New Jersey Department of Environmental Protection
Division of Water Monitoring and Standards
Bureau of Environmental Analysis, Restoration and Standards

2012
New Jersey Integrated Water Quality Monitoring and Assessment Report

Maurice River Photo: Courtesy Ariane Giudicelli

Submitted to USEPA: July 30, 2014
Approved: September 25, 2014

Acknowledgements

The *2012 New Jersey Integrated Water Quality Monitoring and Assessment Report* was prepared by Sandra Cohen, Research Scientist 1; and Kimberly Cenno, Environmental Specialist 4; under the direction of Pat Gardner, Director; Jill Lipoti, former Director (retired); Barbara Hirst, Bureau Chief; Debra Hammond, former Bureau Chief (retired). New Jersey's water quality assessment database was designed and administered by Jack Pflaumer, Environmental Scientist 1, Bureau of Environmental Analysis, Restoration and Standards. New Jersey's Water Quality Data Exchange System was administered by Paul Morton, GIS Specialist 1, Division of Water Monitoring and Standards. Statewide water quality monitoring and assessment requires the participation and expertise of many individuals. Their participation in collecting, compiling, and assessing the data and other information required for this report is gratefully acknowledged (see Appendix L).

2012 New Jersey Integrated Water Quality Monitoring and Assessment Report

Table of Contents

TABLES

FIGURES

2012 New Jersey Integrated Water Quality Monitoring and Assessment Report
July 2014

Executive Summary

New Jersey is the fifth smallest and most densely populated state in the Nation, with approximately 8.9 million people living within 7,500 square miles of land area. New Jersey is also one of the most geologically and hydrogeologically diverse states, with over 18,000 miles of rivers and streams; over 50,000 acres of lakes, ponds, and reservoirs; 950,000 acres of wetlands; 260 square miles of estuaries; 127 miles of coastline; and over 450 square miles of ocean under its jurisdiction. The combination of population density, diversity of natural resources, and a wide range of industries and land uses, presents unique challenges to protecting New Jersey's water resources.

Water quality standards, monitoring, and assessment provide the scientific foundation for the protection of New Jersey's water resources and implementation of the federal Clean Water Act and the New Jersey Water Pollution Control Act. The 2012 Integrated Water Quality Monitoring and Assessment Report (Integrated Report) describes the overall quality of New Jersey's surface waters based on data collected between January 1, 2006 and December 31, 2010. This data is not only generated by the Department, but by various different monitoring organizations from which it is then compiled and evaluated by the Department to verify that the data meets the Department's data quality requirements. Data is then assessed using scientific methods developed specifically for the applicable type of parameter, use, and waterbody to determine compliance with New Jersey's surface water quality standards (SWQS).

The SWQS establish stream classifications and the designated uses for all waters of the State. Designated uses include:

- aquatic life support (maintenance, migration, and propagation),
- recreation,
- fish consumption,
- shellfish harvest for consumption,
- drinking water supply, industrial water supply, and
- agricultural water supply.

The Department assesses each applicable designated use for all of the State's 952 subwatersheds (assessment units), to determine whether each subwatershed is "fully supporting" the use, "not supporting" the use, or if insufficient information is available to assess the use.

The Department assesses each use by comparing the key ("minimum suite") parameters associated with that use with the applicable SWQS criteria. A subwatershed is "fully supporting" a designated use only if data for the minimum suite of parameters are available and there are no

exceedances of the applicable criteria for each parameter in the suite. If data are available for only some of the minimum suite of parameters, the use is not assessed due to insufficient information. If any single parameter associated with a designated use exceeds the applicable criteria, then the subwatershed is "not supporting" the designated use. Assessment methods are explained in more detail in the 2012 Final Integrated Water Quality Monitoring and Assessment Methods referenced in Appendix F of this Report.

The results of the data evaluation and use assessment are used to identify healthy watersheds that fully support designated uses, as well as watersheds that do not support designated uses and watersheds that need more monitoring. The use assessment results and other information presented in the 2012 Integrated Report are designed to answer basic questions and educate the public about the quality of New Jersey's water resources, and to guide and support regulatory and public policy decisions regarding how our water resources are managed.

Introduction: What is an "Integrated Assessment"?

The federal Clean Water Act mandates that states submit biennial reports to the U.S. Environmental Protection Agency (USEPA) describing the quality of their waters. Section 305(b) requires submission of a biennial report ("305(b) Report") that assesses overall water quality and support of designate uses of all principal waters, as well as strategies to maintain and improve water quality. The 305(b) Reports are used by Congress and USEPA to establish program priorities and funding for federal and state water resource management programs. Section 303(d) requires submission of a biennial List of Water Quality Limited Waters ("303(d) List"), which identifies waters that are not supporting designated uses because they do not meet surface water quality standards despite the implementation of technology-based effluent limits. States must prioritize waters on the 303(d) List for Total Maximum Daily Load (TMDL) analyses and identify those high priority waters on the 303(d) List for which they anticipate establishing TMDLs in the next two years. These separate requirements were integrated into one statewide water quality monitoring and assessment process, the Integrated Assessment, in 2002. The results of the Integrated Assessment are presented and explained in detail in this biennial Integrated Water Quality Monitoring and Assessment Report (Integrated Report).

The Integrated Assessment commences with the compilation and analysis of all readily available water quality monitoring data, which is then assessed for compliance with New Jersey's water quality standards using sound and vetted scientific methods. Water quality standards, monitoring, and assessment provide the scientific foundation for the protection of New Jersey's water resources and implementation of the federal Clean Water Act and the state Water Pollution Control Act. Monitoring and assessment of water quality data directs and supports the New Jersey Department of Environmental Protection's (Department) efforts to develop and refine water quality standards that provide measurable targets for identifying and protecting high quality waters, identifying and restoring impaired waters, issuing and enforcing discharge permits, managing nonpoint sources of pollution, setting priorities for water resource management, and evaluating the effectiveness of restoration and protection actions.

Assessing the Health of Our Waters: Water Quality Goals and Measures

The surface water quality standards (SWQS) establish stream classifications and antidegradation designations for all surface waters of the State. The stream classifications reflect the designated uses assigned to individual surface waters. The SWQS also specify the water quality criteria that correspond with the waterbody classifications, which are necessary to achieve the designated uses. Some designated uses apply to all assessment units (AUs), e.g. recreation, while other uses apply only to some AUs (e.g. public water supply). Therefore, in assessing the percentage of uses assessed and attained statewide, the total number of applicable AUs will vary from use to use.

Water quality monitoring data supports the Department's efforts in developing and refining water quality standards, reporting on water quality conditions, listing impaired waters, issuing and enforcing discharge permits, managing nonpoint sources, protecting good quality waters, setting priorities for water quality management, tracking changes in water quality over time, and evaluating the effectiveness of restoration and protection actions in achieving Clean Water Act goals to "restore and maintain the chemical, physical and biological integrity of the Nation's waters". The Department oversees the operation of the primary water quality monitoring networks for the State of New Jersey. Monitoring strategies employed by the Department are comprised of multiple water quality assessment techniques including: habitat assessments, in-stream biological monitoring such as fish population surveys, collection of physical/chemical data on a variety of matrices (surface water, ground water, sediment), identifying pollution sources in the coastal and freshwater environment (discharges, stormwater, marinas), and sediment toxicity testing. However, monitoring conducted by other entities, such as federal and county government agencies, regional commissions (e.g., Pinelands Commission) watershed associations (including voluntary citizen monitoring) and discharger associations, is also used to supplement these networks and expand the range and scope of information available for water quality assessment. New Jersey's water monitoring programs are described in *New Jersey's Water Monitoring and Assessment Strategy (2005-2014)*, available on the Department's Web site at http://www.state.nj.us/dep/wms/longtermstrategyreport.pdf and is referenced in Appendix G of the Integrated Report.

Water quality monitoring data used for the 2012 Integrated Assessment was generally collected between January 1, 2006 and December 31, 2010, and was used to identify high quality waters that are fully supporting applicable designated uses, lower quality waters that are not supporting designated uses, and waters for which insufficient information is available to assess water quality. The Integrated Assessment also identifies causes and sources of water quality problems so that appropriate strategies may be implemented by the State to maintain high quality waters, improve lower water quality waters, and gather sufficient information to assess all waters of the State. The information provided in the Integrated Assessment is used by Congress, USEPA, and the State of New Jersey to establish program priorities and funding for federal and State water resource management programs for maintaining and restoring water quality, including the development of TMDLs for waters that do not meet SWQS despite the implementation of technology-based effluent limits, as identified on the List of Water Quality Limited Waters (303(d) List).

The Integrated Assessment process was refined in 2012 using improved computer technology to focus on subwatersheds where water quality conditions had changed since the prior assessment cycle. All new water quality data was required to be submitted to the Department via the New Jersey Water Quality Data Exchange System (WQDE), which is available on the Department's Web site at http://www.state.nj.us/dep/wms/wqde/. WQDE already contained data covering the 2004-2008 reporting period, so the Department conducted a preliminary assessment (or "screening") of water quality data collected by the Department between 2009 and 2010 (and 2011 data collected in the Barnegat Bay) and any new data submitted by other entities in response to the April 2011 data solicitation public notice. This data was run through a computer database that identified all monitoring stations where the assessment outcome for the new data was different from the 2010 assessment outcome, i.e., stations where unimpaired waters now exceed water quality for one or more parameters and stations where impaired waters now meet water quality standards. These stations were then compiled into their corresponding assessment units for a comprehensive assessment that evaluated water quality data along with historical data and other factors such as hydrology, underlying geology, land use, biological habitat conditions and other scientific considerations, to determine if the overall water quality in the subwatershed supported a new listing or delisting on/from the 2012 303(d) List.

This "comprehensive assessment" included confirmation of data quality, station location, use designation, stream classification, and water quality criteria through the application of Geographic Information Systems (GIS) tools and spatial information overlays, aerial and satellite-based photography, meteorological and hydrologic data (weather and flow conditions), field observations and visual assessments. This additional step allowed the Department to address multiple water resource concerns concurrently and enhance "best professional judgment" decisions through a more robust assessment of environmental conditions affecting the entire subwatershed. Through this process, the Department was able to:

- Evaluate multiple stations, as well as neighboring subwatersheds, through a weight of evidence approach;
- Consider if outliers were due to data entry, analytical, or collection errors;
- Identify transient events such as snow storms that caused temporary excursions of the criteria;
- Verify biological indexes.
- Confirm water quality improvement resulting from restoration projects and identify targets for potential new projects.
- Validate the application of existing TMDLs on newly monitored locations.
- Consider newer data to confirm marginal listing/delisting decisions.
- Identify potential priority sources for permit review/enforcement.
- Justify natural conditions for DO, Temperature and pH based upon biological monitoring.
- Provide justification for station relocation.

As a result of this assessment process, 386 pollutant/AU combinations were delisted for the following reasons:

- Applicable Water Quality Standards (WQS) Attained; Due To Restoration Activities (17);

- Applicable WQS Attained; According To New Method (21);
- Applicable WQS Attained; Due to Change in Water Quality Standard (39);
- Applicable WQS Attained; Reason For Recovery Unspecified (115);
- Total Maximum Daily Load (TMDL) Approved Or Established By USEPA (39);
- WQS Attained; Original Basis For Listing Was Incorrect (110);
- Data And/Or Information Lacking To Determine Water Quality Status; Original Basis For Listing Was Incorrect (45).

A detailed justification of each delisting for good cause is included in Appendix C: 2012 Final Assessment Unit-Cause Combinations Removed from 303(d) List (Delisted Waters) and Justification for Delisted Waters. Previously a Delisting Justification Document was prepared and posted on the Department's Web site in support of the then draft 2012 303(d) List.

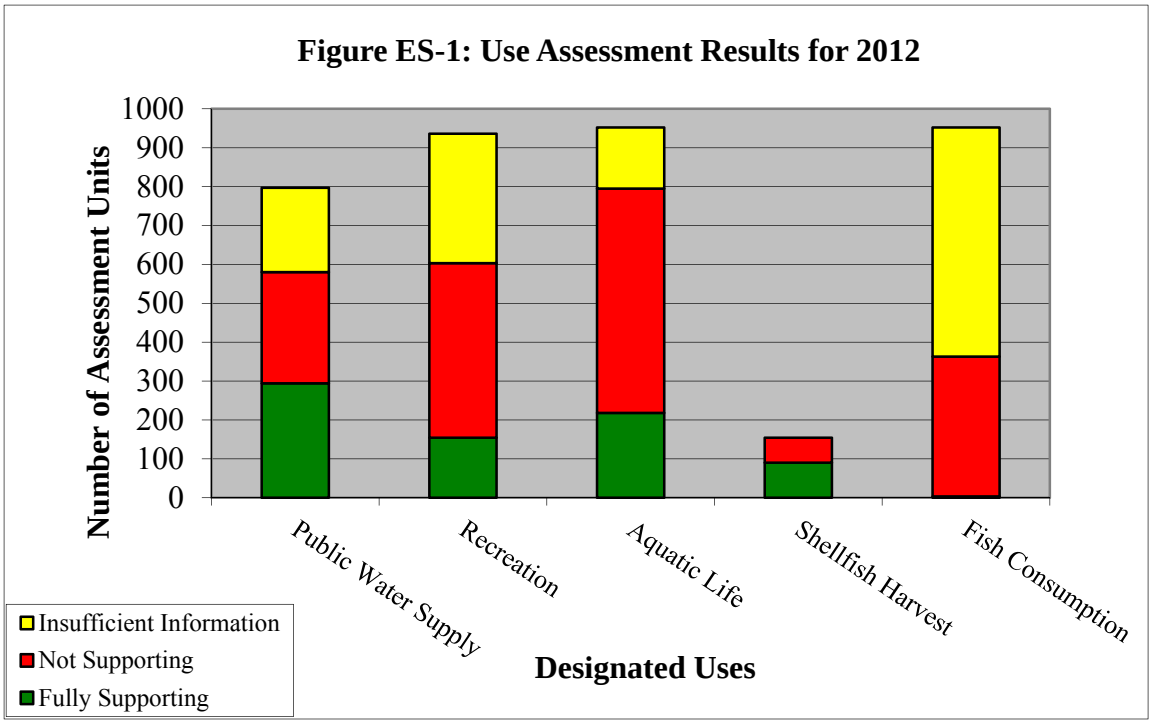
The Results: What Does The Data Tell Us?

Chemical and biological monitoring data collected between 2006 through 2010 were used to generate the 2012 Assessment Unit Summary List (Integrated List)[1] and the 2012 303(d) List of Water Quality Limited Waters (303(d) List). The Integrated List contains the use assessment results for all waters of the State, grouped into 952 assessment units (AUs)[2]. When assessing each designated use, the Department determines whether the use is fully supported, not supported, or not assessed due to insufficient information. Figure ES-1 shows the overall use assessment results for 2012. AUs shown as "not supporting" include those for which a TMDL has been developed as well as AUs on the 2012 303 (d) List that still require a TMDL.

[1]Formerly referred to as the "Status of Designated Uses by Subwatershed Report", "Statewide Water Quality Inventory Report" or "305(b) Report"

[2] New Jersey's waters are grouped for assessment purposes into hydrologically connected assessment units, which are based on United States Geological Survey (USGS) 14-digit Hydrologic Unit Code (HUC) boundaries. HUCs are geographic areas representing part or all of a surface drainage basin or distinct hydrologic feature as delineated by USGS in cooperation with the National Resources Conservation Service (NRCS). Shared waters of the Delaware River mainstem, Estuary, and Bay are assessed by the Delaware River Basin Commission (DRBC). Impaired Delaware River waters are shown in a sub-table of the New Jersey 2012 303(d) List but are not addressed in this report.

Figure ES-1: Use Assessment Results for 2012



- **Public Water Supply:** Thirty-seven percent of waters designated for Public Water Supply Use fully support the use; an 11% decrease from 2010. Thirty-six percent did not support the use, a 12% increase from 2010. Most of this change is attributable to improved detection of arsenic at very low levels. Twenty-seven percent of waters designated for the drinking water supply use were not assessed due to insufficient information, 1% less than 2010.

- **Recreation:** All waters of the State are designated for Recreational Uses and 16% fully support that use, the same as in 2010. Forty-eight percent did not support the use; a 4% increase from 2010. Thirty-six were not assessed due to insufficient information, a 4% decrease from 2010. TMDLs have been completed for most (81%) of the waters that did not support recreational uses because of pathogens (*E. coli*, *Enterococcus*, and fecal coliform). It should be noted that the recreational use applies to all waters throughout the State (including lakes). Assessment of ocean bathing beaches, where most recreation occurs, shows that these waters are fully swimmable.

- **Aquatic Life:** All waters of the State are designated for the General Aquatic Life Use and 23% fully support that use; a 1% increase from 2010. Sixty-one percent did not support the use; a 5% decrease from 2010. Sixteen percent were not assessed due to insufficient information, a 4% increase from 2010. Thirty percent of waters designated for trout aquatic life fully support this use, an 8% increase from 2010. Fifty-three percent of waters designated for trout use did not support this use; an 11% decrease from 2010. Seventeen percent were not assessed due to insufficient information; a 3% increase from 2010.

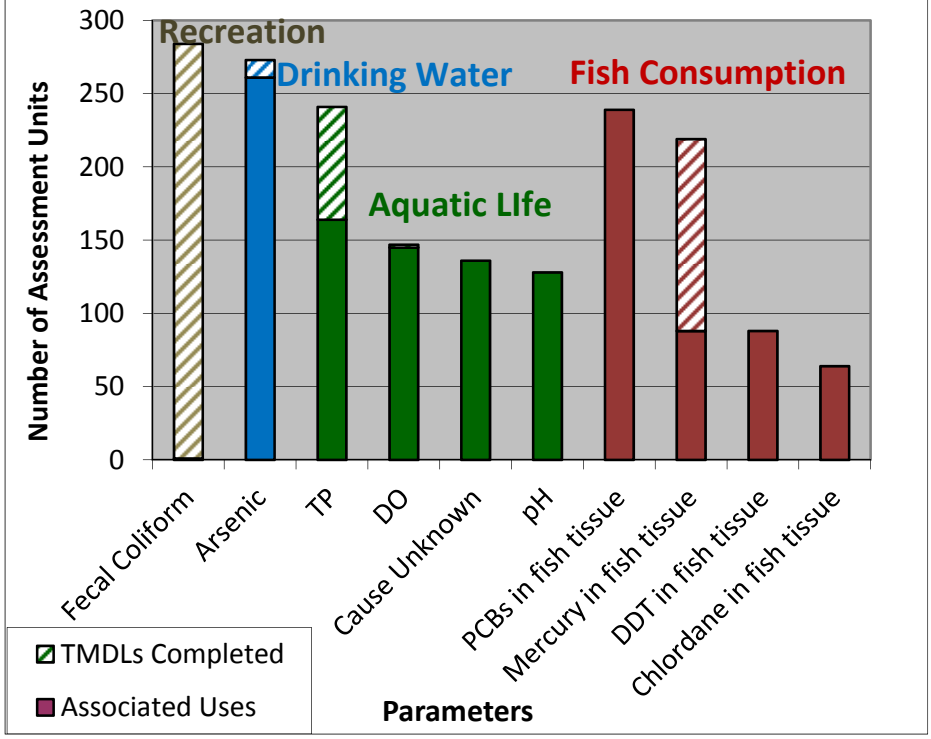
- **Shellfish Harvest for Consumption:** Only waters classified as harvestable for shellfish consumption are assessed for the shellfish use. Federal requirements for shellfish

classification provide three categories of harvestable shellfish: "approved" (with no restrictions), "seasonal harvest", and "special restrictions". Only shellfish waters classified as "approved" are assessed as fully supporting the designated use. While 89% of shellfish waters are currently classified as harvestable, only 58% of AUs associated with the shellfish use fully support the use, a 2% decrease from 2010. Forty-two percent did not support the use; a 2% increase from 2010; however, TMDLs have been developed for most of the shellfish waters assessed as not supporting the shellfish harvest for consumption use.

- **Fish Consumption:** All waters of the State are designated for the Fish Consumption Use. Three out of 952 subwatersheds (0.3%) fully support the use, the same as in 2010. Thirty-eight percent did not support the use; a 3% increase from 2010. Sixty-two percent were not assessed due to insufficient information, a 3% decrease from 2010. While the Department used fish tissue data where available, most of the State's waters were assessed based on fish consumption advisories. Consumption advisories may restrict the amount and/or the type of fish consumed and there may be different advisories for high-risk populations and the general public. The Department issues both statewide and waterbody-specific advisories for the general population and for high-risk groups including infants, children, pregnant or nursing mothers, and women of childbearing age.

The most frequent causes of water quality impairment are shown in Figure ES-2 and are associated with the recreation, aquatic life, fish consumption, and public water supply uses. Impaired waters include those identified on the final 2012 303(d) List as well as those for which a TMDL has already been established.

Figure ES-2: Top Ten Causes of Impairment on the 2012 Integrated List

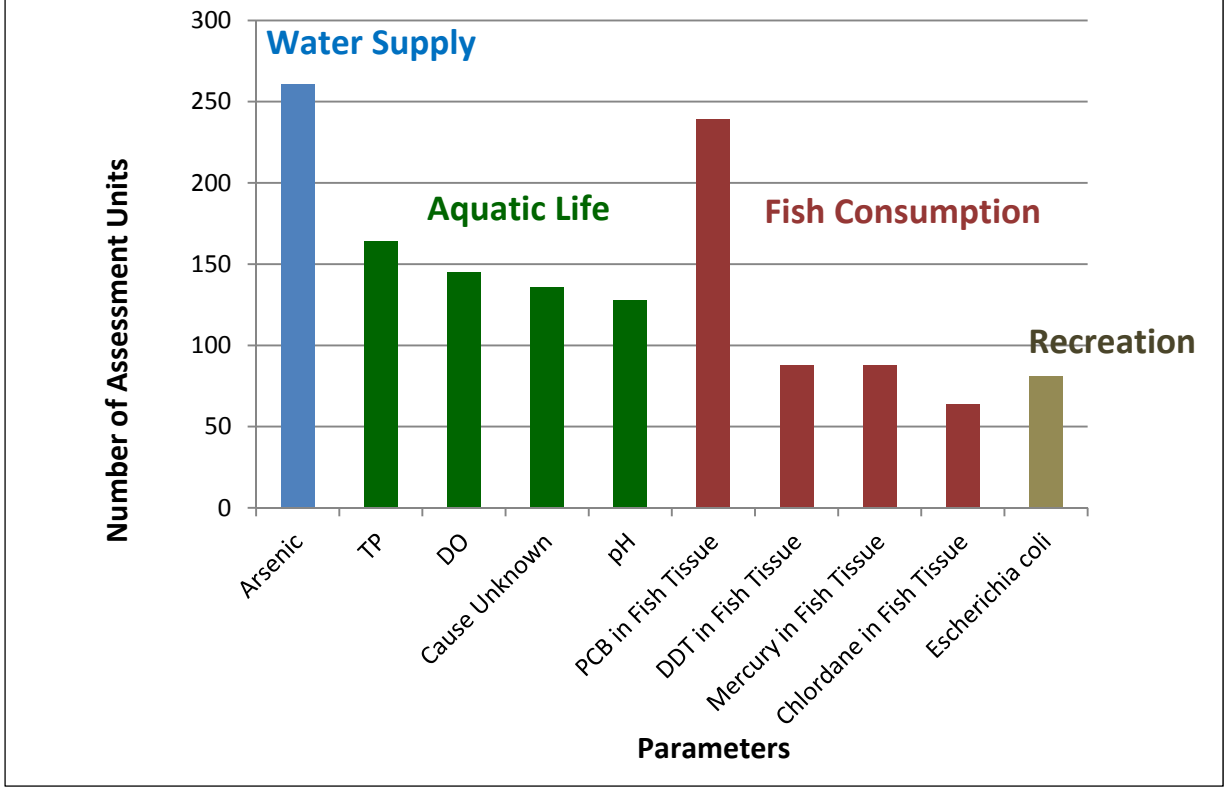


Fecal coliform, a pathogenic bacterium associated with the Recreational Use, is the most frequent cause of water quality impairment in New Jersey; however, most of these impairments are already being addressed through implementation of TMDLs. When water quality is eventually restored and the Recreational Uses are fully supporting, Fecal coliform will no longer be the predominant cause of water quality impairment in New Jersey.

