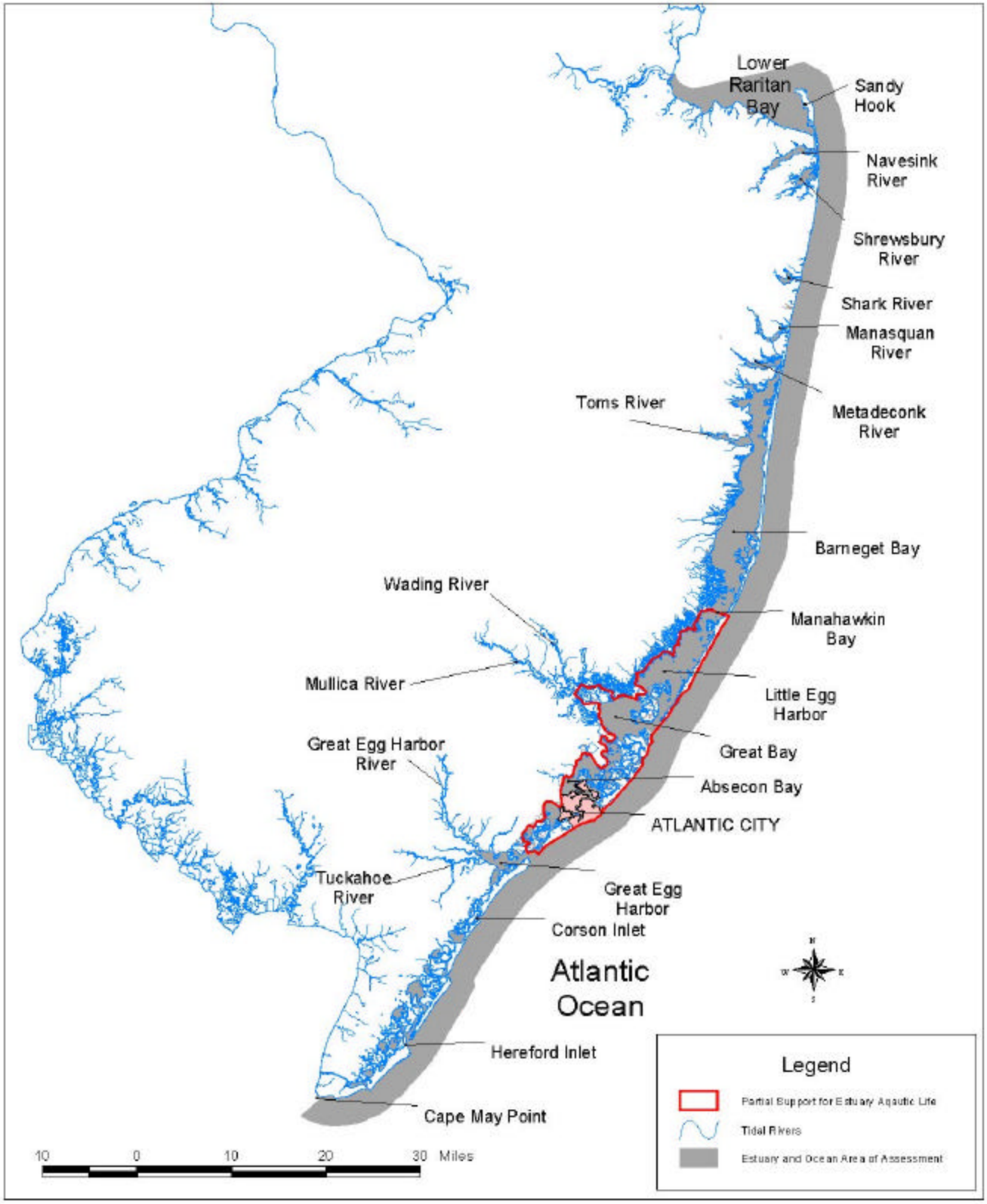


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Figure A5.1.1-1 Estuary Monitoring Network in New Jersey

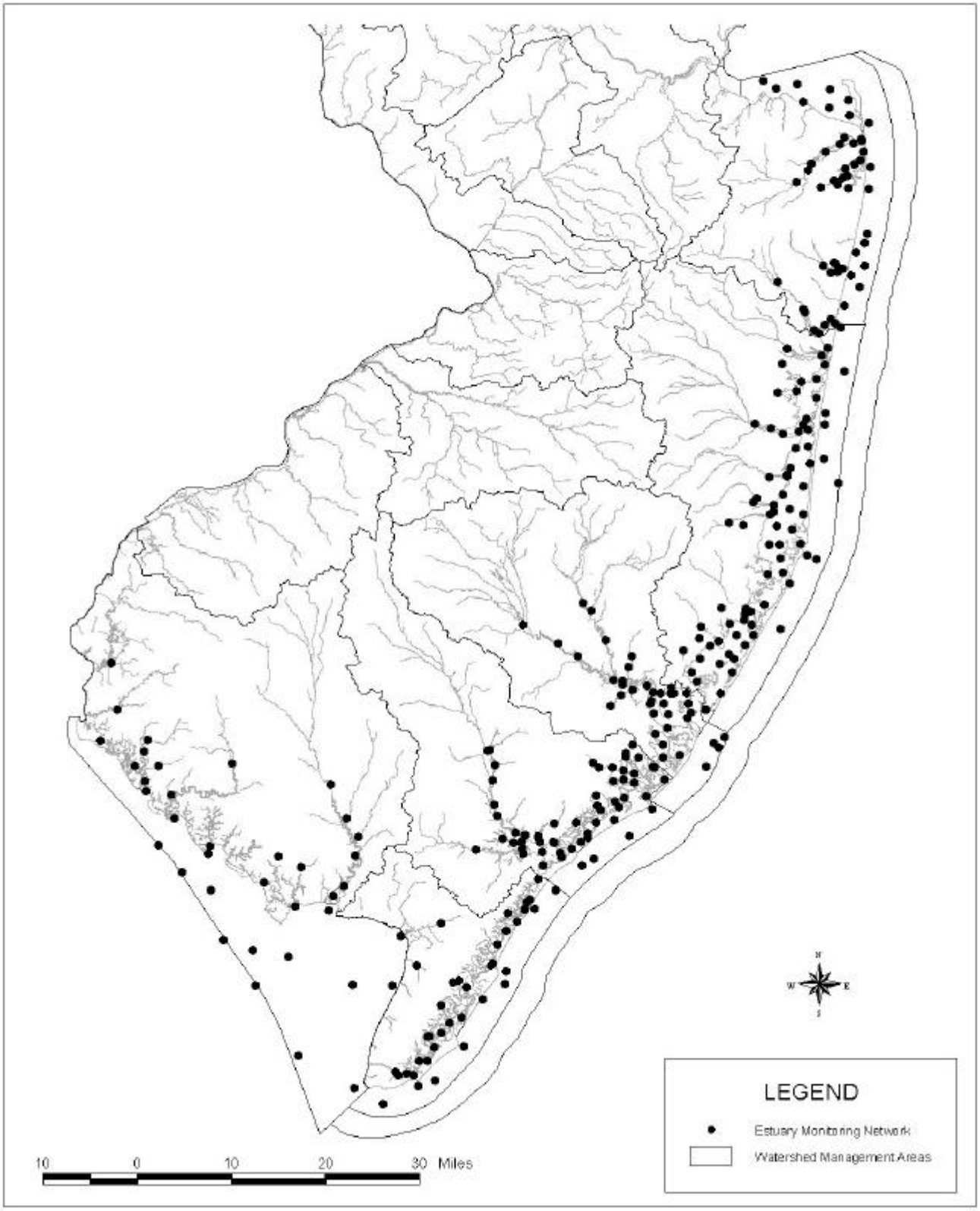


Figure A5.2.2-1 Estuary and Coastal Area of Assessment for Recreational Use

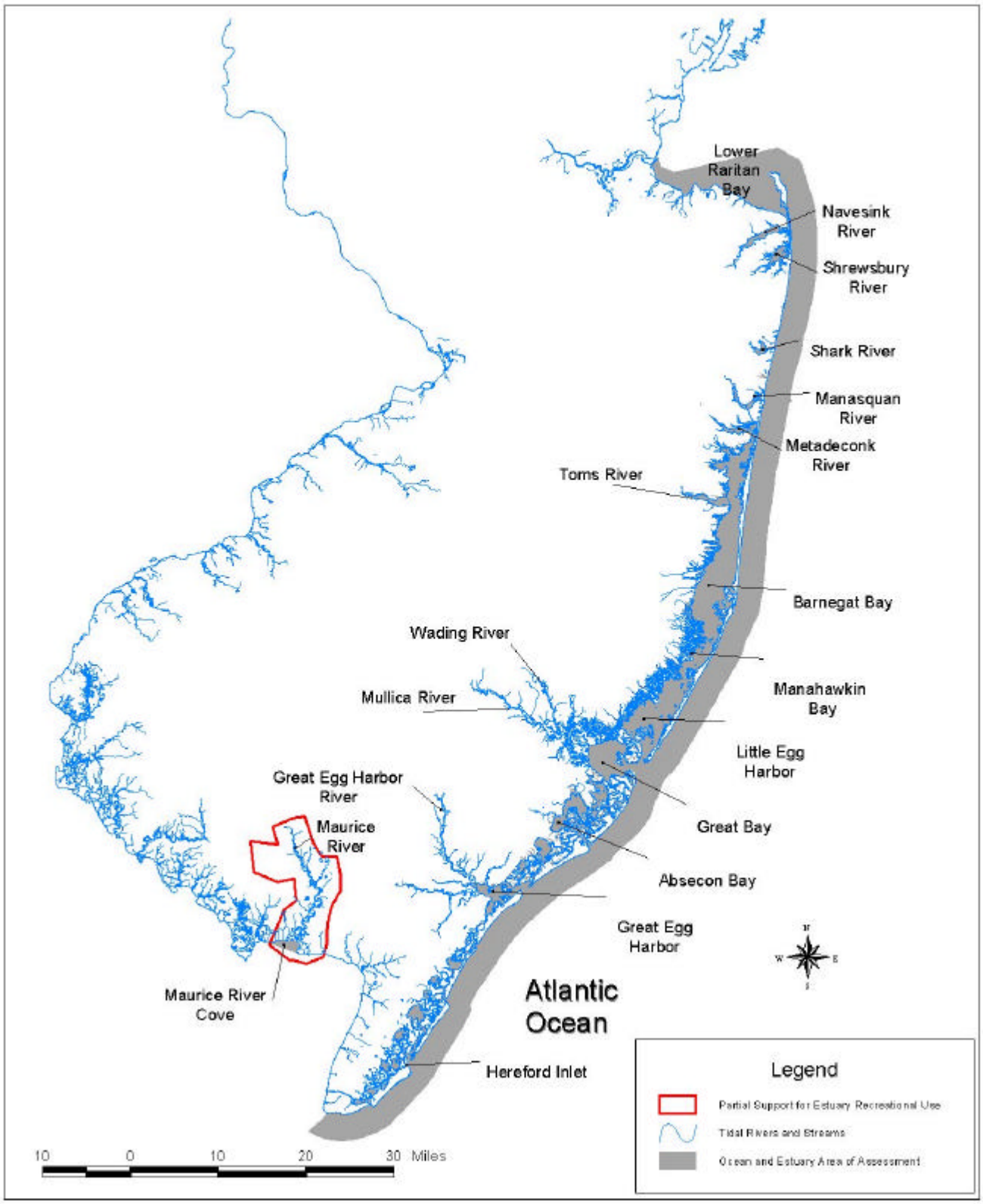