Even though TMDLs have been established that address many of the most predominant pollutants causing water quality impairment in New Jersey waters, impaired waters will continue to be assessed as not supporting designated uses until the measures required by the TMDLs are implemented and water quality is restored. A significant period of time may elapse between TMDL establishment, implementation of load reduction measures, and the availability of new water quality data to reevaluate the conditions. The waters will continue to be assessed as not supporting designated uses (even though they will not appear on the 303(d) List). For example, if a TMDL is adopted in 2012 and permits are issued in 2013 with a three-year compliance schedule, improvements might not be observed until 2016. Water quality data reflecting improved water quality conditions would not be assessed until at least the 2018 Integrated Report.

Pollutants causing impairment that are not addressed by a TMDL are identified on the 303(d) List. The 2012 303(d) List identifies 32 pollutants causing water quality impairment in one or more assessment units for a total of 1,729 listings, of which 136 were attributed to "Cause Unknown". The "top ten" most frequent pollutants are responsible for 81 percent of the 2012 303(d) List. These pollutants are shown in Figure ES-3, grouped by their associated designated uses.

Figure ES-3: 2012 Top Ten Pollutants on the 2012 303(d) List



A "pollutant" is a chemical constituent that causes water quality impairment. If chemical data are unavailable or show no exceedance of applicable criteria, but other data (i.e., biological) indicate that the designated use (i.e., aquatic life) is not supported, "cause unknown" is identified on the 303(d) List as the pollutant causing non-support until a chemical pollutant cause is identified. Several of the top ten pollutants (PCBs, Mercury, and DDT) are associated with the fish consumption use. PCB in fish tissue is no longer the most frequent cause on the 303(d) List because 34 AUs were delisted based on the USEPA-approved PCB TMDL for the Delaware River and Bay. Arsenic, which is associated with the Drinking Water Supply Use, is now the most frequent pollutant on the 2012 303(d) List, based on improved analytic methods. The Department has been working with USGS to identify naturally-occurring regional concentrations of arsenic based on the underlying geology. Mercury remains in the top even though 98 AUs on the 2008 303(d) were delisted in 2010 under the USEPA-approved Statewide Mercury TMDL and despite an additional 13 AUs delisted for mercury in 2012 under the same TMDL.

The data also show us where water quality improved since the last Integrated Report. Appendix C identifies 386 AU/pollutant combinations that were on the 2010 303(d) List but were "delisted" because new data show that the applicable water quality standards are attained or the original listing was in error. The Integrated Report also identifies high quality waters that fully support all or most of their applicable designated uses. These healthy watersheds fully support all applicable designated uses, except for fish consumption, which was not assessed for the majority of these AUs. One of these, Big Flat Brook above Forked Brook (NJ02040104140010-01), fully

supports all applicable designated uses including fish consumption. Big Flat Brook is classified as trout production waters and also designated as a Category One waterbody. Some of its tributaries are classified as FW-1 waters. These 23 "healthy watersheds" shown in Table ES-1 contain the highest quality of all waters assessed for the 2012 Integrated Report.

Table ES-1: New Jersey Healthy Watersheds

AU ID	AU Name
NJ02030103070030-01	Wanaque R/Greenwood Lk(aboveMonks gage)
NJ02030105020060-01	Cakepoulin Creek
NJ02040104140010-01	**Big Flat Brook (above Forked Brook)**
NJ02040104140020-01	Forked Brook/Parker Brook
NJ02040104140030-01	Big Flat Brook (Kittle Rd to Forked Bk)
NJ02040104150020-01	Flat Brook (below Tillman Brook)
NJ02040104240010-01	Van Campens Brook
NJ02040202030020-01	Mount Misery Bk NB (above 74d27m30s dam)
NJ02040202030030-01	Mount Misery Bk MB/NB (below 74d27m30s)
NJ02040202030040-01	Mount Misery Brook SB
NJ02040206210030-01	West Ck (Paper Mill Rd to Rt 550)
NJ02040301030030-01	Metedeconk R SB(BennettsPd to 74d19m15s)
NJ02040301060070-01	Toms River (Rt 70 to Hope Chapel Road)
NJ02040301090020-01	Chamberlain Branch
NJ02040301090030-01	Cedar Creek (74-16-38 to Chamberlain Br)
NJ02040301110020-01	Forked River NB(below old RR grade)
NJ02040301150020-01	Skit Branch (Batsto River)
NJ02040301160030-01	Mullica River (Rt 206 to Jackson Road)
NJ02040301180030-01	Plains Branch (Oswego River)
NJ02040301180050-01	Papoose Branch (Oswego River)
NJ02040301180070-01	Oswego River (below Andrews Road)
NJ02040302050100-01	Gibson Creek / Jackson Creek
NJ02030103070030-01	Wanaque R/Greenwood Lk(aboveMonks gage)

Water Quality Trends

Water quality monitoring data collected over a five-year period provides a "snapshot" of conditions at the time of sampling but may fail to detect acute pollution events. Evaluating data over longer periods of time allows us to identify water quality trends that would otherwise not be apparent.

An analysis of water quality trends was conducted in 2012 for the Department by the U.S. Geological Survey (USGS) by evaluating key indicator parameters, including: dissolved oxygen (DO), pH, total dissolved solids (TDS), total phosphorus (TP), total organic nitrogen plus

ammonia, and dissolved nitrate plus nitrite (nitrate), collected at over 370 sampling stations located in various physiographic regions and land use types throughout the State between 1998 and 2009. These chemical constituents were selected for trends analysis because of their role in eutrophication as well as overall water quality. Water bodies affected by eutrophication (i.e., excessive primary production) are characterized by significant algae and weed growth and episodes of low dissolved oxygen. Nitrate is a readily available form of nitrogen taken up by organisms and plants as a nutrient. Phosphorus is also readily used by aquatic plants as a nutrient. Together, these nutrients are principally responsible for the growth rate of aquatic algae and vegetation. Low dissolved oxygen episodes occur in the respiration cycle in locations where productivity is high as well as when algae die off, and bacteria consume the dissolved oxygen in the process of decomposition. Dissolved oxygen (DO) is necessary for almost all aquatic life; consequently, concentrations of DO in water provide a good indicator of the health of aquatic ecosystems. Under low DO conditions, fish are more susceptible to other pollutants, such as metals and toxics; at very low DO levels, trace metals from sediments are released into the water column. USGS coupled the results of the 1998-2009 trend analysis with results from the 1984-2004 trend analysis to produce a long-term perspective of water quality constituents from the 1980's to the present. The full report is available on the USGS Web site at http://pubs.usgs.gov/sir/2012/5047/.

The 1998 to 2009 trend analysis results show that water quality conditions remained relatively stable (i.e., no trend observed) for all constituents except TDS, nitrate, and TP. TDS and nitrate results over this time period indicate declining conditions, while TP results indicate overall improving conditions (water quality getting better) - even though TP is still one of the top ten most frequent pollutants on the 2012 303(d) List.

TDS is comprised of minerals and other substances dissolved in water. Changes in TDS can affect organisms by altering the flow of water through cell membranes, which can retard growth or even cause death. These changes can make water less fit for other uses. TDS exceedances have been associated with runoff from urban and agricultural areas, including runoff of salt used to control ice on roadways. Discharges from wastewater treatment facilities, including septic systems, can also contribute to increased TDS loadings. These TDS trends represent all types of land uses (urban, agricultural, mixed, and undeveloped) and physiographic regions. Although dissolved solids come from both point and nonpoint sources, road salting and improper salt storage are major contributors of this constituent.

Winter storm-related data supports a correlation between road salting and increased TDS levels in the water column. The data reviewed to develop the Integrated Report identifies numerous occasions of excessive TDS concentrations as well as chlorides that coincide with winter storm events of most years. The Department has made funding available to address the optimization of road salting as a means to address this impairment source.

There has been an effort to reduce the levels of the toxic form of ammonia from wastewater. In doing so, nitrate levels were correspondingly increased as ammonia levels declined (nitrate is a byproduct of ammonia oxidation). The resulting higher in-stream nitrate concentrations may contribute to eutrophication, along with phosphorus. However, the few nitrate listings on the

2012 303(d) List are associated with the drinking water use, because the numeric criteria for nitrate is related to the drinking water use, not the aquatic life use.

Phosphorus is often considered the "limiting nutrient" in freshwater, governing the rate of growth of aquatic plants and algae. While both phosphorus and nitrogen are considered "nutrients" that contribute to eutrophication, historically the focus for controlling eutrophication has been on reducing total phosphorus (TP) concentrations rather than nitrogen. Studies demonstrate that the impact of nutrients on water quality is strongly influenced by other environmental factors such as sunlight availability, stream velocity and water clarity, meaning that the same amount of TP can have varying impacts in different waters.[3] Thus, while improving trends in phosphorus conditions may indicate improving water quality over time, some waters remain susceptible to the adverse effects of eutrophication despite decreasing TP concentrations. Improvements in TP are attributed to a focus on reducing phosphorus loadings through TMDLs, New Jersey Pollution Discharge Elimination System (NJPDES) permits, Section 319(h) nonpoint source grant project implementation, partnerships, and other stewardship activities. Such improvement was documented in the Pequest River, which was submitted to USEPA as a watershed restoration "success story" for the 2012 assessment cycle (see Section 4.5).

Overall, the water quality trend results indicate that, since the 1980's, nutrient levels and DO conditions have significantly improved over time – most likely due to the upgrade and regionalization of wastewater treatment plants that occurred throughout the State in the late 1980's through the early 1990's. Moreover, more recently the development of nutrient TMDLs, focus on nonpoint source restoration activities and other grant-funded reduction strategies are attributed to these improvements. Current trend assessments show some stabilizing of conditions throughout the State with some improvements (e.g., TP) and some declines in water quality (e.g. TDS and nitrates).

[3] NJDEP. 2009. *Nutrient Criteria Enhancement Plan*. April 2009. Available at http://www.state.nj.us/dep/wms/bwqsa/nutrient_criteria.htm.

2012 New Jersey Integrated Water Quality Monitoring and Assessment Report

Chapter 1: Introduction

Water quality standards, monitoring, and assessment provide the scientific foundation for the protection of New Jersey's water resources and implementation of the federal Clean Water Act and the New Jersey Water Pollution Control Act. Ongoing collection and evaluation of water quality data directs and supports the New Jersey Department of Environmental Protection's (Department's) efforts in developing and refining water quality standards that provide measurable targets for identifying and protecting high quality waters, identifying and restoring impaired waters, issuing and enforcing discharge permits, managing and reducing nonpoint sources of pollution, setting priorities for water resource management, and evaluating the effectiveness of restoration and protection actions.

The Department has made great strides in protecting and preserving our natural resources over the past four decades. The environmental and public health issues we face today are not the same as they were when the agency first began. The Department must adapt to ensure that the rate of environmental improvements keeps pace with current and future conditions.

The Department has organized its water program operations to consider water resource issues on a regional, integrated, and holistic basis. This Comprehensive Water Resource Management approach will encourage development of measures to restore, maintain, and enhance water quality uses that maximize effectiveness and efficiency in achieving positive environmental outcomes that are tailored to the unique circumstances of each region. The Department's goal is to align water supply and wastewater planning, permitting, enforcement, watershed restoration/protection efforts and property acquisition programs to successfully implement a more comprehensive approach that supports our environmental mission, community concerns and recognizes a commitment to vibrant regions.

1.1: The Purpose of the Integrated Report

The Integrated Water Quality Monitoring and Assessment Report (Integrated Report) is a key component of the iterative process of managing and protecting the State's water resources. This process, as described in the federal Clean Water Act, includes standards development, monitoring, and assessment of water quality; identification and implementation of management strategies (including total maximum daily loads (TMDLs)), point and nonpoint source controls, and programs to restore, maintain, and enhance water quality; and compliance and enforcement of water quality regulations and permits. The goal of the Integrated Report is to provide information about the quality of New Jersey's waters and the extent to which waters of the State support their designated uses. This information will inform water resource managers, government officials, and the public, on where actions are needed to restore, maintain, and

enhance water quality so that all designated uses may ultimately be fully supported in all waters of the State.

Federal Reporting Requirements

The Integrated Report is prepared pursuant to the federal Clean Water Act, which mandates that states submit biennial reports to the U.S. Environmental Protection Agency (USEPA) describing the quality of their waters. The biennial Statewide Water Quality Inventory Report or "305(b) Report" must include the status of principal waters in terms of overall water quality and support of designated uses, as well as strategies to maintain and improve water quality. The 305(b) reports are used by Congress and USEPA to establish program priorities and funding for federal and state water resource management programs. The biennial List of Water Quality Limited Waters or "303(d) List" identifies waters that are not attaining designated uses because they do not meet surface water quality standards despite the implementation of technology-based effluent limits. States must prioritize waters on the 303(d) List of Water Quality Limited Waters for Total Maximum Daily Load (TMDL) analyses and identify those high priority waters for which they anticipate establishing TMDLs in the next two years. Since 2002, New Jersey has developed and submitted its 303(d) List as part of the Integrated Report. The Integrated Report satisfies the reporting and public participation requirements of Sections 303(d), 305(b), and 314 of the federal Clean Water Act.

The 2012 Integrated Report

The 2012 New Jersey Integrated Water Quality Monitoring and Assessment Report (Integrated Report) describes the quality of New Jersey's surface waters in terms of overall water quality and support of designated uses. The Integrated Report identifies high quality waters that fully support designated uses, lower quality waters that do not support designated uses, and waters for which insufficient information is available to assess water quality and use attainment. The Integrated Report also identifies strategies implemented by the State to maintain high quality waters, improve lower quality waters, and gather additional information where needed to assess all waters of the State. The information provided in the Integrated Report is used by Congress, USEPA, and the State of New Jersey to establish program priorities and funding for federal and state water resource management programs. The Integrated Report includes the following information to inform and guide water resource management at statewide, regional, and local levels:

- Surface water classifications and water quality criteria established in the New Jersey Surface Water Quality Standards (N.J.A.C. 7:9B) to protect the designated uses: aquatic life; recreation; drinking, industrial, and agricultural water supply; fish consumption, and shellfish harvest for consumption;
- Methods used to assess attainment of the designated uses; and
- Results of designated use assessments based primarily on surface water quality monitoring conducted between January 1, 2008 and December 31, 2012; including data provided by other agencies in response to the data solicitation notice.

1.2: New Jersey Water Resources

New Jersey is the fifth smallest and most densely populated state in the Nation, with approximately 8.9 million people[4] living in a land area of just under 7,500 square miles.[5] New Jersey is traversed by four physiographic provinces, The Highlands, Ridge and Valley, Piedmont, and Coastal Plan, and receives an average of forty-four inches of precipitation annually.[6] New Jersey has 18,000 miles of rivers and streams; over 50,000 acres of lakes**,** ponds, and reservoirs; 950,000 acres of wetlands; 260 square miles of estuaries; 127 miles of coastline; and over 450 square miles of ocean under its jurisdiction.

New Jersey is one of the most geologically and hydrogeologically diverse states consisting of a wide variety of land use types, water resources, geologic characteristics, and natural biota. Land use in New Jersey can be broadly categorized into urban/suburban, agricultural, and undeveloped. Highly concentrated and expanding urban and industrial centers along with shrinking agricultural and undeveloped areas characterize New Jersey's current land use trends. Because of the high population and variable land uses, the State's streams, lakes, ponds, bays, ocean and ground water are impacted to varying degrees by point and nonpoint sources of pollution. A summary of the State's population, total area, and water resources is presented in Table 1.1. Thus, the combination of population density, diversity of natural resources, and a wide range of industries and land uses, presents unique challenges to protecting New Jersey's water resources.

New Jersey is also one of the most industrialized states, located midpoint between the Washington, D.C. and Boston, MA transportation corridor, and with excellent access to ports, air transportation, railroads, and the metropolitan areas of New York City and Philadelphia. New Jersey is also home to several ecological treasures including the Pinelands National Preserve, the Great Swamp Wildlife Refuge, Hackensack Meadowlands and four Wild and Scenic Rivers: the Great Egg Harbor, the Maurice River, the Musconetcong River, and portions of the Delaware River, as well as relatively undeveloped areas in northwestern and southern New Jersey. The combination of population density, diversity of natural resources, and a wide range of industrial and land uses, presents unique challenges to protecting New Jersey's water resources. In response, according to the United States Geological Survey (USGS), "the State of New Jersey has developed some of the most progressive and unique monitoring, assessment, and management programs in the country" [7].

[4] Source: United States Census Bureau Quick Facts Web site at http://quickfacts.census.gov/qfd/states/34000.html. Viewed on May 20, 2013.
[5] USGS New Jersey Water Science Center Web site at http://nj.usgs.gov/about/critical_issues.html. Viewed on May 30, 2013.
[6] USGS New Jersey Water Science Center Web site at http://nj.usgs.gov/about/critical_issues.html. Viewed on May 30, 2013.
[7] USGS New Jersey Water Science Center Web site at http://nj.usgs.gov/about/critical_issues.html Viewed on March 14, 2014

Table 1.1: New Jersey Population, Area, and Water Resources*

Resource	Extent
State Population (2010) [8]	8,791,894
State Total Area (square miles)	8,204
State Total Land Area (square miles)	7,505
Rivers and Streams:	
Miles of nontidal rivers and streams	11,702
Miles of tidal rivers and streams	6,424
Miles of rivers and streams (total)	18,126
Border miles shared rivers/streams (nontidal and tidal)	197
Lakes, Ponds and Reservoirs;	
Number of named lakes and ponds	1,747
Acres of named lakes and ponds	37,834
Number of Reservoirs	43
Acres of Reservoirs	14,970
Total Acres of named lakes and ponds and reservoirs	52,804
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	260
Miles of Ocean Coast (linear miles)	127
Miles of Ocean Coast (sq. mi. of jurisdictional waters)	454
Wetlands:	
Acres of Freshwater Wetlands	739,160
Acres of Tidal Wetlands	209,269
Total Acres of Wetlands	948,429

*Note: Figures are based on a high resolution scale of 1:24,000. Although a more detailed resolution of 1:2,400 is available, the 1:24,000 scale is used for the Integrated Report to maintain consistency between reporting cycles, allowing for direct comparison of use assessments and trend analysis over time. A GIS coverage of New Jersey hydrography at this scale is available on the Department's Web site at http://www.nj.gov/dep/gis/stateshp.html#STATERIV.

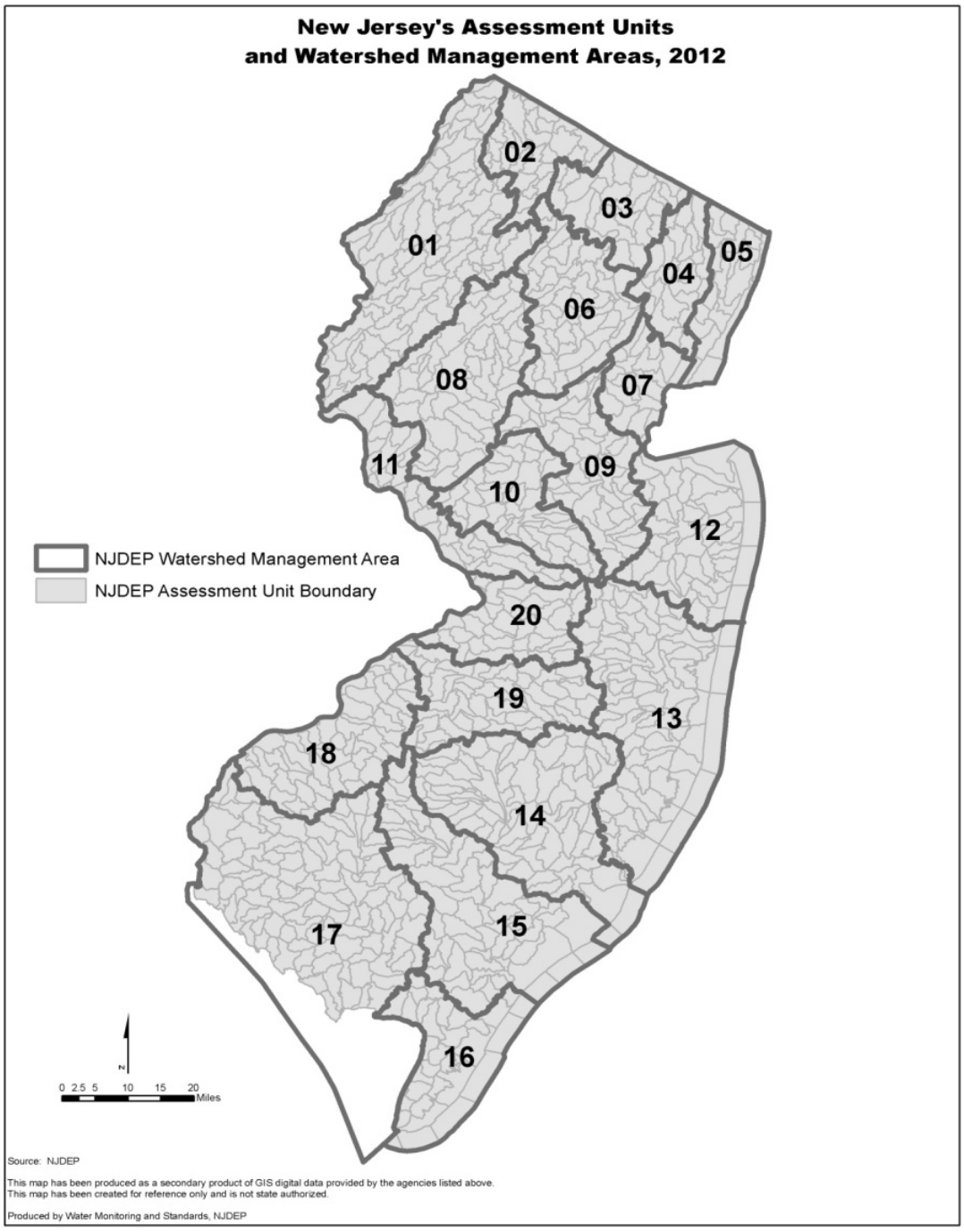
New Jersey's Assessment Units

Water quality in New Jersey is assessed on a subwatershed scale defined by 14-digit Hydrologic Unit Code (HUC) boundaries. HUCs are geographic areas representing part or all of a surface drainage basin or distinct hydrologic feature as delineated by USGS in cooperation with the Natural Resources Conservation Service (NRCS). The HUC system starts with the largest possible drainage area and progressively smaller subdivisions of that drainage area are then delineated and numbered in a nested fashion. New Jersey's assessment units are delineated based on 14-digit HUC (HUC 14) boundaries. The development of these boundaries is discussed in

[8] State of New Jersey Department of Labor and Workforce Development Web site. Available at http://lwd.dol.state.nj.us/labor/lpa/dmograph/Demographics_Index.html. Viewed on May 31, 2011.

more detail in Chapter 2. There are 952 HUC 14 subwatersheds in New Jersey, which comprise the Department's assessment units for the 2012 Integrated Report. The HUC 14 subwatersheds are nested with New Jersey's 20 Watershed Management Areas, as shown in Figure 1.1).

Figure 1.1



Chapter 2: Water Quality Standards, Monitoring and Assessment

Water quality standards, monitoring, and assessment provide the scientific foundation for the protection of New Jersey's water resources and implementation of the federal Clean Water Act and the state Water Pollution Control Act. New Jersey's surface water quality standards are designed to meet the objectives of the federal Clean Water Act, which are to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters". Monitoring and assessment of water quality data directs and supports the Department's efforts to develop and refine water quality standards that provide measurable targets for identifying and protecting high quality waters, identifying and restoring impaired waters, issuing and enforcing discharge permits, managing nonpoint sources of pollution, setting priorities for water resource management, and evaluating the effectiveness of restoration and protection actions.

2.1: New Jersey Surface Water Quality Standards

The New Jersey Surface Water Quality Standards (SWQS) establish a stream classification and an antidegradation designation for all surface waters of the State. The stream classifications reflect the designated uses assigned to individual surface waterbodies. Designated uses include aquatic life support (maintenance, migration, and propagation), recreation, fish consumption, shellfish harvest for consumption, drinking water supply, industrial water supply, and agricultural water supply. The SWQS also specify the water quality criteria that correspond with the waterbody classifications, which are necessary to achieve the designated uses.