Figure A5.2.3-1 Stormwater Outfalls in Asbury Park Area, New Jersey

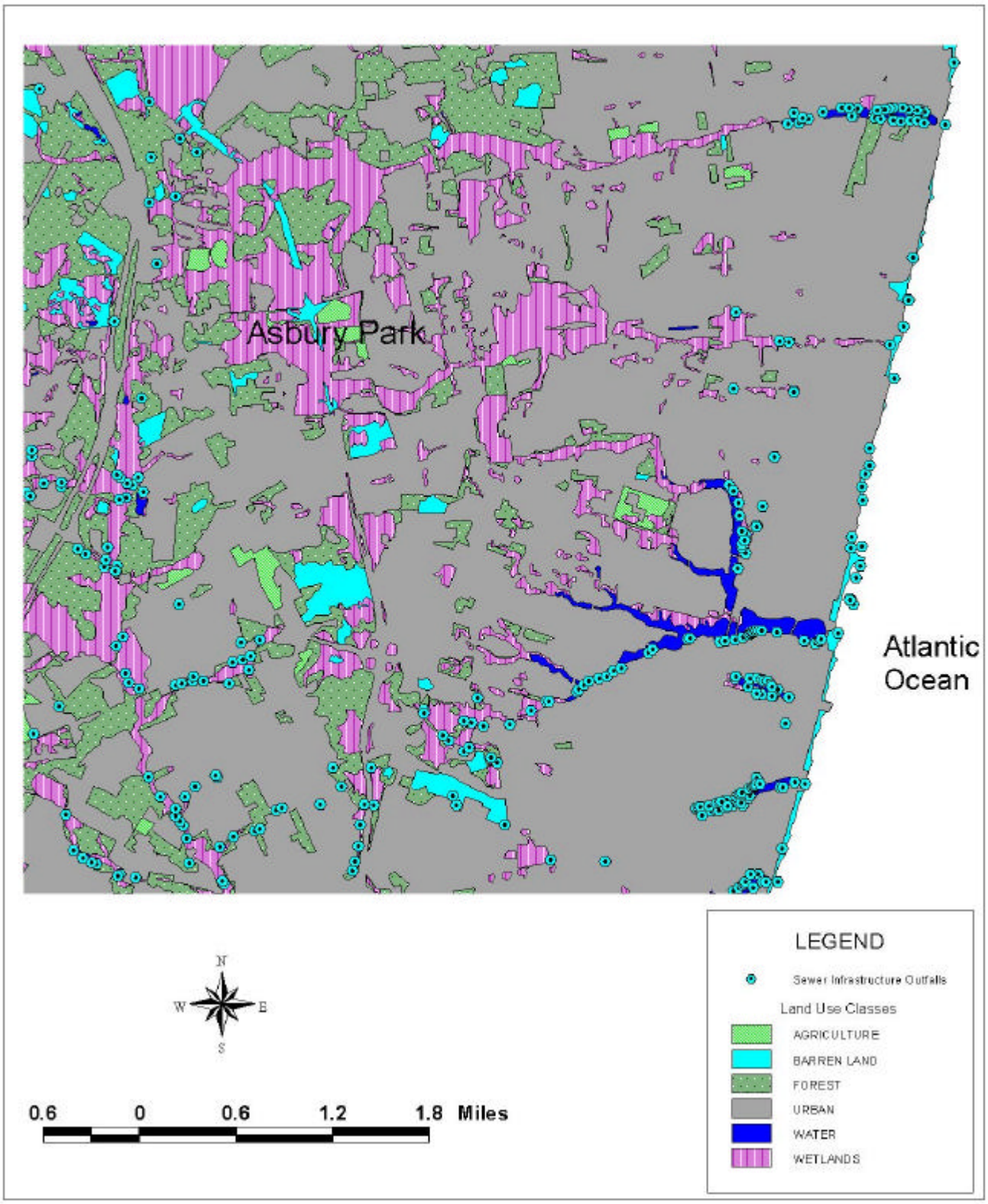


Figure A5.2.3-2 Sewer Service Areas and Municipal Effluent Discharges to Ocean Waters

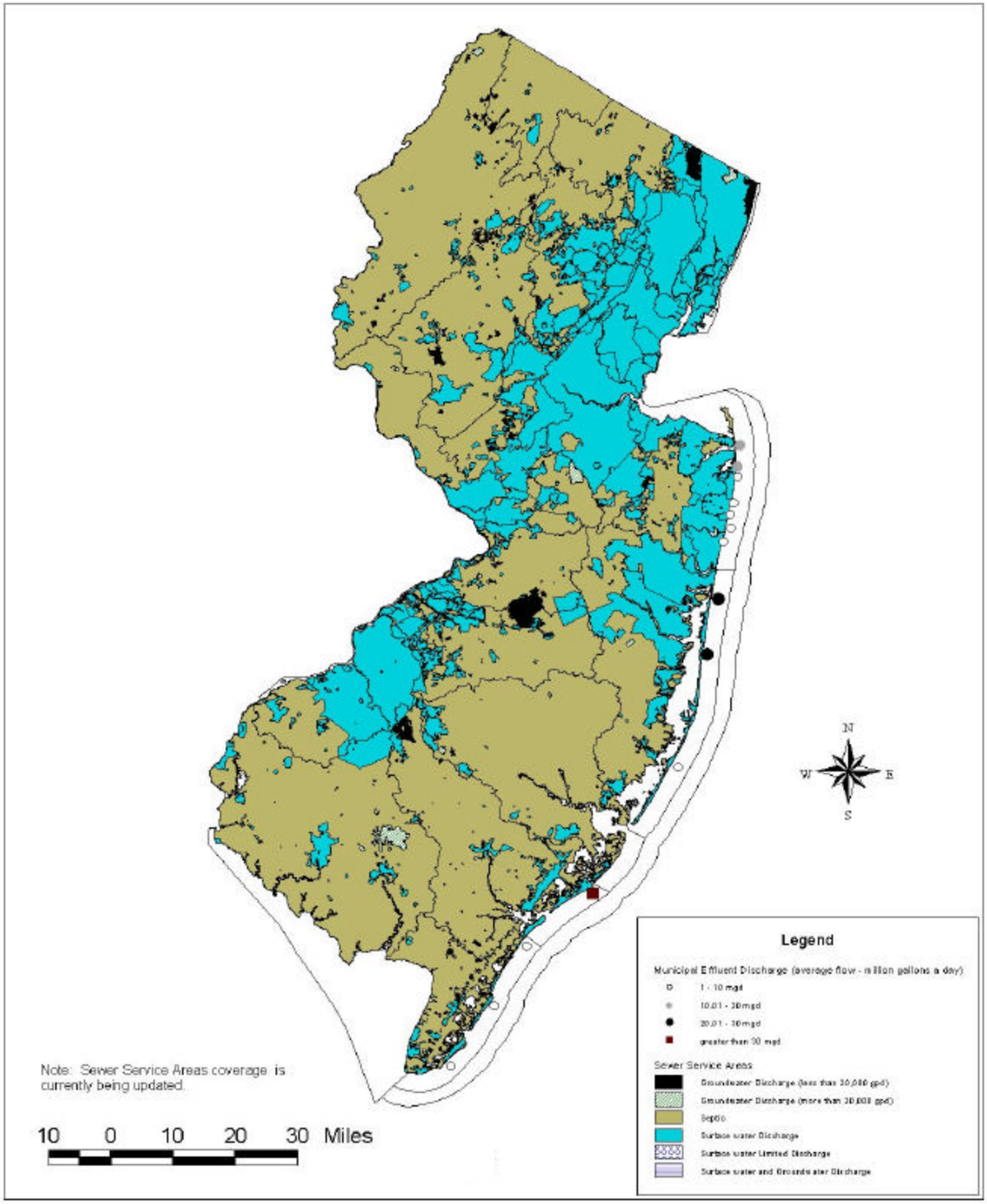


Figure 6.1 Tidal and Freshwater Wetlands in New Jersey