The SWQS are utilized by the New Jersey Pollutant Discharge Elimination System (NJPDES) discharge to surface water permitting program in the development of water quality-based effluent limitations (WQBELs) to protect or improve the existing water quality and designated uses. The SWQS also contain policies on design flows, mixing zones, antidegradation, and nutrients, which specify how the surface water quality criteria are to be applied through NJPDES permits (see http://www.nj.gov/dep/dwq/). The Department is required, pursuant to Section 303(d) of the federal Clean Water Act, to identify waters that do not meet SWQS after the implementation of technology-based effluent limitations, and to develop total maximum daily loads (TMDLs) to restore these impaired waters. The SWQS serve as water quality restoration targets to be achieved by TMDLs (see http://www.nj.gov/dep/wms/bear/tmdls.html). Waters on the 303(d) List are ranked in terms of priority for TMDL development (see Appendix B). High priority TMDLs to be developed in the next two years are listed in Appendix D.

The SWQS are also utilized by the Site Remediation Program to ensure that ground water remediation activities that discharge to surface waters comply with the SWQS (see http://www.nj.gov/dep/srp/). The Department's Division of Land Use Regulation, through the Freshwater Wetlands Program, the Coastal Permitting Program, and the Flood Hazard Area Control Program also utilizes the stream classifications and antidegradation designations adopted in the SWQS to regulate activities under these programs' respective jurisdictions (see http://www.nj.gov/dep/landuse/). Additional information about the SWQS is available on the Department's Web site at http://www.state.nj.us/dep/wms/bwqsa/swqs.htm.

2.2: Water Quality Monitoring

The Department oversees the operation of the primary water quality monitoring networks for the State of New Jersey. Monitoring strategies employed by the Department are comprised of multiple water quality assessment techniques including: habitat assessments, in-stream biological monitoring such as fish population surveys, collection of physical/chemical data on a variety of matrices (inland and coastal surface waters, ground water, sediment), identifying pollution sources in marine and freshwater environments (discharges, stormwater, marinas), and sediment toxicity testing. Monitoring is also conducted by other entities and may be used to supplement these networks and expand the range and scope of information available for water quality assessment. The Department's water monitoring programs are described in *New Jersey's Water Monitoring and Assessment Strategy (2005-2014)* and may be found on the Department's Web page at http://www.state.nj.us/dep/wms//longtermstrategyreport.pdf (also see Appendix G). Additional information about these water monitoring activities and networks is available on the Department's Web site at: http://www.nj.gov/dep/wms/.

Many different organizations and entities conduct water quality monitoring that may supplement the Department's own efforts. Monitoring partners work with the Department to gather information about New Jersey's waters and share their data with the Department for water quality assessment purposes. Monitoring partners generally include:

- Federal agencies, alone or in cooperation with NJDEP (e.g., U.S. Environmental Protection Agency (USEPA), National Oceanic and Atmospheric Association (NOAA), U.S. Geological Survey (USGS));
- Interstate commissions (e.g., Delaware River Basin Commission (DRBC));
- Regional, county, and municipal government agencies (e.g., county health departments, municipal utilities authorities);
- Private entities (e.g., dischargers, water purveyors, academic institutions);
- Volunteer monitoring organizations (e.g., watershed associations and civic/community groups.

The Department provides technical support and capacity building for many of our monitoring partners. In addition, the Department is a key member of The New Jersey Water Monitoring Coordinating Council, established on October 24, 2003, to promote and facilitate the coordination, collaboration, and communication of scientifically sound, ambient water quality and quantity information to support effective environmental management. The Council consists of representatives from various Divisions within the Department; USGS; USEPA Region 2; the DRBC, Pinelands, and Meadowlands Commissions; the Interstate Environmental Commission; county health departments, academia; and the volunteer monitoring community. Meeting quarterly, the Council provides the opportunity to exchange information and data among its participants.

2.3: Water Quality Assessment Methods

USEPA requires that each state have a methodology for assessing support of designated uses and compliance with water quality standards based on analysis of various types of data from different

sources for all waterbody types. The methods used to develop New Jersey's 2012 Integrated Report are described in the *2012 Integrated Water Quality Monitoring and Assessment Methods* (Methods Document). The purpose of the Methods Document is to articulate the objective and scientifically-sound methods employed by the Department for monitoring and assessing the quality of New Jersey's waters in accordance with Sections 305(b) and 303(d) of the federal Clean Water Act. The 2012 Methods Document includes:

- A description of the data the Department will use to assess support of the designated uses;
- The quality assurance aspects of the data;
- A detailed description of the methods used to evaluate compliance with the SWQS; and
- A detailed description of the methods used to evaluate designated use support;
- Changes in the assessment methodology since the last reporting cycle.

The Department updates the Methods Document every two years, as appropriate, prior to development of the Integrated Report. In 2012, the Integrated Assessment process was refined into a two-step assessment process. Step 1 used improved computer technology to apply the assessment protocols in the Methods Document to determine preliminary assessment decisions. In Step 2 there was a consideration of historical data, biological and physical conditions, as well as other relevant scientific considerations alongside water quality data to determine if the preliminary assessment was appropriate to support a listing decision.

The final 2012 Methods Document, along with the Department's responses to public comments on the draft 2012 Methods Document, is available on the Department's webpage at http://www.state.nj.us/dep/wms/bwqsa/assessment.htm and referenced in Appendix F of this report. The Delaware River Basin Commission (DRBC) assesses water quality data for the Delaware River mainstem, Estuary, and Bay. DRBC's assessment results and corresponding methods are published in the *2012 Delaware River and Bay Water Quality Assessment* Report available on DRBC's Web site at: http://www.nj.gov/drbc/library/documents/WQAssessmentReport2012.pdf. Shared waters that are water quality limited based on DRBC's assessment are shown at the end of the New Jersey 2012 303(d) List (Appendix B) but are otherwise not addressed in this report.

2.4: Data Used for the 2012 Integrated Assessment

Development of the 2012 Integrated Report commenced with the compilation and analysis of all readily available water quality monitoring data. "Readily available data" was defined in the 2012 Methods Document as water quality data that was collected prior to January 1, 2011 under a quality assurance plan approved by the Department or USEPA and accessible through electronic submission. All readily available data was compiled by the Department, evaluated for data quality, and assessed for compliance with New Jersey's surface water quality standards based on methods described in the Methods Document. New[9] data that were submitted for the 2012

[9] Data submitted for a prior Integrated List but still considered for the 2012 Integrated Report are identified in Appendix: 2010 Integrated List Data Sources on the Department's Web site at http://www.state.nj.us/dep/wms/bwqsa/2010_revised_final_integrated_report_complete.pdf.)

Integrated List are shown in Appendix E: 2012 List of Data Sources. Data collected under an approved QAPP but not used by the Department to place AU/pollutant combination(s) on the 2012 303(d) List are also identified in Appendix E along with the reason for not listing.

2.5: New Jersey Assessment Units

As explained in Chapter 1, New Jersey's Integrated Water Quality Monitoring and Assessment is conducted on a HUC 14 subwatershed scale. In 2009, the Department revised New Jersey's HUC 14 boundaries to be more consistent with new federal HUC 12 boundaries, which are based on 1:24,000 base maps for elevation control and new 1:2,400 hydrography coverage. The Department's report explaining the changes to the HUC 14 boundaries (NJGS Technical Memorandum TM09-2) entitled, "Revision to New Jersey's HUC 14s, 2009, with a correlation to HUC 12s", is available for download from the Department's Web site at http://www.state.nj.us/dep/njgs/pricelst/tmemo/tm09-2. A coverage containing discrete polygons for each of New Jersey's HUC 14 subwatersheds is also available for download and interactive applications on the Department's Geographic Information System (GIS) and other on-line tools available on the Department's Web site at www.nj.gov/dep/gis/ and www.nj.gov/dep/gis/newmapping.htm.

New Jersey's assessment units for the 2012 Integrated Report are based on the updated HUC 14 boundaries, excluding interstate waters under the jurisdiction of the Delaware River Basin Commission (as shown in Figure 1.1). The 952 assessment units (AUs) range in size from 0.7 to 42 square miles, with an average size of 8.7 square miles.

Chapter 3: Water Quality Trends

The Department's Office of Science publishes periodic "State of The Environment" reports that provide general information on trends and conditions for a variety of environmental factors which, together, comprise an overall assessment of New Jersey's environmental health. These fact sheets are available on the Department's Web site at http://www.state.nj.us/dep/dsr/trends/index.htm. Fact sheets on water quality-related trends include the following:

- Atmospheric Deposition: Acidity and Nutrients
- Beach Closings
- Dissolved Oxygen Levels in Coastal Waters
- Estuarine Algal Conditions
- Fish: Concentrations of Key Contaminants
- Fresh Water Pollution: Streams - Ambient Biomonitoring Network and Fish Index of Biotic Integrity Network
- Ground Water
- Land Use and Land Cover
- Marine Water Pollution: Estuarine Sediment Concentrations
- Marine Water Pollution: Shellfish Waters Marine Water Pollution: Shellfish Waters
- Surface Water Quality; Streams; Chemical and Physical Measurements

Analysis of water quality trends requires data to be collected at fixed stations over a long period of time. USGS conducted an analysis of water quality trends for the Department in 2012 that evaluated key indicator parameters, including: DO, pH, TDS, TP, dissolved phosphorus, total organic nitrogen plus ammonia, and nitrate. These parameters were collected at 371 surface water quality stations located in various physiographic regions and land use types throughout the State between 1998 and 2009. These chemical constituents were selected for the trends analysis because of their role in eutrophication as well as overall water quality. Water bodies affected by eutrophication (i.e., excessive primary production) are characterized by significant algae and weed growth and episodes of low dissolved oxygen. Nitrate is a readily available form of nitrogen taken up by organisms and plants as a nutrient. Phosphorus is also readily used by aquatic plants as a nutrient. Together, these nutrients are principally responsible for the growth rate of aquatic algae and vegetation.

Excessive phosphorus levels often result in increased algal growth. When productivity is high, the DO levels may dip to low levels when photosynthesis is not occurring to counter respiration. In addition, as algae masses die, bacterial decomposition of the dead plant material consumes large amounts of DO. Since DO is necessary for almost all aquatic life, the concentration of DO in the water column is a good indicator of aquatic ecosystem health. Under low DO conditions, fish are more susceptible to other pollutants, such as metals and toxics; at very low DO levels, trace metals from sediments are released into the water column. USGS coupled the results of the 1998-2009 trend analysis with results from the 1984-2004 trend analysis to produce a long-term perspective of water quality constituents from the 1980's to the present. The full report is available on the USGS Web site at http://pubs.usgs.gov/sir/2012/5047/.

3.1 Chemical Trend Analysis Results

The 1998 to 2009 trend analysis results show that water quality conditions remained relatively stable (Variations in Statewide Water Quality of New Jersey Streams, Water Years 1998 – 2009 SIR 2012-5047(i.e., no trend observed) for all constituents except TDS, nitrate, and TP. TDS and nitrate results over this time period indicate declining conditions (i.e., water quality getting worse), while TP results indicate overall improving conditions (i.e., water quality getting better) - even though TP is still one of the top ten most frequent pollutants on the 2012 303(d) List.

Total Dissolved Solids (TDS)

TDS is comprised of minerals and other substances dissolved in water. Changes in TDS can affect organisms by altering the flow of water through cell membranes, which can retard growth or even cause death. TDS exceedances have been associated with runoff from urban and agricultural areas, including runoff of salt used to control ice on roadways. Discharges from wastewater treatment facilities, including septic systems, can also contribute to increased TDS loadings. These TDS trends represent all types of land uses (urban, agricultural, mixed, and undeveloped) and physiographic regions. Although dissolved solids come from both point and nonpoint sources, road salting and improper salt storage are major contributors of this constituent.

Winter storm-related data supports a correlation between road salting and increased TDS levels in the water column. The 2012 Delisting Justification and Decisions to Not List AU/Pollutant Combinations on the 2012 303(D) List which may be found in Appendix K identifies numerous occasions of excessive TDS concentrations, as well as Chlorides, that coincide with winter storm events in February (or early March) of most years.

Ammonia

There has been an effort to reduce the levels of the toxic form of ammonia from wastewater. In doing so, nitrate levels were correspondingly increased as ammonia levels declined (nitrate is a byproduct of ammonia oxidation). The resulting higher in-stream nitrate concentrations may contribute to eutrophication, along with phosphorus. However, it should be noted that the few nitrate listings on the 2012 303(d) List are associated with the drinking water use, not aquatic life. This is because the numeric criterion for nitrate is related to human health, not aquatic life support.

Total Phosphorus (TP)

TP is often considered the "limiting nutrient" in freshwater, governing the rate of growth of aquatic plants and algae. While both phosphorus and nitrogen are considered "nutrients" that contribute to eutrophication, historically the focus for controlling eutrophication has been on reducing TP concentrations rather than nitrogen. Studies demonstrate that the impact of nutrients on water quality is strongly influenced by other environmental factors such as sunlight availability, stream velocity and water clarity, meaning that the same amount of TP can have

varying impacts in different waters.[10] Thus, while improving trends in phosphorus conditions may indicate improving water quality over time, some waters remain susceptible to the adverse effects of eutrophication despite decreasing TP concentrations. Improvements in TP are attributed to a focus on reducing phosphorus loadings through TMDLs, New Jersey Pollution Discharge Elimination System (NJPDES) permits, section 319(h) nonpoint source grant project implementation, partnerships and other stewardship activities.

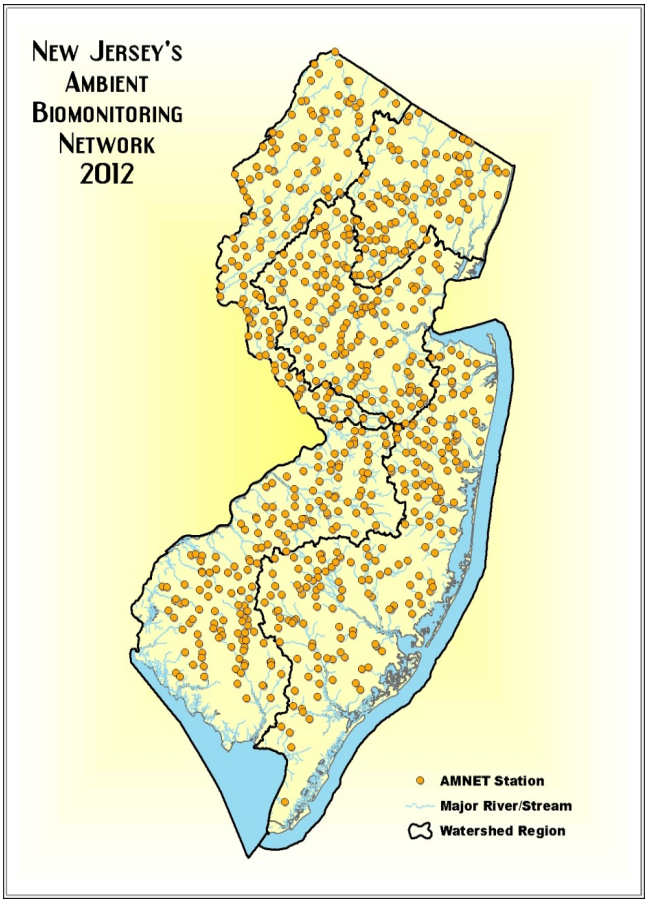
Overall, results of the combined water quality trend analyses indicate that nutrient levels and DO conditions have significantly improved since the 1980's - most likely due to the upgrade and regionalization of wastewater treatment plants that occurred throughout the State in the late 1980's through the early 1990's. The changes in water quality observed in this study parallel many of the findings from previous studies of trends in New Jersey in that the more recent trend analysis results generally show stabilizing of conditions throughout the State with some improvements (TP) and some declines (TDS and nitrates) in water quality.

3.2: Trends in Biological Health of New Jersey Streams

Ambient Biological Monitoring Network (AMNET)

In 1992, the Department established a statewide Ambient Biological Monitoring Network (AMNET) to collect and assess benthic macroinvertebrate populations (insects, worms, mollusks, and other indicator species) in freshwater streams. As of 2012, the network consisted of over 750 stations distributed equally throughout the States five water regions: Northwest, Lower Delaware, Atlantic Coastal, Raritan, and Northeast regions (see Figure 3.1.) Stations in each region are sampled once every five years. When all the stations in each region are sampled this is called a "round".

Figure 3.1



The AMNET data is used for aquatic life use assessment of streams for the Integrated Report. This data is also used to determine if waters qualify for Category One designation based on exceptional ecological significance. The Category One designation provides special protections against degradation for waters of exceptional ecological significance (see

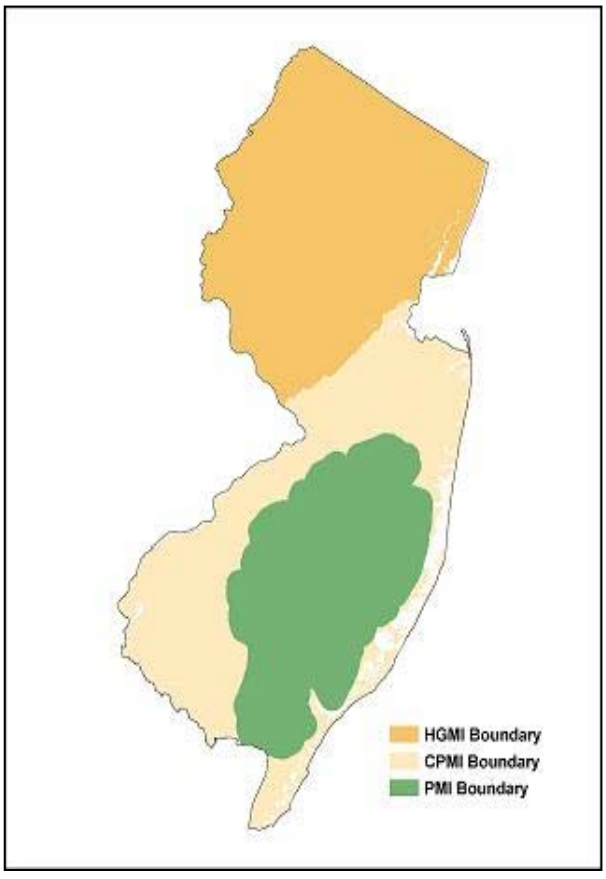
[10] NJDEP. 2009. *Nutrient Criteria Enhancement Plan*. April 2009. Available at http://www.state.nj.us/dep/wms/bwqsa/nutrient_criteria.htm.

Chapters 2 and 5, Surface Water Quality Standards).

After the first round of data collection, the Department recognized that the diversity of ecological habitats in New Jersey required multiple statistical methods for the interpretation of the benthic macroinvertebrate data to serve as a more meaningful environmental indicator. Accordingly, the Department worked with USEPA Region 2 to develop ecologically-based Rapid Bioassessment Protocol multi-metric indices covering all the waters of the State. New Jersey benthic macroinvertebrate communities can be statistically grouped into three distinct structures based on geographical regions. To account for these distinctions, these developed indices are calibrated for each of the unique geographic regions of the State: the high gradient region, the Coastal Plains and the Pinelands (see Figure 3.2).

The High Gradient Macroinvertebrate Index (HGMI), the Pinelands Macroinvertebrate Index (PMI), and the Coastal Plains Macroinvertebrate Index (CPMI) each provide four tiers of assessment that are applicable to headwater streams. These indices, as well as the NJIS index, are not applicable to tidal streams. Therefore, stations determined to have been inadvertently located on tidal portions of streams were omitted from the current analysis.

Figure 3.2: Boundaries for the Ecoregions and Ecologically-based Indices



Multimetric Index

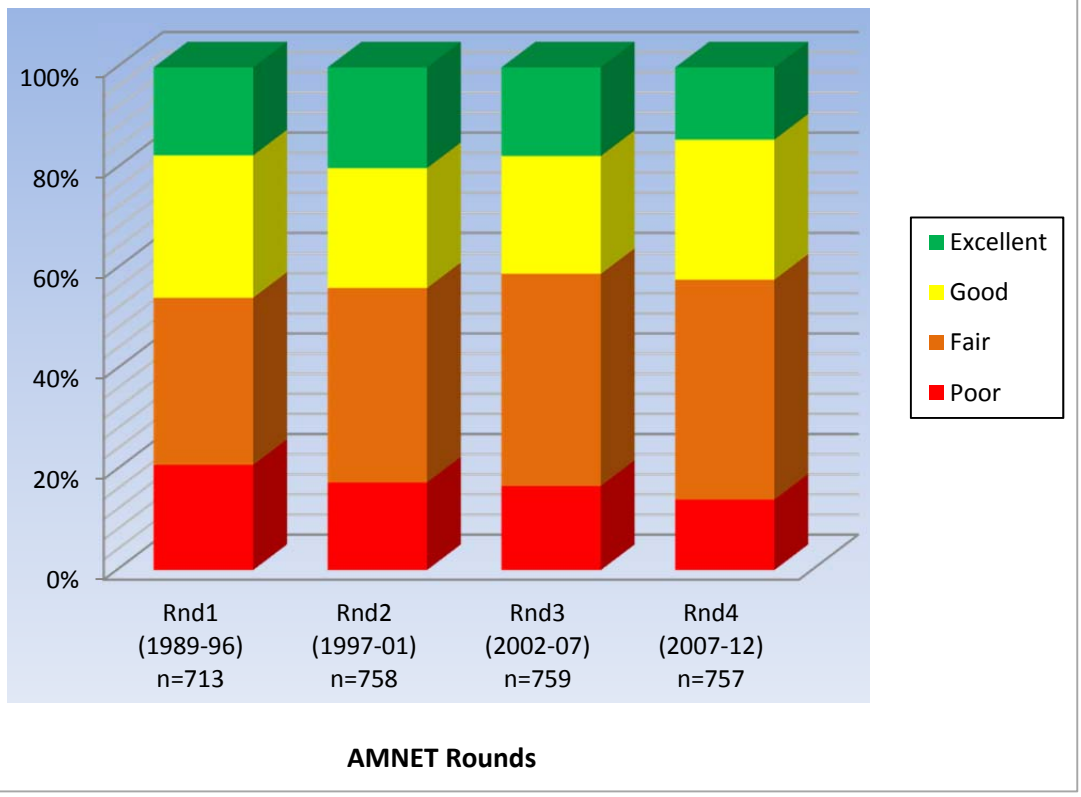
HGMI – High Gradient Macroinvertebrate Index
CPMI – Coastal Plain Macroinvertebrate Index
PMI - Pinelands Macroinvertebrate Index

It should also be noted that, for comparison purposes, earlier round results have been recalculated using the adopted genus level multi-metric indices. Round 1 raw data was recorded for each site at the family level, rather than genus level taxonomy. Also, some sites in Rounds 1 and 2 were sampled outside the currently accepted index period of April through November; however, the effect on index scores is minimal.

The Department has now completed four rounds of AMNET sampling statewide. Overall, the statewide trend shows very little change from 1989 to 2012, although there was a slight negative trend toward impaired conditions (see

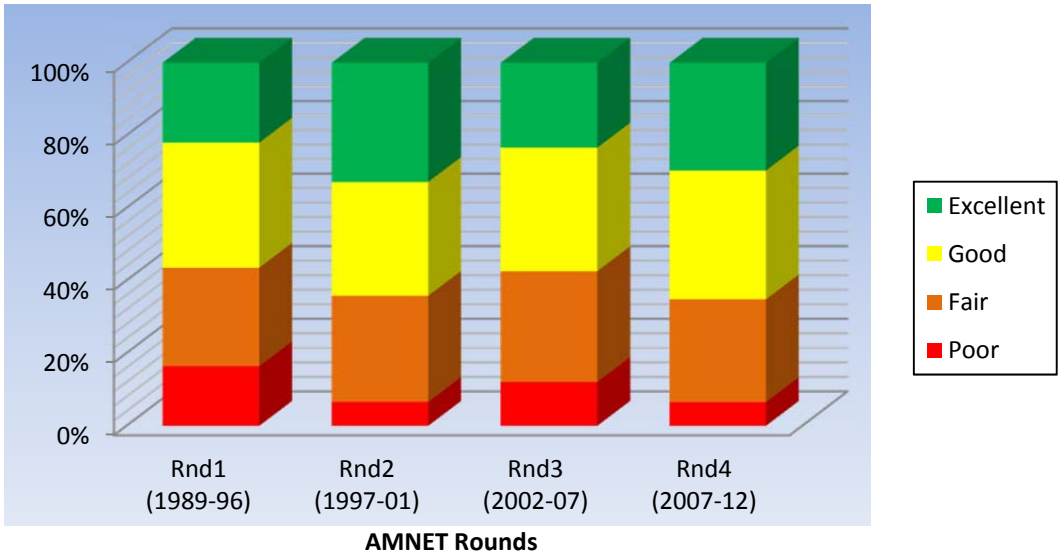
Figure 3.3). Stations with the best results ("Excellent") and the worst conditions ("Poor") both showed decreasing numbers over the time period. The strongest trend was the steady increase in the number of "Fair" stations that contributed to the improvement at "Poor" stations and the decline of non-impaired ("Excellent" and "Good") sites.