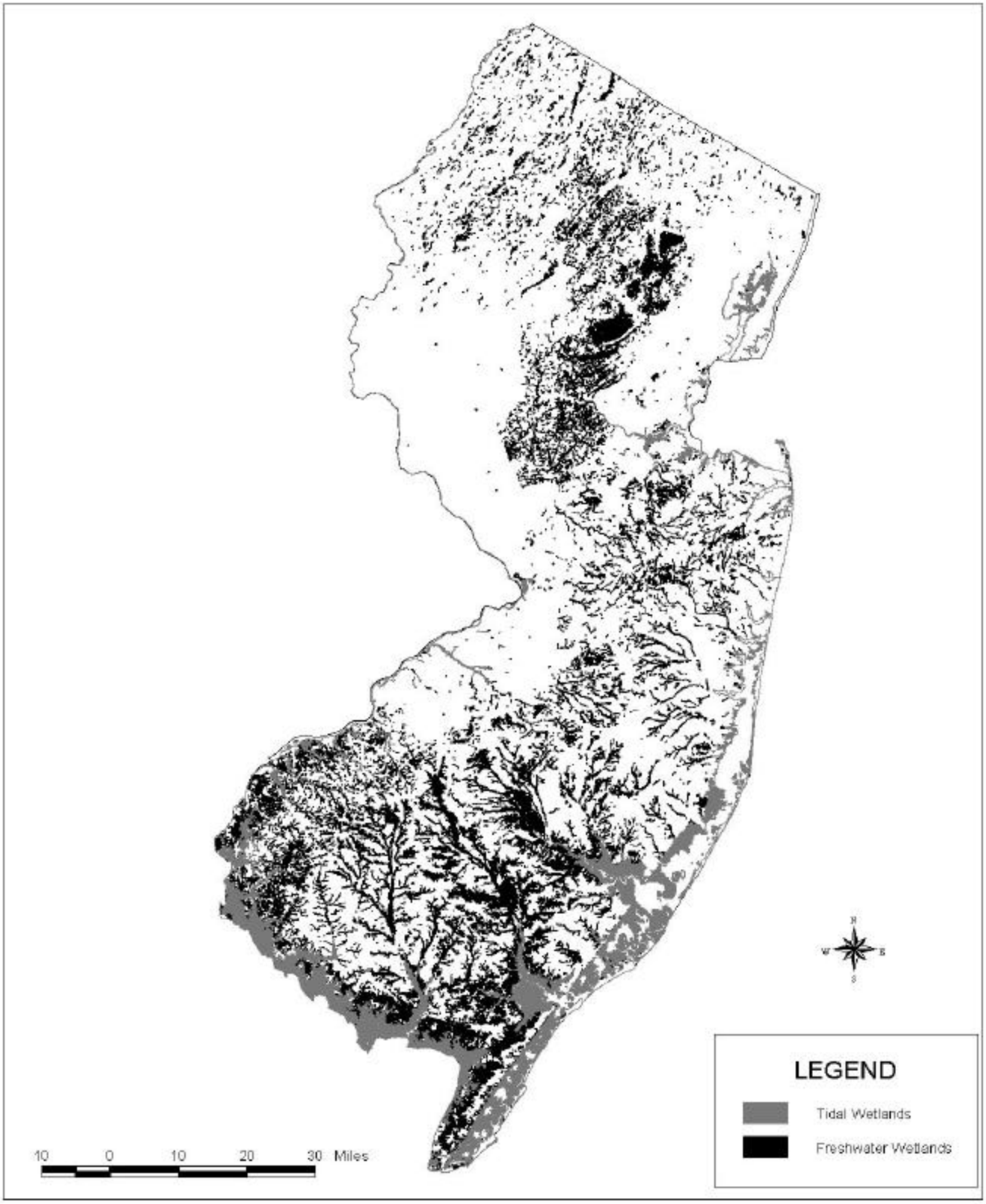


Figure 7.2.1-1 Shellfish Consumption Assessment