Figure 3.3: AMNET Results Statewide



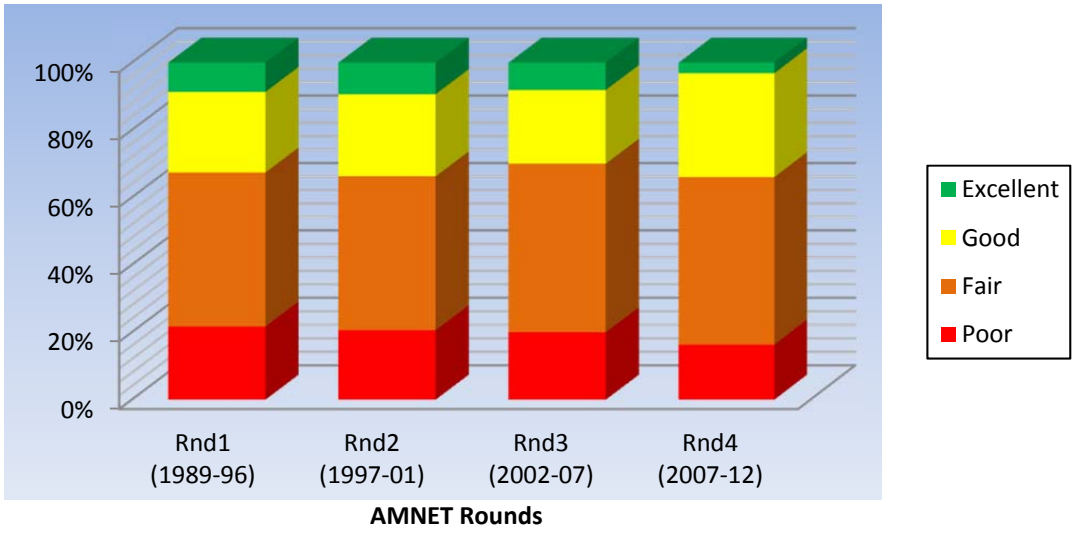
However, this statewide tendency toward "Fair" conditions of macroinvertebrate communities was not evident in all of the water regions of the state where a variety of trends were observed. The following graphs show trends for each of the State's five Major Water Regions within the round in which each was sampled. In the Northwest Region, overall trends showed improving conditions. The number of "Excellent" stations increased, while "Poor" stations decreased, and "Good" and "Fair" stations remained relatively steady (see Figure 3.4).

Figure 3.4: AMNET Results in the Northwest Region



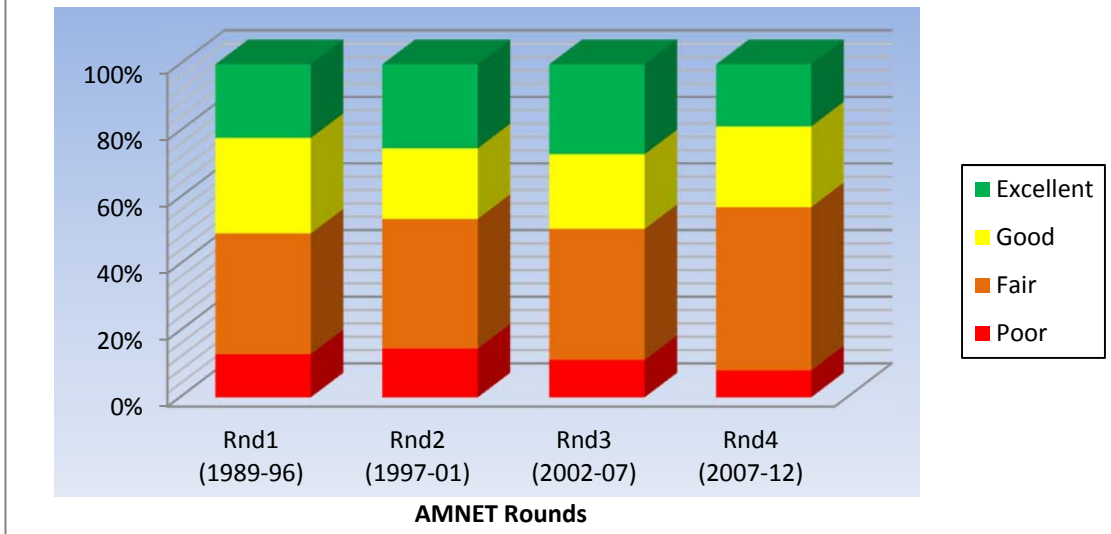
In the Lower Delaware Region, benthic macroinvertebrate communities showed very little change. The number of non-impaired and impaired stations remained stable; however, there was a slight trend from the extreme conditions toward the middle assessment categories with the number of "Excellent" stations decreasing and the number of "Poor" stations improving, with increasing numbers of both "Good" and "Fair" stations (see Figure 3.5).

Figure 3.5: AMNET Results in the Lower Delaware Region



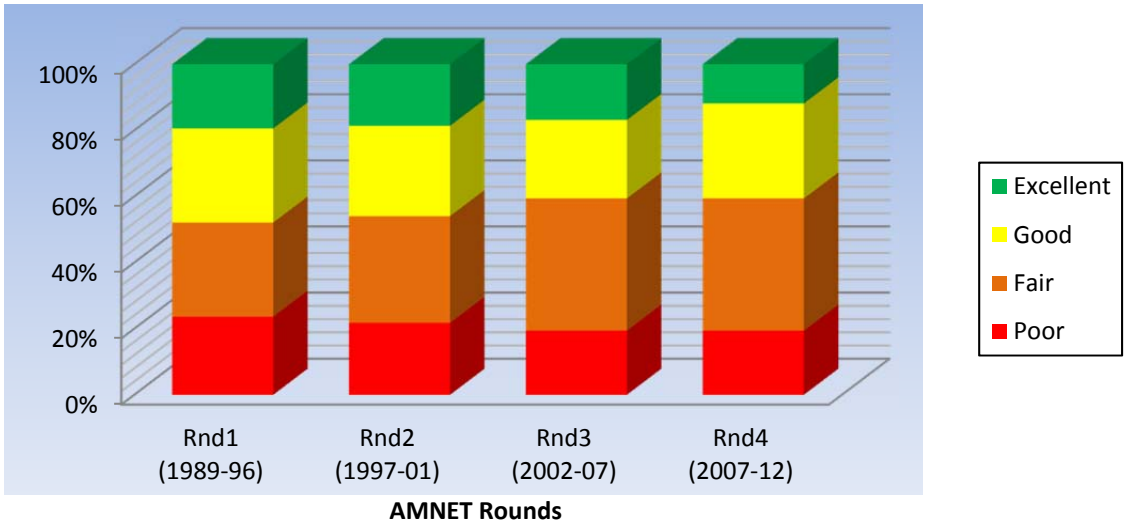
In the Atlantic Coastal Region (Figure 3.6), the benthic macroinvertebrate trends were similar to statewide results. The strongest trend was the steady increase in the number of "Fair" stations that contributed to the improvement at "Poor" stations and the degradation of non-impaired ("Excellent" and "Good") sites. The exception was the number of "Excellent" stations that showed an increasing trend until the last round, which exhibited a significant drop off.

Figure 3.6: AMNET Results in the Atlantic Coastal Region



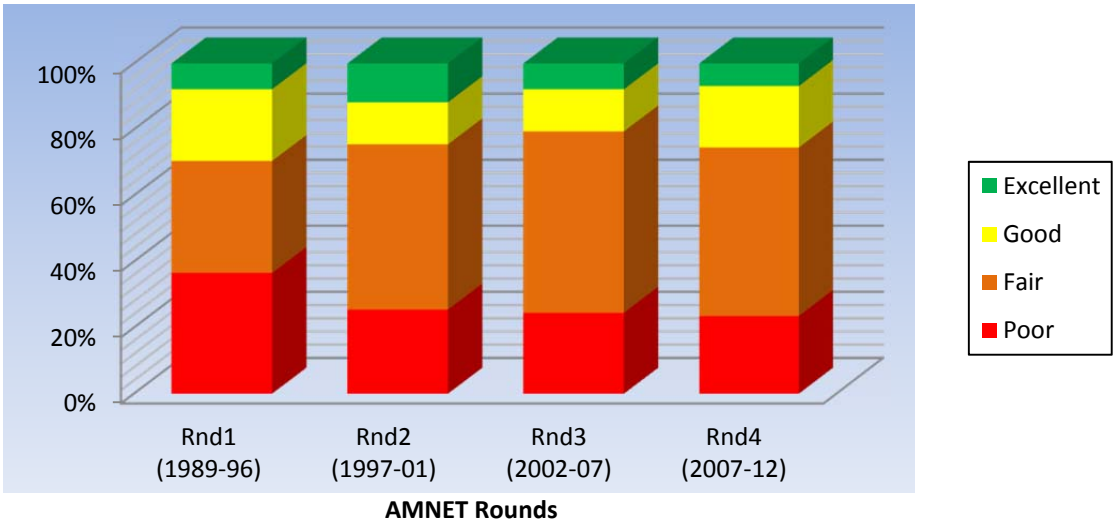
The Raritan Region (figure 3.7) also showed results similar to the statewide trend, with a steady increase in "Fair" results accompanied by an overall increase in the number of "Poor" sites and a decrease in the number of "Excellent" stations. The number of "Good" stations remained stable throughout the time period.

Figure 3.7: AMNET Results in the Raritan Region



In the Northeast Region, conditions still display a highly impacted benthic macroinvertebrate community. While the number of sites reflecting "Poor" conditions have shown a steady improvement toward "Fair" conditions, "Excellent" and "Good" sites have exhibited declining conditions over the same time period (see Figure 3.8).

Figure 3.8: AMNET Results in the Northeast Region



Further investigation is necessary to determine why an individual site's biological assessment declined or improved, and if these changes are related to water quality or to events such as droughts and floods. Ongoing site-specific evaluations, such as stressor identification studies, explore changes in water quality to determine causes of impairment at selected sites; however, the AMNET data show a correlation between benthic macroinvertebrate community impairment and different physiographic land types, land uses, and other anthropogenic factors.[11] Recent data analysis[12] concludes the following:

- Invertebrate communities and fish were commonly impaired in urban streams;
- Invertebrate community impairment was related to total urban land and total wastewater flow upstream of a site;
- Changes in aquatic community structure were statistically related to environmental variables. For example, an increase in impervious surfaces was related to a negative response in the aquatic invertebrate community.

[11] U.S.Geological Survey. 1998. *Relation Of Benthic Macroinvertebrate Community Impairment To Basin Characteristics In New Jersey Streams*. Fact Sheet FS-057-98. USGS. West Trenton, New Jersey.
[12] Ayers, M., Kennen, J., Stackleberg, P., Kauffman, L. 2000. *Building A Stronger Scientific Basis For Land Use Planning And Watershed Management Effects On Water Quality And Aquatic Communities In NJ Streams*. USGS. West Trenton, New Jersey.

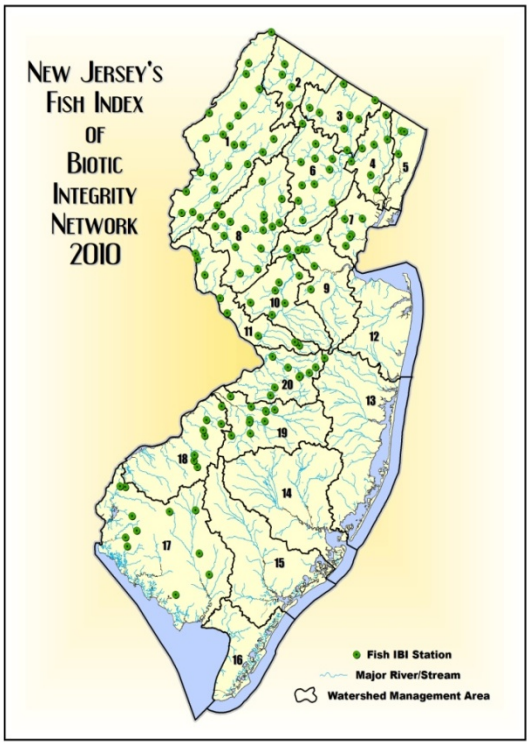
Given the expectations of population growth in New Jersey (an estimated 900,000 more residents by the year 2020) land use changes may have a measurable effect on water quality and aquatic communities. The AMNET network will continue to monitor the effects of that population growth on the aquatic biota of the state's waterways, and provide a measure of success for sound land use practices and mitigation efforts.

Fish Index of Biotic Integrity Network

As discussed above, monitoring of benthic macroinvertebrate populations is widely practiced in New Jersey; however, these species generally are reflective of relatively short-term and local impairment. In summer 2000, the Department began using a fish index of biotic integrity (FIBI) to monitor New Jersey's streams. FIBI measures the health of a stream based on multiple attributes of the resident fish, such as species type and number, and the presence of disease. Each site sampled is then scored based on its deviation from reference conditions and classified as "poor", "fair", "good", or "excellent". In addition, habitat is evaluated at each site and classified as "poor", "marginal", "suboptimal", or "optimal".

The primary objectives of fish collection for this network are to obtain samples with representative species and abundances, at a reasonable level of effort. Using similar stream lengths, collection methods, and habitat types allows standardization of sampling efforts. Stream segments selected for sampling must have a minimum of one riffle, run, and pool sequence to be considered representative. The data provided by the FIBI network has become another component of the Department's suite of environmental indicators and helps assess attainment of aquatic life uses and the Clean Water Act goal of "fishable" waters. FIBI data is also being used to develop biological criteria, prioritize sites for further studies, provide biological impact assessments, and assess status and trends of New Jersey's freshwater fish assemblages. Data collected from the Northern FIBI Network are used, in part, to determine if waters qualify for Category One antidegradation designation based on exceptional ecological significance (see Chapters 2 and 5, Surface Water Quality Standards).

Figure 3.9: FIBI Monitoring



Northern FIBI Network:
With the completion of the 2011 sampling season, the Department established a 98-station FIBI monitoring network in northern New Jersey (see Figure 3.9). The monitoring network consists of fixed, probabilistic, and sentinel sites. Fixed stations are visited once every five years as part of the Department's ambient monitoring efforts. The 2009 season marked the end of the second round of sampling, in which the Department returned to the

network sites originally sampled in 2004. From 2000-2004, the Department sampled 90 FIBI sites in the northern portion of the state covering the Counties of Sussex, Warren, Hunterdon, Passaic, Bergen, Union, Essex, Mercer, Middlesex, and Somerset. In an effort to ensure sensitivity to anthropogenic stressors, the Northern FIBI was re-evaluated in 2005 using Round 1 data (2000-2004). This recalibration resulted in modifications in scoring criteria and species lists for several metrics. The 2009 season is the fifth year in which the revised metrics were utilized. Previous year's data (2000-2004) have been rescored for the purposes of trends analysis in this report, with the revised ratings shown in Figure 3.10. From 2005-2007, the Department sampled 90 FIBI sites in the northern portion of the state covering the Counties of Sussex, Warren, Hunterdon, Passaic, Bergen, Union, Essex, Mercer, Middlesex, Morris, and Somerset. This dataset includes five years of data from this second round (see Figure 3.11).

Figure 3.10

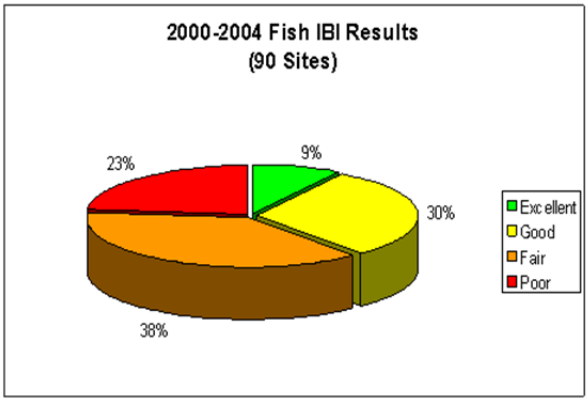
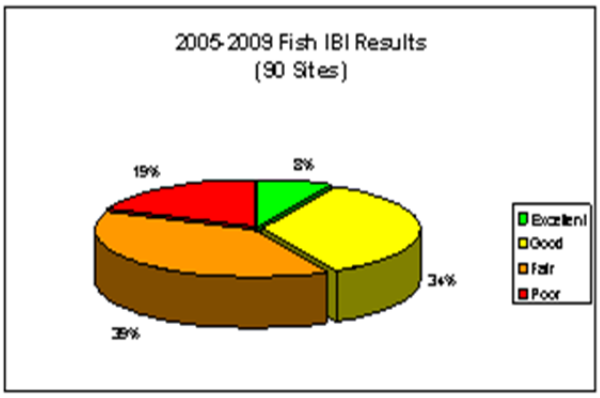
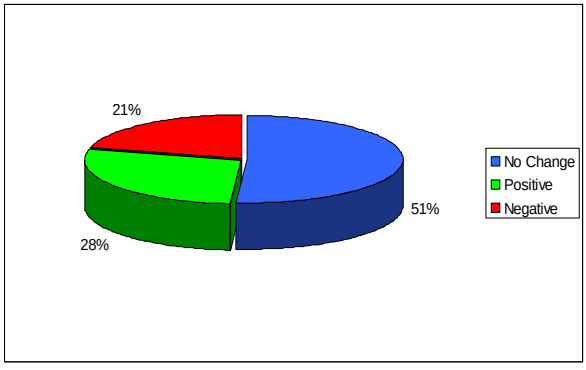


Figure 3.11



The observed trend in FIBI ratings for the northern New Jersey stations is summarized in the Figure 3.12. Between the first (2000-2004) and second (2005-2009) round of Fish IBI monitoring, for the 90 common sites sampled, 28% exhibited a positive change in impairment rating, 21% exhibited a negative change in impairment rating, and 51% exhibited no change in impairment rating. On the whole, these trends would seem to indicate a "status-quo", with a slight positive trend. Almost as many stations are showing an improvement as are exhibiting degradation over a five year time period. However, both the negative and positive trends are marginal ones reflecting shifts in impairment to an adjoining category; for example, from a "Poor" rating to a "Fair" rating or the reverse.

Figure 3.12: Ninety Common Sites

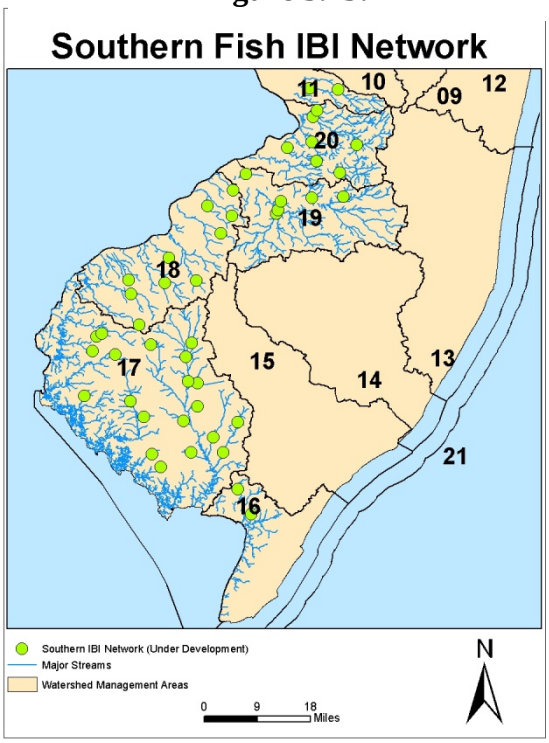


Outlook and Implications

Rounds 1 and 2 data indicate fish biotic integrity is highly sensitive to anthropogenic stressors including impervious cover, siltation, and increased run-off from storm water outfalls. This data concludes the following:

1) Fish IBI data indicates a significant ($r^2 = 0.32$) decline in fish biotic integrity with increasing impervious cover
2) Benthic fish species exhibit a sharp decline ($r^2 = 0.32$) with increasing urbanization
3) Round 2 Fish IBI data indicates a higher occurrence of external deformities (DELT anomalies) in urbanized streams

Figure 3.13:



Southern Fish IBI Network**:**
During the summers from 2007 to 2011, data was collected from an expanded Fish IBI network that included portions of southern New Jersey, marking measurable progress in achieving the Department's goal for a statewide network consisting of at least 150 stations by the end of calendar year 2012. Figure 3.13 shows the location of the sampling stations monitored in southern New Jersey to date. Validation of the Southern FIBI network was completed in 2012.

Lakes Fish IBI Assessment:
In general, current lake water monitoring programs lack direct assessment and reporting on biological conditions. This is partly attributed to a lack of development of biological assessment protocols. Through the use of boat electrofishing, fish samples were collected from the littoral zone of 22 lakes in New Jersey during the summers 2002-2006. Fish data were evaluated for the potential development of an index of biological integrity (IBI). Twenty-five species of fish in the families: Anguillidae, Catostomidae, Centrarchidae, Clupeidae, Cyprinidae, Cyprinodontidae, Esocidae, Ictaluridae, and Percidae were collected. A set of fish species richness and composition metrics were examined for their general response to a gradient of land use conditions. Results indicate that some attributes of the littoral fish assemblage may be used to assess the ecological health of New Jersey lakes. However, additional information on the responses of the littoral fish assemblage to specific physical habitat and water quality parameters is needed before an IBI can be developed.

Data and reports for the all eleven years (2000-2010) of New Jersey's FIBI network may be obtained by visiting the Department's Web site at www.state.nj.us/dep/wms/bfbm.

3.3: Statewide Statistical Surveys of New Jersey Waters

Background

The Department employs two different types of assessment methodologies to characterize New Jersey's water quality: subwatershed/targeted monitoring and statewide statistical surveys. The subwatershed/targeted assessment employs data collected from fixed monitoring locations to characterize the water quality on a subwatershed basis or at specific locations. This method is used for regulatory purposes, such as identifying impaired waterbodies that require TMDLs under Section 303(d) of the federal Clean Water Act, as well as assessing overall water quality at the subwatershed scale to satisfy Section 305(b) reporting requirements. It may also be used to quantify change in water quality over time at targeted locations (i.e., trends analysis). Statewide statistical surveys employ data collected from monitoring stations selected probabilistically so that every location has the same likelihood of being selected and monitored as any other location within that region. The results from the selected stations are then extrapolated to provide a representative assessment of the *entire region*. A statistical survey generates spatial quantification of water quality conditions and can be used to characterize the "overall" water quality of an entire region or state.

Each type of design and assessment method has distinct advantages. The subwatershed/targeted assessment can identify the specific subwatershed that exceeds the SWQS criterion for a particular pollutant and can be used to support listing of water-quality limited waters, as required under Section 303(d) of the federal Clean Water Act, as well development of total maximum daily loads (TMDLs) or other strategies to restore water quality. It can also be used to determine that SWQS are met and the designated uses are fully supporting within the subwatershed. The statewide statistical survey assessment can indicate that a certain percentage of all the river miles in New Jersey are expected to exceed the SWQS criterion for a particular pollutant. Statistical surveys provide broad-brush characterizations that can be applied to an entire region with a known level of confidence. However, since the statistical surveys do not include the minimum suite of parameters needed to determine if a designated use is "fully supporting" (see Appendix F, Section 6.0), survey results are not used for overall use assessment purposes or to generate the Integrated List of Waters.

Statewide Statistical Assessment of Streams

The Department's first statistical assessment for freshwater streams was based upon sampling protocols developed cooperatively with USGS and published in the *2000 New Jersey Water Quality Inventory Report*. Between 2000 and 2007, a total of 108 sites were sampled and assessed, with results converted to river miles. While the sites employed in this assessment were not randomly selected from all possible locations (a true probabilistic design), the 830 fixed sites from which they were selected were considered to be extensive enough to approximate the entire population of all possible sites. Results for this assessment were published in Section 3.4 of the *2008 Integrated Report.* Both reports may be downloaded from Department's website at http://www.nj.gov/dep/wms/bwqsa/support_docs.htm. Nevertheless, this site selection methodology did not meet USEPA requirements for a true probabilistic design; therefore, the

Department worked with USEPA's Office of Research and Development to develop site selection protocols for wadeable streams that concur with USEPA's Generalized Random Tessellation Stratified (GRTS) Spatially-Balanced Survey Design, the method USEPA prefers states to use. In July 2011, the Department adopted the USEPA-recommended GRTS Spatially-Balanced Survey Design based approach for monitoring the supplemental network. In 2012, USEPA launched a new online reporting system for statewide statistical surveys. The Department is implementing the probabilistic network design and working with USEPA to customize the online reporting system to suit New Jersey's assessment methods.

Statewide Statistical Assessment of Lakes

The Department's lake monitoring network is also GRTS based and involves the testing of 200 lakes selected randomly from a list of 635 named lakes over two hectares (5 acres) or greater in surface area, which serve to statistically represent all lakes of that size in the State. Water supply reservoirs are excluded because the water levels are closely managed by the water supply authorities. Sampling is conducted in five panels of 40 lakes each. Each panel is sampled once every five years with each lake within a panel sampled twice a year (growing season and non-growing season). Three parameters are used to assess the general aquatic life use: total phosphorus (TP), dissolved oxygen (DO), and pH. The lake selection and monitoring protocols employed by the Department are described in more detail on the Department's Web site at http://www.state.nj.us/dep/wms/bfbm/lakes.html. Of the 199 lakes assessed (one lake could not be sampled for panel 1), 142 lakes fully support the aquatic life use and 57 did not support the use. Non-support of the aquatic life use may be caused by more than one parameter within a single lake. For example, many lakes that exceed the DO criterion also exceed the TP criterion. Of the 57 lakes that did not support the aquatic life use, 30 exceeded the TP criterion, five exceeded the DO criterion, and 28 exceeded the pH criterion. These results reflect sampling for all five panels (199 lakes).

Table 3.1: Final Results of the Statewide Statistical Assessment of Lakes

Use Assessment Results*	Total Phosphorus	Dissolved Oxygen	pH	Aquatic Life Designated Use
Fully Supporting	84%	97%	86%	71%
Not Supporting	16%	3%	14%	29%

*Use assessment result is based upon TP, DO, and pH but not biological data since there is no established method for biological assessment in lakes

Statewide Statistical Assessment of Estuarine Waters

During 2010, the estuarine waters of New Jersey and other coastal states were assessed under USEPA's National Coastal Conditions Assessment program (NCCA). The Department was a full partner in design and sampling for NCCA in New Jersey's estuarine waters. This program has a probabilistic design that was developed by USEPA's Office of Research and Development (ORD) to estimate the percentage of a state's or the Nation's waters that are in good, fair, or poor condition. This project is now run by USEPA's Office of Water as part of the National Resource Surveys and, as such, operates on a five-year assessment cycle. In 2010, during an index period

of July through September, 27 locations throughout New Jersey's estuarine waters were sampled for water quality, sediment quality, benthic community, fish assemblage, and fish pathology. USEPA has made data, reports, and study design from the NCCA available at http://water.epa.gov/type/oceb/assessmonitor/nccr/index.cfm. The Department does not fully concur with the assessment methods used for the NCCA reports because of the limited nature of the sampling protocol. USEPA's methodology uses a one-time grab sample to represent a location within an entire season. The Department believes more frequent sampling within a season will afford more precision in the assessments.

To further enhance these coastal assessments, New Jersey is working in partnership with USEPA's Atlantic Ecology Division (AED), USEPA Region 2's Monitoring and Assessment Program, and Rutgers University to develop an ocean benthic index for the nearshore New Jersey ocean waters. The index and final report from Rutgers was completed in 2012. Assessment of the data, utilizing the developed index, was performed for all data collected in 2007, 2009 and 2010. Preliminary results in draft reports produced in 2013 indicate the nearshore benthos is in a healthy condition. This included samples collected in the mixing zones of New Jersey's fourteen ocean wastewater treatment outfalls.

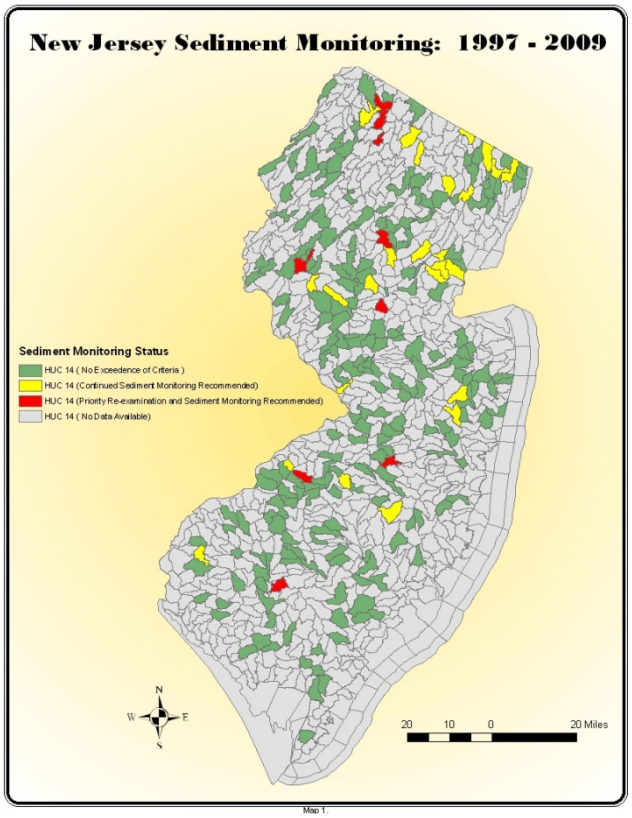
3.4 Assessment of Freshwater Sediment Samples

Sediment samples have been collected in a number of the State's rivers and streams as part of the Department's Ambient Surface Water Monitoring Network, as follow-up monitoring to confirm impairment in 303(d)-listed waters, or as part of stressor identification for biologically-impaired waters. A total of 282 stations were sampled in 244 assessment units (AUs) since 1997 through 2009 (see Figure 3.12). Parameters sampled varied from station to station depending on the monitoring network used and the previous data collected and included: pH, chloride, total solids, total Kjeldahl nitrogen (TKN), ammonia, phosphorous, petroleum hydrocarbons, polychlorinated biphenyls (PCBs), polyaromatic hydrocarbons (PAHs), arsenic, beryllium, boron, cadmium, chromium, hexavalent chromium, cobalt, copper, cyanide, iron, lead, manganese, mercury, nickel, selenium, silver, thallium, and zinc. The Department has not promulgated sediment standards; therefore, this data was evaluated based on other criteria and/or guidelines as a screening tool to identify stations and/or parameters of concern. This data was not used for designated use assessment or in generating the Integrated List of Waters or 303(d) List of Water Quality Limited Waters.

The sediment samples were evaluated by comparing the monitoring location data with the Department's Ecological Screening Criteria in accordance with the Technical Requirements for Site Remediation at N.J.A.C. 7:26E-3.11. The Department's Environmental Toxicology and Risk Assessment (ETRA) Unit developed an Ecological Screening Criteria Table from various sources to allow ease of reference for ecological screening criteria (ESC) for surface water, sediment, and soil. This table is available on the Department's Web site at http://www.nj.gov/dep/srp/guidance/ecoscreening. With the exception of the surface water quality standards (N.J.A.C. 7:9B), the ESC are not promulgated standards, but are used as screening values in ecological assessments. When multiple ESC are provided for the same contaminant and same media, generally the most conservative criterion is used.

The following parameters could not be evaluated for lack of applicable sediment criteria: beryllium, boron, hexavalent chromium, selenium, thallium, and a number of PAHs. An exceedance of an ESC indicates the potential for adverse ecological effects to the benthic community. PAHs were evaluated as total PAHs and compared with a screening criterion of 4.0 mg/kg. If the sum total of PAHs exceeded 4.0 mg/kg, then a station was identified as "of concern". Levels of PAHs (sum total) in the range of 1 to 2 mg/kg, and lead in the range of 50 to 100 mg/kg, were considered typical levels for urban areas. Iron and manganese levels above the screening criteria were not of concern unless they were related to a known discharge. For all other parameters, a station was determined to be of concern if the concentration of an individual parameter was higher than the applicable screening criterion by a significant amount (generally, an order of magnitude), using best professional judgment.

Figure 3.14: Sediment Monitoring Stations

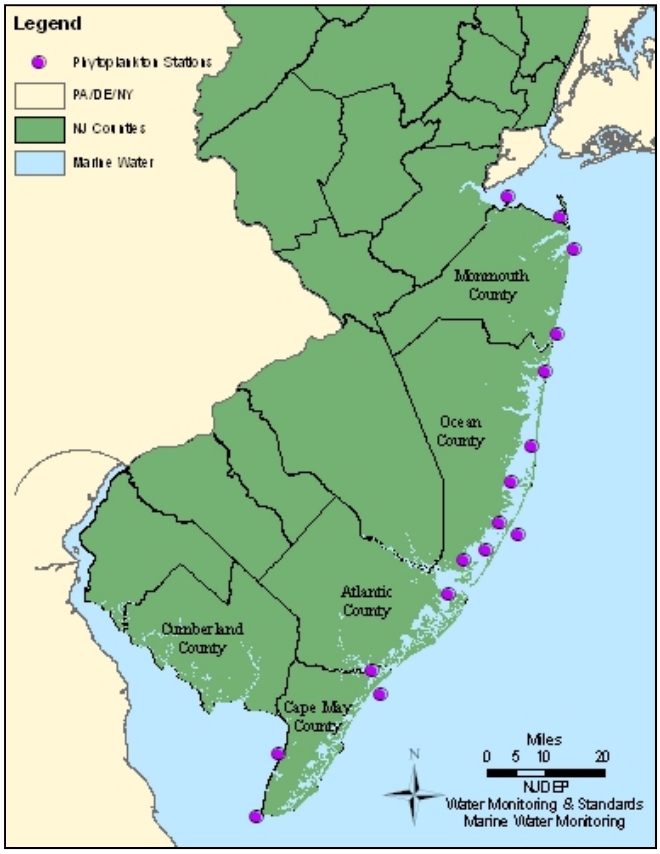


As shown in Figure 3.14, most (210) of the AUs sampled had sediment concentrations below levels used as screening values in ecological assessments. These AUs depicted as green on the map. Sediment quality in 34 AUs exceeded screening values and could contribute to aquatic life use impairment (yellow and red); however, only nine (red) of these were high enough to be recommended for priority attention. All but three of the 34 AUs were assessed as not supporting the aquatic life use. Several stations were sampled over multiple years and, in some cases, parameter values varied significantly. In one case, the variation may be attributed to clean up activities. The North Branch Rancocas Creek at Hanover Furnace (01465950) was sampled in 1998, 2000, and 2009. In 1998 and 2000, lead and copper levels were elevated and staff found pieces of spent ammunition (made of lead and copper) in the sediment, which was found to have originated upstream in Fort Dix. In 2009, parameter concentrations were below the applicable screening criteria, suggesting that the upstream munitions clean-up was successful. In the remaining cases where sample results varied from year to year, it is suspected that samples may have been collected after storm events with significant scouring effects, or that samples were collected from slightly different sub-sections (composite samples are made from several sub-sections across a transect).

3.5: Assessment of Coastal Phytoplankton

Phytoplankton are microscopic plants that float in coastal waters. Under normal conditions, they are beneficial and form the base of the food chain on which most other marine life depend. The Department's Bureau of Marine Water Monitoring (BMWM) monitors phytoplankton assemblages and looks for the presence of blooms each summer in New Jersey's coastal waters and major estuaries (see Figure 3.15) as part of the State's compliance with the National Shellfish Sanitation Program (NSSP). The National Shellfish Sanitation Program requires that each coastal state develop a contingency plan that includes control measures for marine biotoxins. Filter-feeding molluscan shellfish, known as bivalves (clams, oysters, and mussels) are capable of accumulating toxins that may be produced by certain algal species. The phytoplankton-monitoring program provides surveillance of shellfish growing areas for possible toxin-producing algal species, which are identified and enumerated along with other phytoplankton present.

Figure 3.15: Coastal Phytoplankton Monitoring Stations



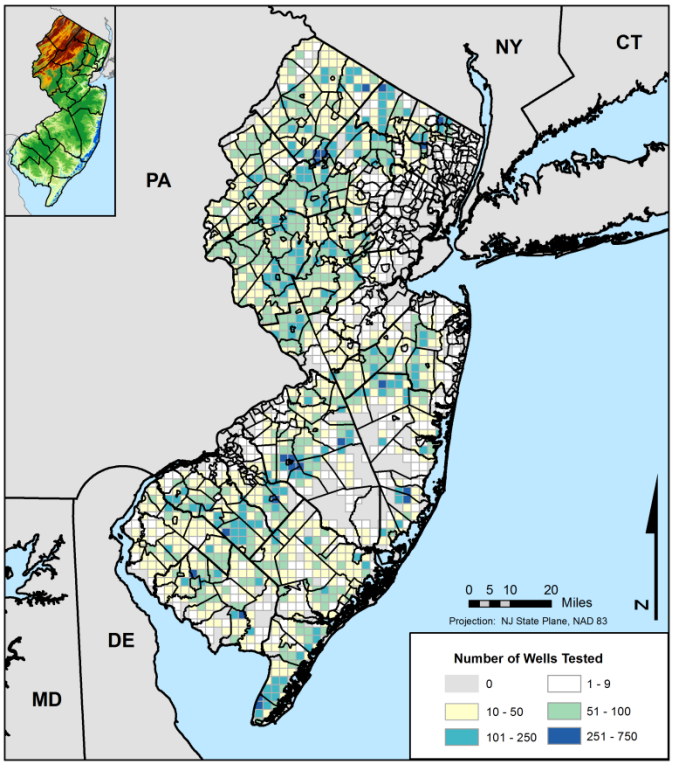
The primary purpose of this program is to ensure that shellfish harvested in New Jersey are not toxic for human consumption due to the presence of certain phytoplankton known to produce toxins. However, algal blooms may have other harmful effects, including marine fauna kills, mild toxicity to bathers, and reduced aesthetic quality. This information is obtained cooperatively with USEPA Region 2 during their summer New York Bight Water Quality helicopter survey. The BMWM has also implemented an aircraft remote sensing program for estimating chlorophyll levels in New Jersey's coastal waters. This program provides a valuable perspective on algal conditions and trends see http://www.nj.gov/dep/bmw/phytoplankton.htm.

Historical information on algal conditions in New Jersey's estuarine and coastal waters is available in the weekly reports (June through August) of algal conditions in New Jersey coastal waters, entitled "Annual Summary of Phytoplankton Blooms and Related Conditions in New Jersey Coastal Waters Summer" that are available on the Department's Web site at http://www.state.nj.us/dep/wms/bmw/phytoplankton.htm. Periodically toxic species are identified, but rarely in bloom conditions.

3.6: Ground Water Quality Assessment

Approximately 400,000 private wells (about 13 percent of New Jersey residents) are used for drinking water in New Jersey. There are no federal regulations regarding the quality of private wells and, before the Private Well Testing Act (PWTA) was passed in 2001, state regulations focused on well construction. Since September 2002, testing of private wells for a list of contaminants has been required when the property is sold or leased. All samples are raw water samples taken before any treatment. Wells statewide are required to be tested for bacteria (total coliform, fecal coliform, and E. coli), nitrates, 26 volatile organic compounds, and lead (see Figure 3.16).

Figure 3.16: Private Wells Tested Statewide



The following is a summary of the Department's assessment of private well data compared with the federal and state drinking water standards for potable supplies. This analysis shows that naturally-occurring contaminants (i.e., arsenic, gross alpha particle counts, manganese, and iron) most frequently exceeded drinking water primary/secondary standards in private wells, followed by contaminants entering ground water via nonpoint sources of pollution (i.e., nitrates and fecal coliform). Contaminants associated with point sources of pollution (i.e., VOCs and mercury) were the least frequently found in concentrations above drinking water maximum contaminant levels (MCLs).

Fecal Indicator Bacteria: Over 93,000 wells have tested or retested for the presence of a group of bacteria called total coliform (TC). When TC is detected in a private well it is further tested for fecal coliform (FC) and E. coli (EC) bacteria. The presence of either FC of EC bacteria is strong evidence that a well has been contaminated with fecal wastes, which can come from a variety of human (septic tanks, leaking sewer lines) or animal (surface water infiltration) sources. FC or EC were detected in 2.1 percent (2,008) of the sampled or resampled wells. Table 3.2 shows the breakdown of the number and percent of wells in which either FC or EC were detected, by physiographic provinces. The Coastal Plain had the lowest percentage of wells in which FC or EC was detected. This may be because the sand and clay layers of the Coastal Plain protect wells from fecal contamination better than the sedimentary, igneous, or metamorphic rocks that comprise the three bedrock provinces in the north.

Table 3.2: Number and Percentage of Total Coliform-Positive Wells With Fecal Coliform or E. coli Detected

Province	No. of TC Pos Wells	No. FC- or EC-positive	Percent
Valley and Ridge	6,862	305	4.4
Highlands	21,206	576	2.7
Piedmont	17,997	675	3.8
Coastal Plain	47,721	452	0.9
Totals	93,786	2,008	2.1

Nitrates: Nitrate and its reduced form, nitrite, are found in ground water due to natural deposition, runoff from fertilizer use or manure, leaching from septic tanks, and leakage from sewer lines. The drinking water maximum contaminant level (MCL) for nitrate is 10 mg/l. Table 3.3 shows a breakdown of the number and percent of 78,589 unique wells sampled that exhibited levels of the nitrate above the MCL, by physiographic province. Of the private wells sampled, 2.8 percent (2,164 wells) contained nitrate levels above the drinking water MCL. The Coastal Plain had the highest percentage (3.9 percent) of wells containing nitrate levels above the drinking water MCL. As more data becomes available, it may be possible to evaluate trends in nitrate concentrations over time.

Table 3.3: Number and Percentage of Wells with Nitrate Above the 10 mg/L MCL

Province	No. of Wells	No. of Wells Above 10 mg/L	Percent
Valley and Ridge	5,824	60	1.0
Highlands	17,518	463	2.6
Piedmont	15,142	93	0.6
Coastal Plain	40,105	1,548	3.9
Total	78,589	2,164	2.8

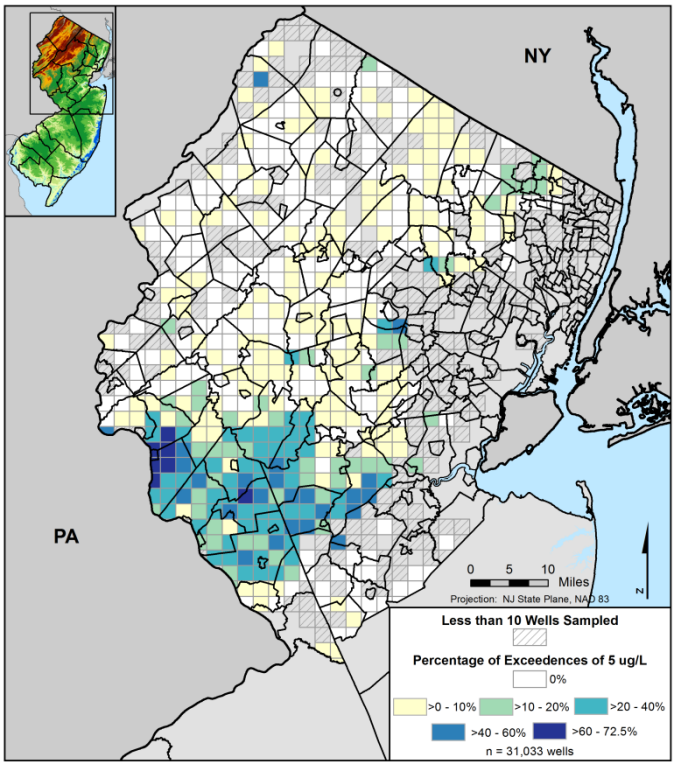
Arsenic: Arsenic in New Jersey ground water has mainly geologic origins; however, in some areas it may be related to land use practices. The Department found that high arsenic concentrations occur when the dissolved oxygen concentration is low and pH values are greater than 7.5[13]. All of the northern New Jersey counties are required by the PWTA to monitor for arsenic. Table 3.4 shows the breakdown of wells sampled that contained arsenic levels above the New Jersey drinking water MCL of 5 *u*g/l, by physiographic province. Of the 17,524 private wells sampled, 10.8 percent (1,884) contained levels of arsenic above the New Jersey MCL. The Piedmont region had the highest percentage of wells (19.0 percent) with arsenic levels above the MCL (see Figure 3.17).

[13] New Jersey Geological Survey. New Jersey Department of Environmental Protection. *Arsenic in New Jersey Ground Water*. 2004. Information circular available at http://www.state.nj.us/dep/njgs/enviroed/infocirc/arsenic.pdf.

Table 3.4: Number and Percentage of Wells with Arsenic Above the 5 *u*g/LMCL

Province	No. Wells	No. Wells Above 5 *u*g/l	Percent
Valley and Ridge	1,914	41	2.1
Highlands	13,342	155	1.2
Piedmont	15,136	2,626	17.3
Coastal Plain	641	6	0.9
Totals	31,033	2,828	9.1

Figure 3.17: Percentage of Wells with Arsenic Concentrations above the 5 *u*g/L MCL



Mercury: Mercury concentrations were measured in 39,478 wells in southern New Jersey's nine counties, which are all located within the Coastal Plain. Less than one percent of the wells contained mercury levels above the drinking water MCL for mercury (2 *u*g/l). The source of mercury in these private wells is not clear.

Radium (Gross Alpha): Gross alpha particle activity (pCi/l) is used as a surrogate measurement for radium due to the high cost of radium isotope testing. It is a measurement of all alpha activity present, regardless of the specific radionuclide source. The federal MCL for gross alpha is 15 pCi/l minus the contribution of uranium. In the Coastal Plain, where only radium is present, this screening test works quite well; however, in northern New Jersey, where samples may contain uranium, radium, or a combination of both, gross alpha measurements do not provide sufficient

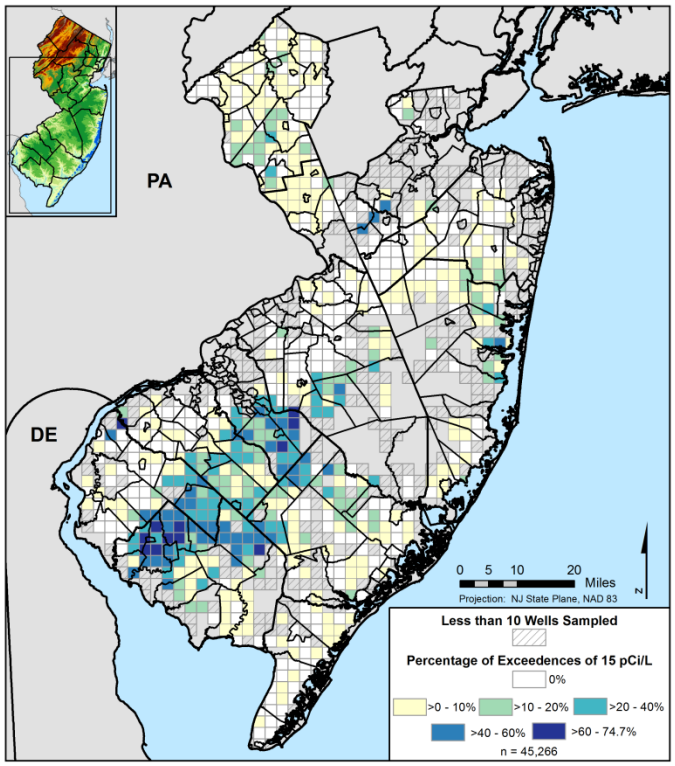
information to evaluate whether a particular sample exceeds the drinking water MCL. Table 3.5 shows the breakdown of private wells sampled that contained levels of gross alpha above the federal MCL, by physiographic province. Of the 45,266 private wells sampled, 9.9 percent (4,474) contained gross alpha levels above the federal MCL; however, only the results for the Coastal Plain are considered accurate due to the likely presence of other radionuclides in the other provinces. Approximately eleven percent (4,161) of private wells tested in the Coastal Plain contained levels of gross alpha above the federal MCL (see Figure 3.18).