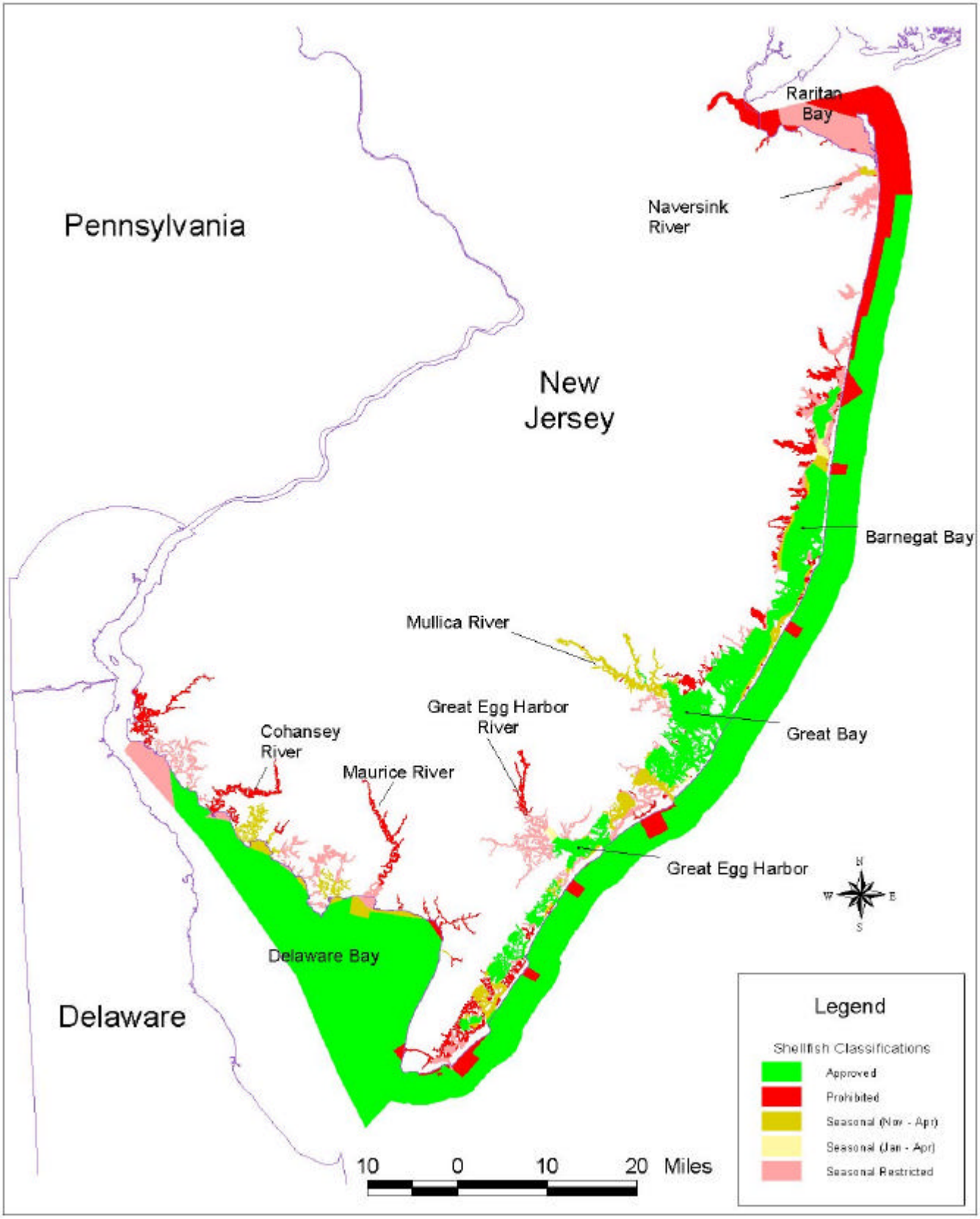


Figure IV-2.4-1 Physiographic Provinces of New Jersey