Table 3.5: Number and Percentage of Wells with Gross Alpha Above the MCL (15 pCi/l)

Province	No. Wells	No. Well Above 15 pCi/l	Percent
Coastal Plain	37,321	4,161	11.1
Piedmont*	6,339	270	4.3
Highlands*	1,606	43	2.7
Totals	45,266	4,474	9.9

* Piedmont and Highlands samples may contain Radium and/or Uranium.

Figure 3.18: Percentage of Wells with Gross Alpha above the 15 pCi/L MCL



Manganese: Manganese is commonly found in ground water. High concentrations of manganese may cause the water to become brown or black, resulting in staining and a bitter metallic taste. USEPA has set a secondary MCL for manganese of 0.05 mg/l. USEPA has also set a lifetime

health advisory of 0.30 mg/l based on the occurrence of neurological effects. Table 3.6 shows the breakdown of private wells sampled that contained manganese levels above the federal secondary MCL of 0.05 mg/l and the lifetime health advisory for manganese, by physiographic province. Overall, 19.6 percent of the private wells tested contained manganese levels above the secondary standard; 3.2 percent contained levels above the lifetime health advisory. Manganese levels above the federal lifetime health advisory were present most frequently in private wells in the Highlands and Ridge and Valley physiographic provinces.

Table 3.6: Number and Percentage of Wells with Manganese above the Secondary MCL (0.05 mg/l) and the Lifetime Health Advisory (0.300 mg/l)

Province	No. of Wells	No. Wells Above 0.05 mg/l	% above 0.05 mg/l	No. Wells Above 0.300 mg/l	% above 0.300 mg/l
Valley and Ridge	5,824	1,574	27.0	327	5.6
Highlands	17,518	3,334	19.0	1,195	6.8
Piedmont	15,142	1,378	9.1	277	1.8
Coastal Plain	40,105	9,113	22.7	709	1.8
Totals	**78,589**	**15,399**	**19.6**	**2,508**	**3.2**

Iron: Iron is a common problem in private wells. Iron-bearing ground water is often noticeably orange in color, causing discoloration of laundry, and has an unpleasant taste. Iron dissolved in ground water is in the reduced iron II form. This form is soluble and normally does not cause any problems by itself. Iron II is oxidized to iron III upon contact with oxygen in the air or by the action of iron-related bacteria. Iron III forms insoluble hydroxides in water. These are rusty-red and cause staining and blockage of screens, pumps, pipes, reticulation systems, etc. USEPA has set a secondary standard for iron of 0.300 mg/l. USEPA has not set a lifetime health advisory for lead. Table 3.7 shows the breakdown of private wells tested that contained iron concentrations above the secondary standard, by physiographic province. Of the 78,589 private wells sampled, 29.4 percent (23,067) contained iron concentrations above the federal secondary standard. The acidic Coastal Plain exhibited the highest percentage of wells (39.0%) with iron concentrations above the secondary standard.

Table 3.7: Number and Percentage of Wells with Iron above the Secondary Standard (0.3 mg/l)

Physiographic Province	No. Wells	No. Wells Above 0.300 mg/l	Percent
Valley and Ridge	5,824	1,286	22.1
Highlands	17,518	4,410	25.2
Piedmont	15,142	1,739	11.5
Coastal Plain	40,105	15,632	39.0
Totals	**78,589**	**23,067**	**29.4**

Volatile Organic Compounds: Volatile organic compounds (VOCs) are often found in ground water. All wells in New Jersey are required to be tested for the 26 VOCs that have state or federal MCLs. Table 3.8 shows the number of wells in which each of the 26 VOCs was detected at concentrations greater than 0.5 parts per billion (ppb), and the percentage of detections of each

VOC out of the 63,036 private wells sampled. The highest percentage of VOCs detected (over the 0.5 ppb were MTBE (7.6%) and toluene (5.1%), which are components of gasoline; and the solvents trichloroethylene (0.8%) and tetrachloroethylene (0.7%). This table also shows the corresponding MCL for each VOC and the number of private wells sampled that contained concentrations of each VOC above its MCL. Of the 63,063 private wells tested statewide, 1.5 percent (969) contained VOCs in concentrations above the corresponding drinking water MCL.

Table 3.8: Volatile Organic Compounds Detected in NJ Private Drinking Water Wells

VOC	Number of Wells with Detections (over 0.5 ppb)	Percentage of Wells with Detections	Applicable MCL (ppb)	Number of Wells Above MCL	Percentage of Wells Above MCL
Benzene	425	0.67	1	70	0.1
Carbon Tetrachloride	271	0.43	2	74	0.1
Chlorobenzene	40	0.06	50	0	0.0
1,2-Dichlorobenzene	34	0.05	600	0	0.0
1,3-Dichlorobenzene	32	0.05	600	0	0.0
1,4-Dichlorobenzene	85	0.13	75	0	0.0
1,1-Dichloroethane	222	0.35	50	1	0.0
1,2-Dichloroethane	116	0.18	2	36	0.1
1,1-Dichloroethylene	155	0.25	2	41	0.1
cis-1,2-Dichlorothylene	148	0.23	70	2	0.0
trans-1,2-Dichlorothylene	10	0.02	100	0	0.0
1,2-Dichloropropane	129	0.20	5	28	0.0
Ethylbenzene	100	0.16	700	0	0.0
Methylene Chloride	397	0.63	3	58	0.1
MTBE	4758	7.55	70	40	0.1
Naphthalene	256	0.41	300	0	0.0
Styrene	87	0.14	100	1	0.0
1,1,2,2-Tetrachloroethane	28	0.04	1	10	0.0
Tetrachloroethylene	457	0.72	1	282	0.4
Toluene	3185	5.05	1000	0	0.0
1,2,4-Trichlorobenzene	26	0.04	9	0	0.0
1,1,1-Trichloroethane	254	0.40	30	1	0.0
1,1,2-Trichloroethane	19	0.03	1	3	0.0
Trichloroethylene	531	0.84	1	312	0.5
Vinyl Chloride	53	0.08	2	10	0.0
Xylenes (Total)	206	0.33	1000	0	0.0
Totals	**12024**	**19.04**	**4775**	**969**	**1.5**

Chapter 4: Results of the 2012 Integrated Water Quality Assessment

4.1: Designated Uses of New Jersey's Waters

New Jersey's surface water quality standards (SWQS) establish stream classifications and antidegradation designations for all surface waters of the State. The stream classifications reflect the designated uses assigned to individual surface waters. Designated uses include aquatic life support (maintenance, migration, and propagation), recreation, fish consumption, shellfish harvest for consumption, drinking water supply, industrial water supply, and agricultural water supply. The SWQS also specify the water quality criteria that correspond with the waterbody classifications, which are necessary to achieve the designated uses (see Appendix L).

As explained in Chapter 1, New Jersey is divided into 952 assessment units (AU) for the 2012 Integrated Report. New Jersey's designated uses and their corresponding water body classifications are listed in the Surface Water Quality Standards at N.J.A.C. 7:9B-1.12 and 1.13. Each use is assessed using the scientific methods applicable to the use and waterbody type to evaluate associated parameters and/or biological indicators (see Appendix F: 2012 Methods Document). Some designated uses apply to all AUs (e.g., recreation) while other uses apply only to some AUs (e.g., drinking water supply). Therefore, in assessing the percentage of uses assessed and attained statewide, the total number of applicable AUs will vary from use to use. Table 4.1 shows the number of assessment units (AUs) to which each designated use applies. For the 2012 Integrated Report, the Department based its water quality assessments on five categories of designated uses. These categories are explained briefly below:

Aquatic Life Uses: refers to the **"**maintenance, migration, and propagation of the natural and established biota." In some limited cases (i.e., waters classified as FW1), it also means, "set aside for posterity to represent the natural aquatic environment and its associated biota." For assessment purposes, these aquatic life uses are grouped into two categories. The first category, "Aquatic Life Use - General" (ALG), is a general level of support and is applied to all waters. The second category, "Aquatic Life Use - Trout" (ALT), applies exclusively to waterbodies classified for Trout Production (TP) and Trout Maintenance (TM). Assessment criteria are generally more restrictive for the ALT uses than for ALG use. Both physical/chemical and biological data are used. Methods for assessing both categories of the aquatic life use are explained in Section 6.1 of the Methods Document (Appendix F).

Recreational Use (REC): refers to suitability for recreation on or in the water. All New Jersey waters are designated for some type of recreational use. Most are designated for primary contact recreation whether activities described below occur or not. Methods for assessing the recreational use are explained in Section 6.2 of the Methods Document, as well as Section 4.2, "Pathogenic Indicators" (see Appendix F).

- Primary contact recreation includes those water-related recreational activities that involve significant ingestion risks and includes, but is not limited to, wading, swimming, diving, surfing, and water skiing. Of primary concern for these activities is the ingestion of water

containing pathogens that can cause illness and even death; therefore, SWQS criteria for primary contact recreation are based on human health rather than ecology.

- Secondary contact recreation is defined as recreational activities where the probability of water ingestion is minimal and includes, but is not limited to, boating and fishing. SWQS criteria have been promulgated for primary contact recreation in saline coastal (SC), saline estuary (SE)1, Pinelands (PL), freshwater (FW)1, and FW2 waters. SWQS criteria have also been promulgated for secondary contact recreation in SE2 and SE3 waters.

Water Supply Uses: refers to the use of water for potable, agricultural, or industrial water supplies. All FW2 and Pinelands waters are designated for the drinking, agricultural, and industrial water supply uses whether or not the waters are actually used for these purposes. Methods for assessing these water supply uses are explained Sections 6.5-6.7 of the Methods Document (Appendix F).

- Drinking Water Supply (DWS): refers to water that is safe to ingest after conventional filtration treatment (i.e., filtration, flocculation, coagulation, and sedimentation) and disinfection. Many of these waters do not contain drinking water intakes due to stream size and other considerations.

- Agricultural Water Supply (AWS): refers to water used for field crops, livestock, horticulture, and silviculture. Many of the waters designated for AWS are not used for these purposes due to stream size and land use constraints.

- Industrial Water Supply (IWS)**:** refers to water used for processing or cooling. Many of the waters designated for IWS are not used for these purposes due to stream size and land use constraints.

Fish Consumption Use (FC): refers to ability to catch and consume fish that are safe for human consumption. While this use is not expressly identified in the New Jersey Surface Water Quality Standards, "fishable waters" is a goal of the federal Clean Water Act. Therefore, the Department assesses the fish consumption use as part of the Integrated Report. All waters of the State are designated for the fish consumption use. Assessment methods for the fish consumption use are explained in Sections 4.3 and 6.3 of the Methods Document (Appendix F).

Shellfish Harvest for Consumption Use (SF): refers to the harvest of mollusks (commonly known as clams, oysters, or mussels) that are safe for human consumption without further treatment such as depuration and seasonal restrictions. Only saline coastal (SC) and saline estuary-1 (SE1) waters classified as "Approved" shellfish waters pursuant to the Shellfish Classification rules at N.J.A.C. 7:12 are assessed as fully supporting this use. Assessment methods for the shellfish harvest for consumption use are explained in Section 6.4 of the Methods Document (Appendix F).

Table 4.1: Designated Uses Applicable to Stream Classifications and Assessment Units

Stream Classification	ALG	ALT	DWS	AWS	IWS	REC	FC	SF
FW1	X					X	X	
FW1 (TP, TM)	X	X				X	X	
PL	X		X	X		X	X	
PL(TM)	X	X	X	X		X	X	
FW2-NT	X		X	X	X	X	X	
FW2-TM	X	X	X	X	X	X	X	
FW2-TP	X	X	X	X	X	X	X	
SE1	X					X	X	X
SE2	X					X	X	
SE3	X					X	X	
SC	X					X	X	X
Total # Applicable AUs	952	203	794	815	665	952	952	151

4.2: Reporting Assessment Results Using ADB

The results of these individual designated use assessments are entered into the USEPA Assessment Database (ADB). ADB is a relational database application for tracking water quality assessment data for thousands of waterbodies, such as use assessment results, causes and sources of non-attainment and impairment, and integrating it into meaningful reports. ADB was designed to make reporting under Sections 305(b) and 303(d) of the federal Clean Water Act automated, accurate, straightforward, and user-friendly for participating States. The Department used ADB to generate the Section 305(b) Integrated List of Waters (Integrated List), the Section 303(d) List of Water Quality Limited Waters (303(d) List), and the List of Delisted Waters (Delisting Document) for the 2012 Integrated Report. USEPA integrates the information collected through its TMDL and assessment databases and then provides this information to the public through "ATTAINS" (Assessment Total Maximum Daily Load Tracking and Implementation System), which is available on USEPA's Web site at http://www.epa.gov/waters/ir.

The ADB reports present the assessment results for a total of 962 assessment units, which include New Jersey's 952 HUC 14 subwatersheds as well as 10 additional assessment units representing the Delaware River and Bay Zones assessed by the Delaware River Basin Commission (DRBC). DRBC is responsible for collecting and assessing water quality data for the Delaware River mainstem, Estuary, and Bay. Their assessment results are reported in New Jersey's Integrated List (Appendix A) and 303(d) List (Appendix B) but are not included in the tabulated results presented in this chapter. The water quality assessment results explained here pertain only to New Jersey waters that comprise the state's 952 AUs. DRBC's *2012 Delaware River and Bay Integrated List Water Quality Assessment Report* and corresponding methods are available on DRBC's Web site at: http://www.state.nj.us/drbc/public.htm#305b.

The 2012 Integrated List of Waters

The 2012 Integrated List of Waters (Integrated List) appears in Appendix A as the "Assessment Unit Summary List", which is a standard report generated from USEPA's assessment database (ADB) to satisfy Section 305(b) reporting requirements. The Integrated List includes, in tabular format, the assessment results for all designated uses assigned to each AU, along with information such as assessment unit identification number (ID), assessment unit name, and waterbody type and size[14]. Use assessment results are displayed for each applicable designated use in each assessment unit as "fully supporting", "not supporting", or "insufficient information". For uses that are not supported, the Integrated List identifies the pollutant causing non-support and displays the status of any TMDLs completed for that pollutant, along with potential sources of the pollutant (e.g., urban runoff as a source of fecal coliform). Pollutants shown with a "date completed" are already covered by an approved TMDL.

2012 303(d) List, Priority Ranking, and Two-Year TMDL Schedule

As stated above, TMDLs are required for all pollutants identified on the Integrated List as causes of designated use non-support. The Integrated List identifies all causes for which TMDLs have already been completed and approved. The 2012 303(d) List (Appendix B) shows all the AU/pollutant combinations for waters that are not fully supporting applicable designated uses and are not covered by an approved TMDL. The 303(d) List includes the priority ranking ("high", "medium", or "low") of these waters for TMDL development. A detailed explanation of the priority ranking process can be found in Section 8 of the 2012 Methods Document. The Department has developed a Two-Year TMDL Schedule based on these priorities, which identifies the AU/pollutant combinations for which a TMDL will be developed during the next two years. The 2012 Two-Year TMDL Schedule can be found in Appendix D.

Delisted Waters

The Department generated a report out of USEPA's ADB that identifies all the AU/pollutant combinations from the 2010 303(d) List that are not included in the 2012 303(d) List for one of the reasons shown in Table 4.2. This report is entitled: "Assessment Unit-Cause Combinations Removed from 303(d) List" and can be found in Appendix C. A companion document, entitled: Justification for Delisted Waters" groups these waters by delisting reason and provided a more detailed justification for the delisting.

[14] The Department publishes a fact sheet at http://www.state.nj.us/dep/wms/bwqsa/2012_fact%20sheet_final.pdf, which explains how to use the ADB report format. This report was previously entitled: "Status of Designated Uses by Subwatershed" by the ADB system used by USEPA to generate the 2012 Integrated List.

Table 4.2: Delisting Reasons and Description

Delisting Reason	Detailed Description
Applicable Water Quality Standards (WQS) Attained; Due To Restoration Activities;	The waterbody is currently found to attain the applicable water quality standard because restoration activities have improved water quality.
Applicable WQS Attained; According To New Method;	The waterbody is currently found to attain the applicable water quality standard because water quality data are being interpreted with a new assessment method.
Applicable WQS Attained; Reason For Recovery Unspecified;	The waterbody is currently found to attain the applicable water quality standard but the reason for recovery is unknown.
Total Maximum Daily Load (TMDL) Approved Or Established By USEPA (4A);	The waterbody no longer needs a TMDL because a TMDL exists and can therefore be removed from Category 5 (the 303(d) list).
WQS Attained; Original Basis For Listing Was Incorrect;	The waterbody is currently found to attain the applicable water quality standard because the original basis for an impairment decision was incorrect.
Data And/Or Information Lacking To Determine Water Quality Status; Original Basis For Listing Was Incorrect (Category 3).	The original basis for an impairment decision was incorrect and there is insufficient information to support the listing or to assess current conditions.

Decisions to Not List

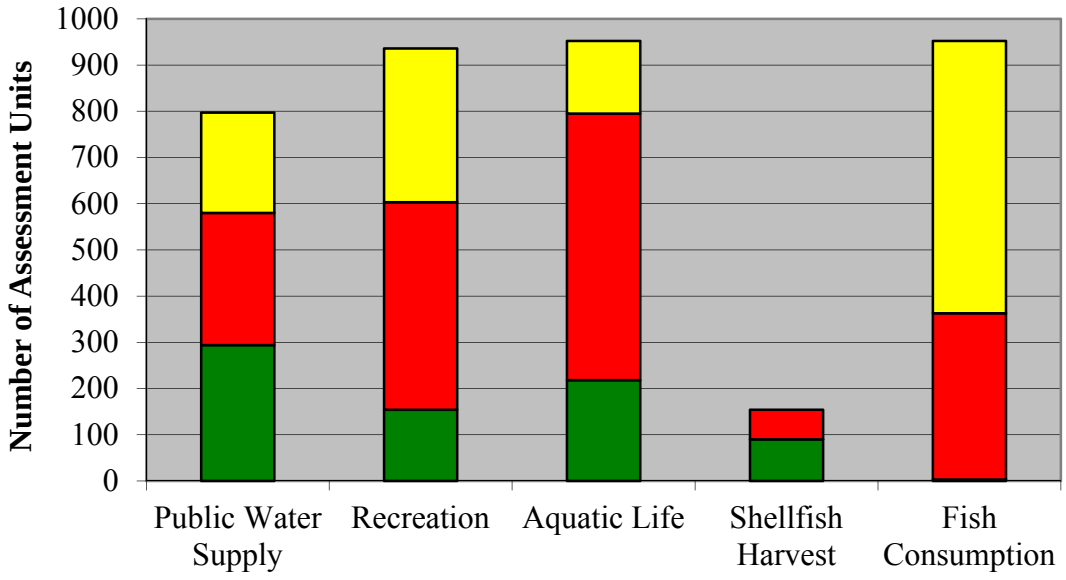
For the 2012 Integrated Report, the Department also generated a report entitled: "Decisions to Not List Assessment Unit/Pollutant Combinations on the 2012 303(d) List of Water Quality Limited Waters" (see Appendix K). This document provides the justification for the Department's decisions to not list the certain assessment unit/pollutant combinations based on the methods and scientific principles articulated in the 2012 Methods Document, including data that is within the margin of error of the analytic method or instrument, natural conditions, or transient events. This document also explains decisions to not list where monitoring station data is inconclusive, insufficient, or inconsistent, and the Department considered other factors using Best Professional Judgment (BPJ) to determine that the weight of evidence did not support a listing decision.

4.3: 2012 Integrated Water Quality Assessment Results

Physical, chemical, and biological monitoring data collected by many organizations between 2006 through 2010 were used to generate the 2012 Integrated List and 303(d) List. The Department's assessment of all readily available data in all 952 AUs resulted in a total of 4,128 individual use assessments (out of 6,543 possible designated use/assessment unit combinations), and the evaluation of another 2,415 combinations that had insufficient information to assess uses.

Assessment results for key designated uses are summarized in Figure 4.1 and explained further below.

Figure 4.1: Use Assessment Results for 2012



*AUs shown as "Not Supported" include those for which a TMDL has been developed and those on the 2012 303(d) List that still require a TMDL.

Forty of New Jersey's 952 AUs were not assessed for any designated uses in 2012; which means that 96 percent (912 AUs) were assessed for at least one designated use. Of these AUs, twenty-two were fully supporting all uses except fish consumption and one, NJ02040104140010-01 Big Flat Brook (above Forked Brook), fully supports all applicable designated uses including fish consumption. These 23 "healthy watersheds" contain the highest quality of all waters assessed for the 2012 Integrated Report (see Table 4.3). Big Flat Brook is classified as trout production waters and is designated as a Category One waterbody. Some of its tributaries are classified as FW-1 waters. Big Flat Brook is located in a relatively pristine area in Northwestern New Jersey, mostly within Stokes State Forest or High Point State Park (see Figure 4.2). The watershed is relatively undeveloped and mostly

Figure 4.2: Big Flat Brook

forested with few roads and a small amount of agricultural land use; thus explaining its high quality waters.

Table 4.3: New Jersey Healthy Watersheds

AU ID	AU Name
NJ02030103070030-01	Wanaque R/Greenwood Lk(aboveMonks gage)
NJ02030105020060-01	Cakepoulin Creek
NJ02040104140010-01	**Big Flat Brook (above Forked Brook)**
NJ02040104140020-01	Forked Brook/Parker Brook
NJ02040104140030-01	Big Flat Brook (Kittle Rd to Forked Bk)
NJ02040104150020-01	Flat Brook (below Tillman Brook)
NJ02040104240010-01	Van Campens Brook
NJ02040202030020-01	Mount Misery Bk NB (above 74d27m30s dam)
NJ02040202030030-01	Mount Misery Bk MB/NB (below 74d27m30s)
NJ02040202030040-01	Mount Misery Brook SB
NJ02040206210030-01	West Ck (Paper Mill Rd to Rt 550)
NJ02040301030030-01	Metedeconk R SB(BennettsPd to 74d19m15s)
NJ02040301060070-01	Toms River (Rt 70 to Hope Chapel Road)
NJ02040301090020-01	Chamberlain Branch
NJ02040301090030-01	Cedar Creek (74-16-38 to Chamberlain Br)
NJ02040301110020-01	Forked River NB(below old RR grade)
NJ02040301150020-01	Skit Branch (Batsto River)
NJ02040301160030-01	Mullica River (Rt 206 to Jackson Road)
NJ02040301180030-01	Plains Branch (Oswego River)
NJ02040301180050-01	Papoose Branch (Oswego River)
NJ02040301180070-01	Oswego River (below Andrews Road)
NJ02040302050100-01	Gibson Creek / Jackson Creek
NJ02030103070030-01	Wanaque R/Greenwood Lk(aboveMonks gage)

- **Public Water Supply:** Thirty-seven percent of waters designated for the Public Water Supply Use fully support the use; an 11% decrease from 2010. Thirty-six percent did not support the use. Most of this change is attributable to improved detection of arsenic at very low levels. Twenty-seven percent of waters designated for the public water supply use were not assessed due to insufficient information. It should be noted that all New Jersey freshwater streams and lakes are designated for Public Water Supply Use as potential potable water supplies; however, most of the waters that do not support this use do not contain potable water intakes and are not used for drinking water purposes.

- **Recreation:** All waters of the State are designated for Recreational Uses and 16% fully support that use, the same as in 2010. Forty-eight percent did not support the use; a 4% increase from 2010. Thirty-six percent were not assessed due to insufficient information, a 4% decrease from 2010. TMDLs have been completed for most (81%) of the waters that did not support recreational uses because of pathogens (*E. coli, Enterococcus*, and fecal coliform). It should be noted that the recreational use applies to all waters of the State (including lakes); however, most recreation occurs in ocean bathing beaches. Assessment results for 2012 show that all ocean waters are fully swimmable.

- **Aquatic Life:** All waters of the State are designated for the General Aquatic Life Use and 23% fully support that use; a 1% increase from 2010. Sixty-one percent did not support the use; a 5% decrease from 2010. Sixteen percent were not assessed due to insufficient information; a 4% decrease from 2010. Thirty percent of waters designated for the trout aquatic life use fully support this use; an 8% increase from 2010. Fifty-three percent of waters designated for trout use did not support this use; an 11% decrease from 2010. Seventeen percent were not assessed due to insufficient information; a 3% increase from 2010.

- **Shellfish Harvest for Consumption:** Only waters classified as harvestable for shellfish consumption are assessed for the shellfish use. Federal requirements for shellfish classification provide three categories of harvestable shellfish: "approved" (with no restrictions), "seasonal harvest", and "special restrictions". Only shellfish waters classified as "approved" are assessed as fully supporting the designated use. While 89% of shellfish waters are currently classified as harvestable,[15, 16] only 58% of AUs associated with the shellfish use fully supported the use, a 2% decrease from 2010. Forty-two percent did not support the use; a 2% increase from 2010; however, TMDLs have been developed for most of the shellfish waters assessed as not supporting the shellfish harvest for consumption use.

- **Fish Consumption:** All waters of the State are designated for the Fish Consumption Use. Three out of 952 subwatersheds (0.3%) fully support the use, the same as in 2010. Thirty-eight percent of did not fully support the use; a 3% decrease from 2010. Sixty-two percent were not assessed due to insufficient information; a 3% decrease from 2010. While the Department used fish tissue data where available, most of the State's waters were assessed based on fish consumption advisories. Consumption advisories may restrict the amount and/or the type of fish consumed and there may be different advisories for high-risk populations and the general public. The Department issues both statewide and waterbody-specific advisories for the general population and for high-risk groups including infants, children, pregnant or nursing mothers, and women of childbearing age.

[15] NJ Department of Environmental Protection Web site. Bureau of Marine Water Monitoring. "Water Classifications: New Jersey Harvestable Shellfish Waters." Available at http://www.state.nj.us/dep/wms/bmw/info01.htm. Viewed on May 8, 2014.
[16] Debra Watkins. NJ Department of Environmental Protection. Bureau of Marine Water Monitoring. Email to author. May 9, 2014.

Waters that do not fully support a designated use are placed on the 303(d) List along with the pollutant(s) causing water quality impairment (i.e., does not fully support the use). A "pollutant" is a chemical constituent that causes water quality impairment. If chemical data are unavailable or show no exceedance of applicable criteria, but biological data indicate that the designated aquatic life use is not fully supported, the cause of the use impairment is identified on the 303(d) List as "cause unknown" until a pollutant cause is identified or biological data show that the use is no longer impaired.

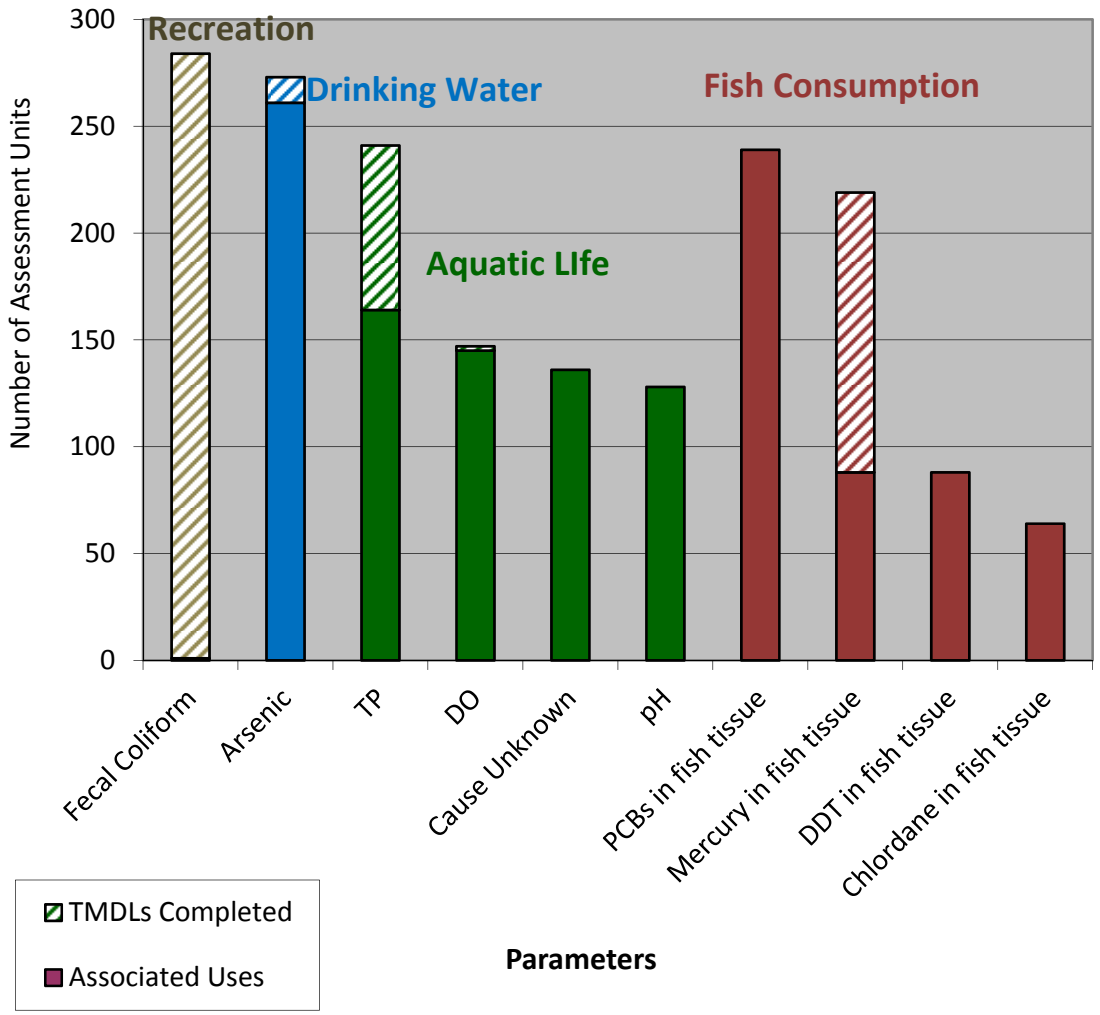
4.4: Causes and Sources of Water Quality Impairment in New Jersey Waters

The most frequent causes of water quality impairment are shown in Figure 4.3 and are associated with the recreation, aquatic life, fish consumption, and public water supply uses. Impaired waters include those identified on the final 2012 303(d) List as well as those for which a TMDL has already been established. Even though TMDLs have been established that address many of the most predominant pollutants causing water quality impairment in New Jersey waters, impaired waters will continue to be assessed as not supporting designated uses until the measures required by the TMDLs are implemented and water quality is restored. A significant period of time may elapse between TMDL establishment, implementation of load reduction measures, and the availability of new water quality data to reevaluate the conditions. The waters will continue to be assessed as not supporting designated uses (even though they will not appear on the 303(d) List). For example, if a TMDL is adopted in 2012 and permits are issued in 2013 with a three-year compliance schedule, improvements might not be observed until 2016. Water quality data reflecting improved water quality conditions would not be assessed until at least the 2018 Integrated Report.

Pathogens

The pollutants responsible for causing most of New Jersey's water quality impairment are the bacteria collectively referred to as "pathogens" but which are actually indicators of pathogenic bacteria (*E. coli*, *Enterococcus*, fecal coliform, and total coliform). Pathogens are the primary cause of impairment for recreational and shellfish harvest for consumption uses. Sources of pathogens include nonpoint sources, stormwater discharges, combined sewer overflows (CSOs), and illicit discharges. In 2012, 24 AUs were delisted for pathogens; five attained applicable water quality standards, 16 were covered by approved TMDLs, and three were incorrect listings with insufficient information to assess use support. Generally, these TMDLs identified various control measures included in the Municipal Stormwater Permit to reduce bacteria loadings. Municipal stormwater permits require municipalities to eliminate "illicit connections" of domestic sewage and other waste to the stormwater collection system, adopt and enforce a pet waste ordinance, prohibit feeding of unconfined wildlife on public property, clean catch basins, perform good housekeeping at maintenance yards, and provide related public education and employee training.

Figure 4.3: Top Ten Causes of Impairment on the Final 2012 Integrated List



Fish Tissue Contaminants

Mercury, PCBs, and DDT and its metabolites are the predominant pollutants causing non-support of the fish consumption use. Sources of these pollutants are primarily discharges that are no longer allowed. PCBs and DDT have been banned and consumer products containing mercury are being eliminated. A PCB TMDL has been established for the Delaware Estuary and requires NJPDES-permitted facilities to implement "pollutant minimization plans" (PMPs). The Department also imposes PMP requirements in NJPDES permits for facilities that discharge to other PCB-impaired waters. A statewide mercury TMDL has also been established, which identifies the predominant source of mercury in fish tissue as air deposition, including sources from other states and countries. In 2012, 25 AUs were delisted for fish tissue contaminants. Fourteen AUs were delisted for mercury in fish tissue because they were covered by the statewide mercury TMDL. Eleven AUs were delisted for chlordane in fish tissue (1), DDT in fish tissue (3), mercury in fish tissue (4), or PCB in fish tissue (3) because they were listed

incorrectly and insufficient information is available to assess water quality.

Nutrient-related parameters

Nutrients are necessary to promote healthy ecosystems. However, excessive nutrients may cause adverse changes in the biological community. Chronic over-enrichment can result in large diurnal swings in dissolved oxygen and/or pH, the replacement of the natural flora and fauna with nutrient tolerant biota, and low dissolved oxygen levels which can lead to fish kills. Parameters associated with nutrient-related impairment – total phosphorus (TP), dissolved oxygen (DO), and pH, are the predominant causes of aquatic life use non-support. Many of the listings for "cause unknown" may actually be due to excessive nutrients. These parameters are often interrelated and reflect the inputs of nutrients into waterways from both point and nonpoint sources.

Both phosphorus and nitrogen are considered "nutrients" that contribute to eutrophication; however, the Department has only promulgated numeric criteria for nitrogen based on human health impacts related to drinking water. Historically, the focus for controlling eutrophication in freshwaters has been on reducing total phosphorus (TP) concentrations rather than nitrogen because phosphorus is usually the "limiting nutrient". Numeric criteria for nitrogen exist relative to protecting human health, but have not been promulgated for use in assessing aquatic life use support, i.e. as a "nutrient".

Studies demonstrate that the impact of nutrients on water quality is strongly influenced by other environmental factors such as sunlight availability, stream velocity and water clarity, meaning that the same amount of TP can have varying impacts (biological responses) in different waters. Total suspended solids (TSS) and temperature exceedances are generally due to, among other things, loss of riparian buffers and tree canopies, the presence and expansion of impervious cover throughout the watershed, and the abundance of small run-of-the-river impoundments common in New Jersey watersheds. In 2010, the Department had developed a nutrient assessment method to evaluate the site-specific variability of TP impacts. In the past, if TP exceeded the numeric phosphorus criteria, the water was deemed impaired regardless of the actual impact of the nutrient on the designated use. The new method assesses waters impaired for aquatic life use based upon biological monitoring to determine if the impairment was due to nutrients or other causes. Insufficient information was available to apply this method in 2012 and TP remains one of the most frequent pollutants causing use impairment.

In 2012, 138 AUs were delisted for nutrient-related parameters. One hundred, twenty-three were delisted for DO (39), Temperature (46), TP (12), or TSS (26) because applicable water quality standards were attained. Eight AUs were delisted for Temperature (4) or TP (4) because they were covered by an approved TMDL. Seven AUs were delisted for DO because they were listed incorrectly and insufficient information is available to assess water quality.

Nutrients are also suspected of being a source of water quality problems in the Barnegat Bay. The determination of the role of nutrient loading relative to designated use support and the basis to develop numeric translators for narrative nutrient criteria in the unique setting of the Barnegat

Bay are complex and challenging tasks that are part of the Governor's Barnegat Bay Action Plan to address the ecological health of the Barnegat Bay watershed. During this reporting cycle, a comprehensive water quality monitoring network was established for both fresh water and marine water quality of the Bay. Data collected will establish the baseline conditions of the Bay, provide the basis to assess these conditions against numeric standards, and to assess against narrative standards once translators are developed.

New Jersey has developed a Nutrient Criteria Enhancement Plan (Nutrient Plan) for enhancing the existing nutrient criteria for freshwaters and developing new nutrient criteria for other (estuarine, marine) waters of the State. The Barnegat Bay work is one component of this plan. Nutrient criteria (including numeric criteria and translators of narrative criteria) will be developed over time to address and prevent nutrient-related use impairment in New Jersey waters (Chapter 9). The Plan and subsequent progress reports are available on the Department's Web site at http://www.state.nj.us/dep/wms/bwqsa/nutrient_criteria.htm.

Cause Unknown

If chemical data are unavailable or show no exceedance of applicable criteria, but biological data indicate impairment, the cause of Aquatic Life Use (general or trout) non-support will be identified on the 303(d) List as "cause unknown". Where biological data indicate impairment and chemical data show exceedance(s) of applicable criteria, the chemical parameter(s) will be identified as pollutant causes and placed on the 303(d) List; "cause unknown" will be identified as a non-pollutant cause of Aquatic Life Use non-support (i.e., "pollution") on the Integrated List of Waters (Appendix A), but will not be placed on the 303(d) List. Further study may identify the cause of biological impairment as habitat alteration, hydrologic modification, and other environmental stressors, which would be addressed through measures other than a TMDL. In 2012, 25 AUs were delisted for cause unknown – 17 were delisted because AMNET or other data showed that biology was not impaired and 8 were delisted because the original listing was incorrect and there was insufficient information to assess the Aquatic Life Use.

Arsenic

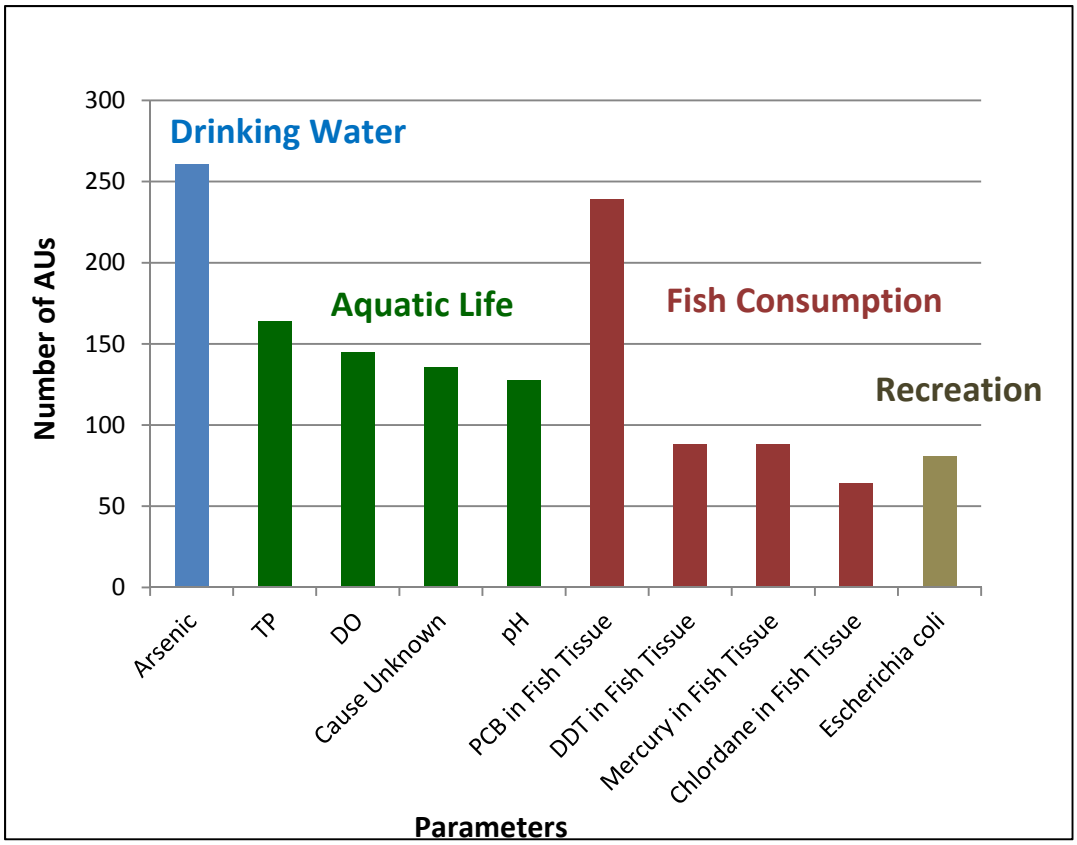
Arsenic is the most frequent pollutant on the 2012 303(d) List. While pathogens are the most frequent cause of designated use impairment, most of those waters are no longer on the 303(d) list because they are being addressed by approved TMDLs. Improved detection of arsenic at very low levels has increased the number of waters found to be exceeding applicable water quality standards for arsenic; however, recent water quality studies determined that a large number of these exceedances might actually reflect naturally-occurring levels of arsenic based on geologic conditions found in the Coastal and Outer Coastal Plains of New Jersey. The Department contracted with the United States Geological Survey (USGS) to determine the concentration of arsenic that should be attributed to natural causes. However, USEPA does not support an assessment of waters as "fully supporting" the Public Water Supply use unless documentation is provided that shows the human health criterion associated with that use has been met. This is problematic because, in New Jersey, the human health criterion for arsenic is 0.017 ug/L (total recoverable), while the New Jersey MCL for arsenic under the Safe Drinking Water Act is 5

ug/L (the federal drinking water standard is 10 ug/L). Water supply sources (both surface and ground water) with arsenic concentrations less than 5 ug/l do not require additional treatment. The levels of arsenic determined to be naturally-occurring were well below 5 ug/l, but above the SWQS for arsenic. The Department is evaluating options to address this issue in the 2014 cycle. In 2012, five AUs were delisted for Arsenic because the basis for the listing was incorrect as either data were insufficient to assess water quality or the water quality criteria were not applicable because waters were not designated for the Public Water Supply Use.

303(d) Listed Parameters

Pollutants causing impairment that are not addressed by a TMDL are identified on the 303(d) List. The 2012 303(d) List identifies 32 pollutants causing water quality impairment in one or more assessment units for a total of 1,729 listings, of which 136 were attributed to "Cause Unknown". The "top ten" most frequent pollutants are responsible for 81 percent of the 2012 303(d) List. These pollutants are shown in Figure 4.4, grouped by their associated designated uses. To simplify the graphic, Drinking Water represents the Public Water Supply Use, Aquatic Life represents the General Aquatic Life Use, and Recreation represents the Primary Contact Recreation Use.

Figure 4.4: Top 10 Pollutants on the 2012 303(d) List



4.5: Delisted Parameters

The 2012 Final Delisted Waters identifies 386 AU/pollutant combinations removed from the 303(d) List for the following reasons:

- Applicable Water Quality Standards (WQS) Attained; Original Basis For Listing Was Incorrect (110);
- Applicable WQS attained; reason for recovery unspecified (115)
- Applicable WQS attained; due to change in WQS (39)
- Applicable WQS Attained; According To New Method (21);
- Applicable WQS Attained; Due To Restoration Activities (17);
- Total Maximum Daily Load (TMDL) Approved Or Established By USEPA (39);
- Data And/Or Information Lacking To Determine Water Quality Status; Original Basis For Listing Was Incorrect (45).

Table 4.4 provides a breakdown of all the delistings by pollutant and delisting reason. A more detailed explanation of each delisting is provided in the final 2012 Justification of Delisted Waters (see Appendix C). Three of these delistings serve as the basis for a Section 319(h) "success story" for the Pequest River that was submitted to USEPA for the 2012 integrated reporting period. Monitoring data collected in NJ02040105090060-01 Pequest River below Furnace Brook between January 2006 and December 2010 demonstrated that the applicable surface water quality standards were attained for TP, TSS and pH. These documented improvements in water quality were a direct result of restoration activities funded through 319(h) grants, and were complemented by significant reductions in phosphorus concentrations discharged from sewerage treatment plants, implemented in anticipation of the Pequest River TMDL adopted by the Department in June 2011.

Table 4.4: Number of Delistings Per Pollutant

Parameter	Delisting Reason							Total # AUs Delisted
	TMDL	Insuf. Info.	WQS Attained					
		Incorrect Listing	Reason Unknown	Restoration Activity	Incorrect Listing	New Method	SWQS Changed	
Ammonia	0	0	0	0	18	0	0	**18**
Arsenic	0	1	0	0	4	0	0	**5**
Benzene	0	0	1	0	0	0	0	**1**
Cadmium	0	0	5	0	2	5	0	**12**
Cause Unknown	0	8	9	3	5	0	0	**25**
Chlordane in fish tissue	0	1	0	0	0	0	0	**1**
Chloride	0	0	0	0	4	0	0	**4**
Chromium (total)	0	0	5	0	3	0	0	**8**
Chromium, hexavalent	0	0	1	0	1	0	0	**2**
Copper	0	0	8	0	3	1	0	**12**
Cyanide	0	0	0	0	0	10	0	**10**
DDT in fish tissue	0	9	0	0	0	0	0	**9**
Enterococcus	2	0	1	0	1	0	0	**4**
E. coli	11	0	1	0	2	0	0	**14**
Fecal Coliform	0	3	0	0	0	0	0	**3**
Lead	0	0	5	0	1	1	0	**7**
Mercury in Fish Tissue	14	5	0	0	0	0	0	**19**
Mercury in Water Column	0	1	1	0	0	0	0	**2**
Nickel	0	0	5	0	0	0	0	**5**
Nitrate	0	0	2	0	0	0	0	**2**
DO	0	7	17	3	18	1	0	**46**
PCB in fish tissue	0	3	0	0	0	0	0	**3**
pH	0	6	16	1	16	2	0	**41**
TP	4	0	2	2	8	0	0	**16**
Silver	0	0	0	0	1	0	0	**1**
Sulfates	0	0	4	0	0	0	0	**4**
Temperature	4	0	2	0	5	0	39	**50**
Thallium	0	0	0	0	2	0	0	**2**
Total Coliform	3	0	0	0	0	0	0	**3**
TDS	0	1	1	3	6	0	0	**11**
TSS	0	0	19	3	4	0	0	**26**
Turbidity	1	0	3	2	6	0	0	**12**
Zinc	0	0	7	0	0	1	0	**8**
TOTALS	**39**	**45**	**115**	**17**	**110**	**21**	**39**	**386**

Chapter 5: Water Quality Management Programs

5.1: Comprehensive Water Resource Management

The Department's path forward requires that we expand on our successes, learn from past challenges, and evolve to the next generation of environmental protection. The objective is to focus on outcomes to improve the quality of life for all New Jersey residents and visitors, and the tool to do so is to organize efforts under a paradigm of comprehensive water resource management (CWRM).

Under CWRM, the Department will evaluate the water resource management issues of each region to ensure that identified problems are addressed comprehensively and holistically, with the most efficient and effective use of both regulatory and non-regulatory tools and partnerships, to achieve measureable environmental outcomes. The Department, along with its partners, has already invested significant resources in characterizing the causes of water quality impairments in several watersheds and has found that reducing nonpoint sources of pollution will be key to meeting water quality objectives in those watersheds. CWRM will also allow the Department to better address overarching issues, such as combined sewer overflows (CSOs) and improving resiliency to storm events like Superstorm Sandy, that require cross-programmatic integration of expertise and authority to implement innovative solutions like green infrastructure and living shorelines. Through this approach, the Department will be able to address stressors that affect water flow, quality, and quantity within a defined region; determine the regional priorities; and identify and implement solutions. The water quality management programs identified in this chapter all play an important role in achieving their individual and collective environmental objectives through CWRM.