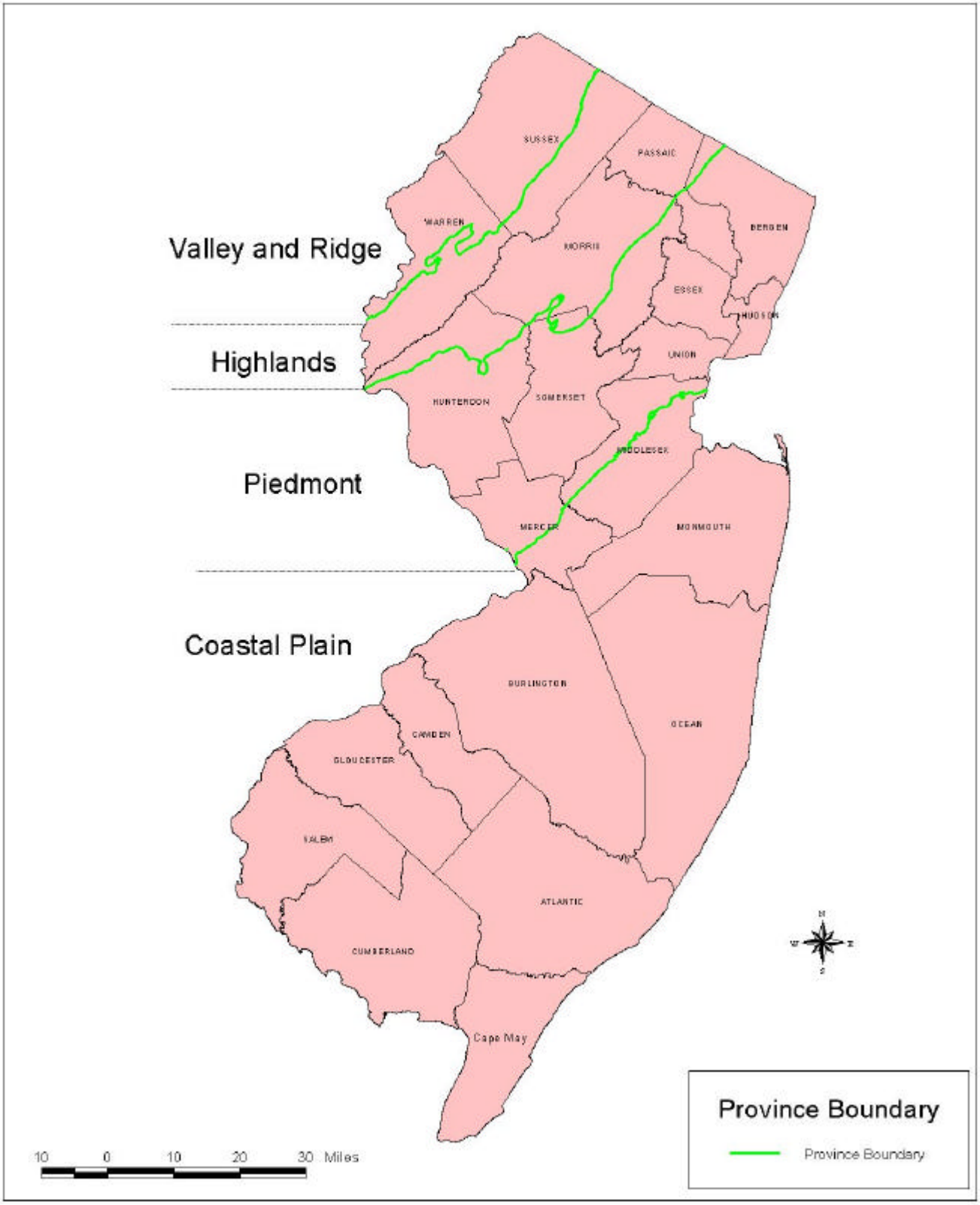
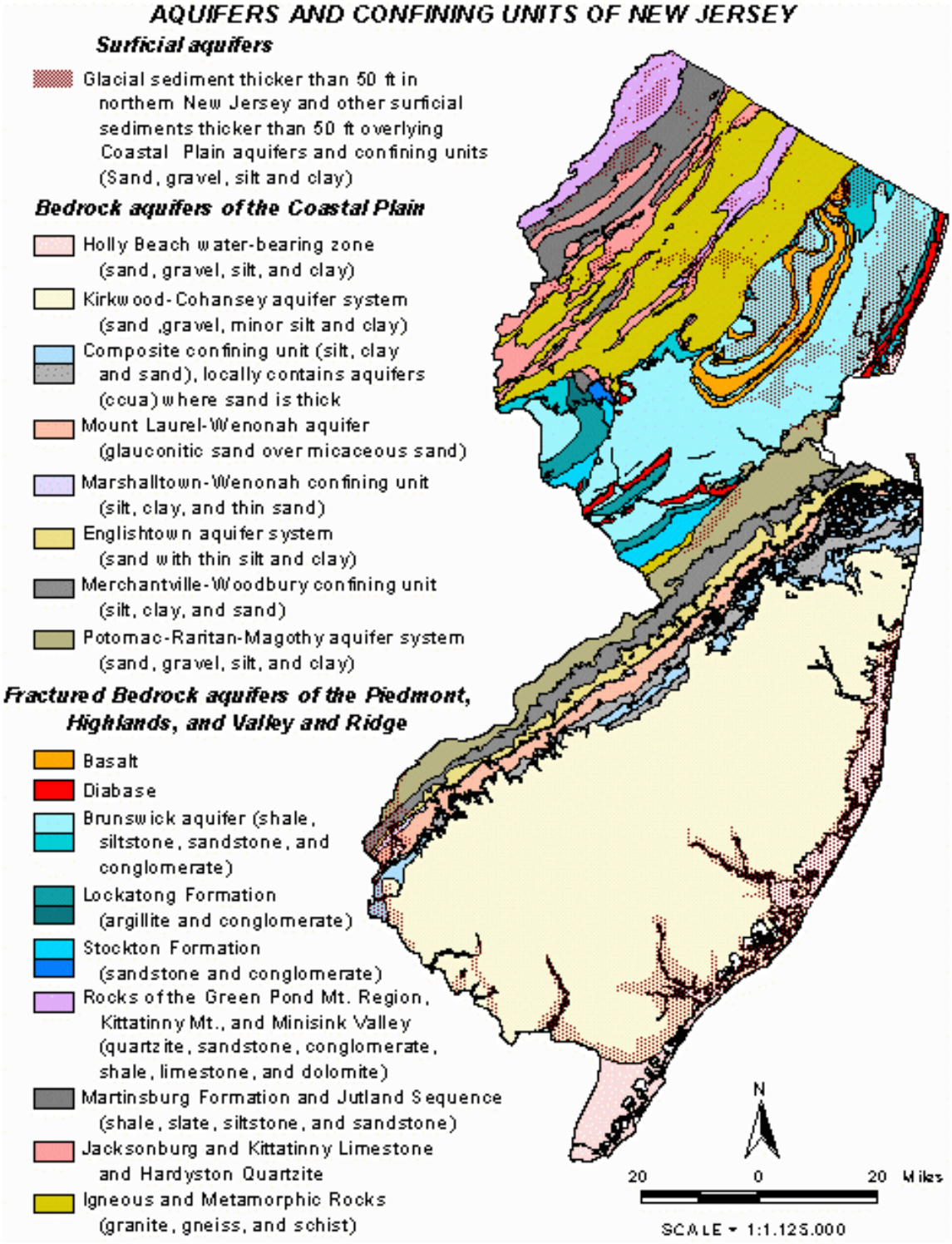


Figure IV-2.4-2 Aquifers of New Jersey


AQUIFERS AND CONFINING UNITS OF NEW JERSEY
Surficial aquifers
Glacial sediment thicker than 50 ft in northern New Jersey and other surficial sediments thicker than 50 ft overlying Coastal Plain aquifers and confining units (Sand, gravel, silt and clay)
Bedrock aquifers of the Coastal Plain
Holly Beach water-bearing zone (sand, gravel, silt, and clay)
Kirkwood-Cohansey aquifer system (sand ,gravel, minor silt and clay)
Composite confining unit (silt, clay and sand), locally contains aquifers (ccua) where sand is thick
Mount Laurel-Wenonah aquifer (glauconitic sand over micaceous sand)
Marshalltown-Wenonah confining unit (silt, clay, and thin sand)
Englishtown aquifer system (sand with thin silt and clay)
Merchantville-Woodbury confining unit (silt, clay, and sand)
Potomac-Raritan-Magothy aquifer system (sand, gravel, silt, and clay)
Fractured Bedrock aquifers of the Piedmont, Highlands, and Valley and Ridge
Basalt
Diabase
Brunswick aquifer (shale, siltstone, sandstone, and conglomerate)
Lockatong Formation (argillite and conglomerate)
Stockton Formation (sandstone and conglomerate)
Rocks of the Green Pond Mt. Region, Kittatinny Mt., and Minisink Valley (quartzite, sandstone, conglomerate, shale, limestone, and dolomite)
Martinsburg Formation and Jutland Sequence (shale, slate, siltstone, and sandstone)
Jacksonburg and Kittatinny Limestone and Hardyston Quartzite
Igneous and Metamorphic Rocks (granite, gneiss, and schist)
N
20 0 20 Miles
SCALE - 1:1,125,000