5.2: Overview of Water Quality Management Programs

The New Jersey Department of Environmental Protection (Department) is dedicated to restoring, enhancing, and protecting the quality of New Jersey's water resources, as well as ensuring equitable and beneficial uses of the State's waters. The policies expressed in the federal Clean Water Act; the New Jersey Water Pollution Control Act, N.J.S.A. 58:10A-1 et seq.; the New Jersey Water Quality Planning Act, N.J.S.A. 58:11A-1 et seq.; and the New Jersey Water Supply Management Act, N.J.S.A. 58:1A-1 et seq.; provide the foundation for the environmental programs that protect New Jersey's waters. Other State laws also play important roles, including the Freshwater Wetlands Protection Act, N.J.S.A. 13:9B-1 et seq.; the Stormwater Management Act, N.J.S.A. 40:55D-93 through 99; the Watershed Protection and Management Act, N.J.S.A. 58:29-1 et seq.; the Flood Hazard Area Control Act, N.J.S.A. 58:16A-50 et seq.; the Wetlands Act of 1970, N.J.S.A. 13:9A-1 et seq.; and the Coastal Area Facility Review Act, N.J.S.A. 13:19-1 et seq.

New Jersey's Water Quality Management Programs extend beyond the traditional water pollution control programs identified in the federal guidance for the Integrated Report. New Jersey statutes require comprehensive water resource management and planning that address issues such as land use and cumulative impacts to water resources, implementation of regulatory

and non-regulatory approaches to environmental restoration, and consideration of environmental factors such as alteration of habitat, flow, substrate, climate, and tree canopy on aquatic life and other water resources.

5.3: Statewide Water Quality Management Planning Programs

The Department administers New Jersey's Statewide Water Quality Management Planning Program pursuant to the New Jersey Water Quality Planning Act (N.J.S.A. 58:11A-1 et seq.), the New Jersey Water Pollution Control Act (N.J.S.A. 58:10A-1 et seq.), and the Water Quality Management Planning rules (N.J.A.C. 7:15). The New Jersey Water Quality Planning Act (Act) was adopted in 1977 and provided the authority needed for New Jersey to implement sections 201, 208, and 303 of the federal Clean Water Act. The purpose of the Act is to restore, maintain, and preserve the quality of the waters of the State, including both surface and ground water, for the protection and preservation of the public health and welfare, food supplies, public water supplies, propagation of fish and wildlife, agricultural and industrial uses, aesthetic satisfaction, recreation, and other beneficial uses. The Act endeavors to achieve this purpose by instituting a continuing planning process that includes areawide Water Quality Management (WQM) plans, and specific measures and programs that are implemented within the Department, such as surface water quality standards and discharge permitting. Additional information about the Statewide Water Quality Management Planning Program is available on the Department's Web site at or http://www.nj.gov/dep/wqmp/.

5.4: Water Quality Standards Program

The New Jersey Water Quality Planning Act (N.J.S.A. 58:11A-1 et seq.) requires the State to maintain water quality in existing high quality waters and to restore water quality in impaired waters. The Department accomplishes this by developing and implementing Surface Water Quality Standards (SWQS) and Ground Water Quality Standards (GWQS) for New Jersey's waters pursuant to N.J.A.C. 7:9B and N.J.A.C. 7:9C, respectively. Unofficial copies of these rules are available on the Department's Web site at http://www.nj.gov/dep/rules/nj_env_law.html.

Surface Water Quality Standards (SWQS)

The SWQS establish a stream classification and an antidegradation designation for all surface waters of the State. The stream classifications reflect the designated uses assigned to individual surface waterbodies. Designated uses include aquatic life support (maintenance, migration, and propagation), recreation, fish consumption, shellfish harvesting for consumption, drinking water supply, industrial water supply, and agricultural water supply. The SWQS specify the water quality criteria that correspond with the waterbody classifications, which are necessary to achieve the designated uses. The antidegradation designation specifies to what degree a lowering of water quality may be authorized for a new or expanded activity. There are three antidegradation designations in the SWQS: Outstanding Natural Resource Waters (the most protective antidegradation designation), Category One Waters, and Category Two Waters. Additional

information about surface water classifications and applicable criteria and policies is available on the Department's Web site at http://www.state.nj.us/dep/wms/bwqsa/swqs.htm.

Ground Water Quality Standards

The Ground Water Quality Standards (GWQS) establish ground water classifications and antidegradation policies for all ground waters of the State. The GWQS specify the water quality criteria and designated uses for ground water in New Jersey. The criteria are numeric values assigned to ground water constituents (i.e., pollutants) and implemented to protect the ambient ground water quality and associated designated uses. The GWQS also contain technical and general policies to ensure that the designated uses are protected.

Under the GWQS, ground water is classified according to its hydrogeologic characteristics and designated uses. Ground water within watersheds of FW1 surface waters, state-owned Natural Areas, and the major aquifers of the Pinelands Region, are designated as Class I ground waters**.** The designated use for Class I ground waters is the maintenance of special ecological resources. Secondary uses include potable, agricultural, and industrial water supply. The designated use of Class II ground waters is to provide potable water supplies using conventional treatment. Both existing and potential potable water supply uses are included. Class II criteria specify the levels of constituents above which the water would pose an unacceptable risk for drinking water. Class II includes all areas that are not designated as Class I or Class III. Class III ground waters can be used for anything other than potable water. Most ground waters of the State fall under the Class II-A designation, whose primary designated use is potable water supply and conversion to potable water supply.

The GWQS serve as the basis for setting ground water discharge standards under the NJPDES Discharge to Ground Water Permit Program (see Chapter 5, Section 5.4), and for establishing remediation standards for ground water cleanups under the Site Remediation Program. Other relevant programs using the GWQS include, but are not limited to, those implemented pursuant to the Spill Compensation and Control Act, Solid Waste Management Act, Industrial Site Recovery Act, Underground Storage of Hazardous Substances Act, Realty Improvement Sewerage and Facilities Act, and Pesticide Control Act of 1971. Additional information about the Ground Water Quality Standards is available on the Department's Web site at http://www.state.nj.us/dep/wms/bwqsa/gwqs.htm.

More information:

The Department has also developed an electronic compendium of standards for water and soil used by the Department's regulatory programs to establish site-specific requirements in accordance with the appropriate regulations. This compendium is available on the Department's Web site at http://www.nj.gov/dep/standards/ and is for informational purposes only.

5.5: Water Pollution Control Programs

The discharge of pollutants to waters of the State is regulated by the Department under the authority of the New Jersey Water Pollution Control Act (WPCA), N.J.S.A. 58:10A. The WPCA specifies, "No person shall discharge any pollutant except in conformity with a valid NJPDES permit." The Department implements the New Jersey Pollutant Discharge Elimination System (NJPDES) Program pursuant to the NJPDES regulations at N.J.A.C. 7:14A. The NJPDES Program protects New Jersey's ground and surface water quality by assuring the proper treatment and discharge of wastewater (and its residuals) and stormwater from various types of facilities and activities.

Discharge to Surface Water Permits

The Department regulates the discharge of treated effluent from various municipal and industrial facilities directly into a river, stream, or the ocean under the NJPDES Program. These facilities operate under the authority of a NJPDES permit which limits the mass and/or concentration of pollutants discharged. The NJPDES permit program is operated under the additional authority of the federal Clean Water Act delegated to New Jersey by USEPA to implement the National Pollutant Discharge Elimination System (NPDES). Permittees include various industries; federal, state, county, and municipal facilities; private companies; private residential developments; hospitals; and schools. Additional information about surface water discharge permits is available on the Department's Web site at http://www.nj.gov/dep/dwq/sw.htm.

Discharge to Ground Water Permits

The Department regulates facilities that discharge sanitary and industrial wastewater to ground water. The pollution control requirements contained in NJPDES discharge to ground water (DGW) permits are those conditions necessary to restrict the discharge of pollutants to ground waters of the State and to protect the public health and the environment. The types of discharge activities that are regulated include surface impoundments, infiltration/percolation lagoons, overland flow systems, spray irrigation systems, and various types of subsurface disposal systems that are classified as underground injection systems. The types of facilities regulated include: mines, pits and quarries; schools and hospitals; potable water treatment plants; large corporate office buildings; industrial manufacturing facilities; campgrounds and mobile home parks; food processors; and sewage treatment plants and other discharges of wastewater that can impact ground water, including the management of dredged materials at upland locations. Additional information about the NJPDES DGW Permit Program is available on the Department's Web site at www.state.nj.us/dep/dwq/dgw_home.htm.

Stormwater Permits

The Stormwater Permitting Program was mandated by Congress in the 1987 amendments to the federal Clean Water Act under Section 402(p). Consistent with the corresponding federal regulations, New Jersey's Stormwater Permitting Program is divided into two sections: Industrial Stormwater Permitting ("Phase I") and Municipal Stormwater Regulation ("Phase II"). Both

programs emphasize pollution prevention techniques and source control rather than "end-of-pipe" treatment. The program is implemented through the issuance of individual permits and general permits. These stormwater permits rely primarily on pollution prevention and reasonable and cost effective best management practices (BMPs) that eliminate or minimize the contact between source materials and stormwater, preventing pollution and saving industry money by reducing inventory and material losses.

Additional information about the Stormwater Permitting Program is available on the Department's Web site at http://www.nj.gov/dep/dwq/bnpc_home.htm and the Flood Hazard Control Act is located at http://www.nj.gov/dep/landuse/lawsrules/fhacar_index.html.

Stormwater Management

The Stormwater Management rules (N.J.A.C. 7:8) provide the basis for municipalities to develop stormwater management plans and specify stormwater management standards that are mandatory for new major development. The New Jersey Stormwater Best Management Practices Manual (BMP manual) has been developed to provide guidance to review agencies and the regulated community on complying with the standards in the Stormwater Management rules.

The Stormwater Management rules also establish performance standards for ground water recharge to increase the integrity of the State's aquifers and protect dry weather base flow in streams. The rules require that 100 percent of the average annual ground water recharge be maintained for new development projects, to help mitigate future droughts and flooding. For the most part, these requirements are waived in urban areas. In addition to recharge standards, the rules promote smart growth techniques by requiring consideration of non-structural design methods for stormwater management. These include maintaining natural vegetation, reducing unnecessary loss of trees, minimizing existing drainage surfaces, preventing large contiguous areas of impervious surfaces, and maintaining existing drainage characteristics and patterns. Consideration of these techniques will require that stormwater management be considered early in the project design and not as a secondary concern. Once nonstructural measures have been fully integrated into the site design, any remaining water quality concerns must be addressed through the use of best management practices to reduce runoff of total suspended solids (TSS) by 80 percent and other pollutants up to the maximum extent feasible.

Riparian buffers are acknowledged as an effective BMP and receive protection under the Stormwater Management rules at N.J.A.C. 7:8 special water resource protection area requirement around Category One (C1) waterbodies and their intermittent and perennial tributaries, within the HUC 14 subwatershed. Moreover, the New Jersey Flood Hazard Area Control Act Rules N.J.A.C. 7:13 require a 300-foot buffer or riparian zone for all "regulated activities" within the 300-foot riparian zone that is adjacent to designated C1 waters and upstream tributaries within the same HUC 14 subwatershed.

The Stormwater Management Rules are currently implemented through the Residential Site Improvement Standards (RSIS) and the Department's Division of Land Use Regulation (DLUR) in the review of permits such as freshwater wetlands, stream encroachment, CAFRA, Waterfront

Development, and through the NJPDES rules for the Municipal Stormwater Regulation Program. Additional information about the Stormwater Management rules and BMP Manual is available on the Department's Web site at http://www.nj.gov/dep/stormwater/.

Green Infrastructure

Traditional stormwater infrastructure design focuses on collecting and conveying rainwater off-site to ultimately be discharged into a downstream waterway. Green infrastructure mimics natural processes utilizing soils and vegetation to manage rainwater where it falls by allowing it to infiltrate into the soils, be taken up by plants, or stored for re-use as irrigation. USEPA strongly promotes the use of green infrastructure as a best management practice to address stormwater runoff. Likewise, the Department supports the use of green infrastructure as a preferred method of stormwater management. Green infrastructure GI strategies reduce runoff volume by allowing rainfall to infiltrate into the soil where it can be used by plants or where it can recharge aquifers and stream base flow. Another way to reduce volume is to capture the rainfall in manufactured structures like rain barrels or cisterns where it is stored until it can be reused; however, the use of this stored water is limited to non-potable uses, such as irrigation.. Green infrastructure encourages the idea that stormwater is a resource that can be reused, rather than simply conveyed elsewhere. A comprehensive list of the Department's recommended green stormwater practices and completed projects is available on the Department's Web site at http://www.nj.gov/dep/gi/.

Residuals, Biosolids, Sewage Sludge

Residuals are generated by both domestic treatment plants (sewage sludge) and industrial treatment plants (industrial residuals). Residuals are managed in a variety of ways, including the development of Marketable Residuals Products (often referred to as biosolids) used to fertilize or condition the soil. Examples include pellets, compost, and alkaline materials. Residuals are also incinerated in New Jersey and managed in a variety of ways at out-of-state facilities. Beneficial use of residuals as a fertilizer or soil conditioner is regulated under a NJPDES permit. Incineration of residuals is regulated under New Jersey's Air Pollution Control Program (see the Department's Web site at http://www.nj.gov/dep/aqpp/). Residuals managed in other states are regulated by the receiving state.

The Department oversees the Statewide Sludge Management Plan (a component of the Statewide Solid Waste Management Plan) and reviews and approves long-term generator residuals management plans. Through the implementation of the Sludge Quality Assurance Regulations (N.J.A.C. 7:14C), residuals generators must test their residuals and report the results to the Department on a regular basis. This data is available to assure compliance with the appropriate residuals management criteria in much the same way that the surface water program uses effluent data to assure compliance with wastewater discharge requirements. Additional information about residuals management is available on the Department's Web site at http://www.state.nj.us/dep/dwq/sludge.htm.

Significant Industrial Users

Some industrial dischargers do not discharge their wastewater directly into a surface waterbody like a stream or river, but rather discharge into a sanitary sewer system or publicly-owned treatment works (POTW). The wastewater is conveyed to a local agency's treatment plant where it is treated and usually discharged into a river or stream. These dischargers are known as "indirect users." Although not all indirect users require individual NJPDES permits, all must comply with at least minimum regulatory requirements under N.J.A.C. 7:14A-21.2, as well as the rules and regulations or sewer use ordinance of the local agency. When this type of discharge meets one or more specific criteria, the discharger becomes a significant indirect user (SIU), and requires a permit. The criteria include discharging from specific operations, discharging high strength or high volume wastewaters, being subject to Federal Categorical Pretreatment Standards, and failure to comply with regulatory requirements under N.J.A.C. 7:14A-21.2. The Division of Water Quality's Bureau of Pretreatment and Residuals is responsible for issuing permits for SIUs discharging to POTWs.

The Department may grant "delegated" status to a local agency that demonstrates to the Department that it has the legal authority, procedures, and resources to adequately administer an SIU permitting program, as required under the Federal General Pretreatment Regulations (40 CFR Part 403) and NJPDES regulations. Such a program requires setting appropriate discharge limits for SIUs, enforcing those limits to ensure compliance, conducting site inspections, and performing sampling of the regulated SIUs. Once a pretreatment program has been delegated to a local agency, SIU permits are no longer issued by the Department in that service area. Additional information about pretreatment program requirements is available on the Department's Web site at http://www.nj.gov/dep/rules. Additional information about SIUs is available on the Department's Web site at http://www.state.nj.us/dep/dwq/sius.htm.

Combined Sewer Overflow Program

Combined Sewer Systems (CSSs) are wastewater collection systems designed to carry sanitary sewage, industrial and commercial wastewater, and stormwater runoff in a single system of pipes to a publicly owned treatment works (POTW). During periods of rainfall or snowmelt, the total wastewater flows entering the collection system can exceed the capacity of the system or the treatment facility. Under such conditions, CSSs are designed to overflow at predetermined Combined Sewer Overflow (CSO) Points and result in discharges of excess wastewater flows, known as Combined Sewer Overflows (CSOs), directly to surface waterbodies such as rivers, estuaries, and coastal waters.

CSO discharges contain raw sewage consisting of a combination of untreated human waste and pollutants discharged by commercial and industrial establishments. CSOs also have a significant stormwater component that includes pollutants from urban and rural runoff. The pathogens, solids, and toxic pollutants carried by CSOs may be discharged directly to the waters of the state during wet weather events. CSOs are a human health concern because they can create the potential for exposure to disease-causing pathogens including protozoa, bacteria, and viruses. Exposure to CSO contaminants through swimming or other contact can lead to infectious

diseases such as hepatitis, gastrointestinal disorders, dysentery, and swimmer's ear infection. Other forms of bacteria can cause typhoid and cholera. Human health can also be affected by ingesting fish or shellfish contaminated by CSO discharges.

CSOs are point sources subject to federal NPDES permit requirements, including both technology-based and water quality-based requirements of the federal Clean Water Act. The National Combined Sewer Overflow Control Policy (National Policy) requires CSO permittees to develop Combined Sewer Overflow Long Term Control Plans (CSO-LTCPs) that include the evaluation of alternatives for attaining compliance with the Clean Water Act, including compliance with surface water quality standards and protection of designated uses of waters of the state.

The Department is implementing a Statewide Combined Sewer Overflow Control Strategy consistent with the National Policy. As a first step, New Jersey has required its owners and operators of CSSs to develop and implement the Nine Minimum Control Measures (NMCs), specified in the National Policy. NMCs are actions or measures that can reduce CSO discharges and their effect on receiving water quality. New Jersey requires all CSO Permittees to capture and remove solids and floatables above a certain size at every CSO Point. As of March 2013, 93 percent of the planned solids and floatables control facilities have been constructed and are operating. It is estimated that New Jersey's CSO Solids/Floatables Control Facilities currently capture, remove, or otherwise prevent the discharge of over 700 tons of solids and floatables materials per year. Additionally, over 60 CSO Points were eliminated since the onset of the program. The Department is currently moving forward with the first round of draft permits, which were issued in April 2013. Additional information on New Jersey's CSO Program is available on the Department's Web site at http://www.nj.gov/dep/dwq/cso.htm.

5.6 Nonpoint Source Pollution Control Programs

Nonpoint source (NPS) pollution is caused by precipitation moving over and through the land and carrying natural and synthetic pollutants into surface and ground water. The significance of NPS loadings can vary widely depending upon the watershed and the pollutant. NPS pollution is diffuse in origin, can emanate from anywhere in the watershed and is significantly associated with human activity. It is also not generally subject to regulatory controls. NPS pollution may include chemicals and pathogens carried into streams by rainfall, such as oil and grease from roadways and parking lots; fertilizers from lawns, golf courses, and agricultural fields; and bacteria from improperly maintained septic systems, pet waste, and large congregations of waterfowl. However, NPS pollution can also include impacts not typically thought of as pollution, such as increased water temperature resulting from the clearing of streamside vegetation, or significant changes in the hydrology of the stream resulting from either increased stormwater runoff, which can erode the stream bed and banks, or the loss of water in the stream during dry weather resulting from the loss of recharge in a watershed under development and/or increased water withdrawals within a water supply watershed.

The federal government recognizes that nonpoint sources of pollution are difficult to control through regulation and provides funds for pass through grants to effect NPS reductions under

Section 319(h) of the federal Clean Water Act. The Department administers this pass-through grant program and has awarded millions of dollars to grant recipients for this purpose. The accomplishments of the 319(h) grant program are tracked through USEPA's Grant Reporting Tracking System (GRTS), which is available on USEPA's Web site at http://iaspub.epa.gov/apex/grts/f?p=110:199. Additional information about the Department's NPS Program, including the State of New Jersey Nonpoint Source Report annual updates, is available on the Department's Web site at http://www.nj.gov/dep/watershedrestoration/nps.html and at http://www.state.nj.us/dep/wms/bear/319_grant_program.htm.

Coastal Nonpoint Source Pollution Control Program

The Coastal Nonpoint Source Pollution Control Program (Section 6217 of the Coastal Zone Act Reauthorization Amendments of 1990) addresses NPS pollution in coastal waters. This program is administered jointly by the US Environmental Protection Agency (USEPA) and the National Oceanic and Atmospheric Administration (NOAA). Section 6217 requires the 29 states and territories with approved Coastal Zone Management Programs to develop Coastal Nonpoint Pollution Control Programs (CNPCP). A CNPCP describes how a state will implement NPS BMPs to reduce pollution associated with several sources such as forestry practices, urban development, marinas and boating activities, hydromodification, and others. The Department has an approved CNPCP, a description of which may be found at http://www.state.nj.us/dep/cmp/czm_cnpp.html.

Floatables Control

The Department administers both the Adopt-A-Beach and Clean Shores Programs to address coastal debris. The Clean Shores Program uses inmates from state correctional facilities to remove wood and garbage from tidal shorelines. Cleaning up these wastes helps prevent the deleterious effects of marine debris upon recreational ocean bathing beaches and the coastal environment. Since its inception in 1989, the total amount of wastes removed from New Jersey beaches under this program exceeds 125 million pounds. The program is funded entirely from the sale of "Shore to Please" shore protection license plates. The sponsoring municipalities and state/federal parks provide support to the program and lay out the initial costs of the cleanup. The Clean Shores program in turn reimburses the sponsors for the cost of waste disposal and contracted services incurred during cleanup activities. The program is also responsible for building dune fencing and planting dune grass in several oceanfront communities and one state park. In an average year, cleanups are carried out with the cooperation of more than 45 municipalities, seven county agencies, two state parks, one federal park, and the Department of Corrections.

In 2010, the Clean Shores Program won the U.S. Environmental Protection Agency's Environmental Quality Award for demonstrating an outstanding commitment to protecting and enhancing environmental quality and public health. Additional information about the Clean Shores Program is available on the Department's Web site at http://www.nj.gov/dep/bmw/cleanshores/csindex.html.

The Adopt-A-Beach program fosters volunteer stewardship of the State's coastal beaches to reduce the threat of marine debris to marine fish and wildlife. The Department partners with the New Jersey Clean Communities Council and Clean Ocean Action to conduct the twice-a-year program. Participants are encouraged to adopt one of New Jersey's ocean beaches and become responsible for cleaning up debris and floatables that wash up on the shore. Since 1993, Adopt-A-Beach volunteers have been cleaning up litter and debris from about 60 beaches statewide. The cleanup results are forwarded to our national partner the Ocean Conservancy for analysis and inclusion in national and international marine debris databases. The results are used to gauge the type of education and outreach activities needed to change public attitudes and behavior about litter and the importance of keeping our waterways clean. Adopt-A-Beach volunteers have removed over 50,000 pounds of trash since 2004 that would have otherwise become pollution in our coastal waters. Additional information about the Adopt-A-Beach Program is available on the Department's Web site at www.state.nj.us/dep//seeds/aabeach.htm.

Agricultural Nonpoint Source Pollution Control Program

The Department continues to foster a partnership with the New Jersey Department of Agriculture (NJDA), the United States Department of Agriculture - Natural Resources Conservation Service (USDA-NRCS), and other agricultural organizations to achieve New Jersey's water quality goals. In some of New Jersey's more rural watersheds, agricultural land uses are the major nonpoint source of pathogens and nutrients. Implementing best management and conservation practices on agricultural lands is an important component of New Jersey's nonpoint source pollution control strategy because it will improve water quality, conserve water and energy, prevent soil erosion, and reduce the use of nutrients and pesticides. The following are conservation programs that address nonpoint source pollution from agricultural activities. These programs are described in more detail in the Department's "State of New Jersey Nonpoint Source Report" available at http://www.nj.gov/dep/watershedrestoration/nps.html.

Farm Security and Rural Investment Act (Farm Bill) Funding Programs

The USDA-NRCS provides technical and financial assistance to help farmers, ranchers, and forest landowners conserve soil, water, air, and other natural resources. All programs are voluntary and offer science-based solutions that benefit both the landowner and the environment. NRCS provides conservation technical assistance (CTA) through their staff at NRCS Field Offices and through NRCS-certified Technical Service Providers, in cooperation with New Jersey's fifteen Soil Conservation Districts and the New Jersey Association of Conservation Districts. Other key partners include the NJDA, Rutgers University, and other State and Federal Agencies. New Jersey receives funds under the Farm Bill that are administered through the following USDA voluntary programs for eligible New Jersey landowners and agricultural producers (see descriptions below).

Statewide Agricultural Nonpoint Source Pollution Control Funding Programs:

- Agricultural Management Assistance (AMA): provides cost share assistance to voluntarily address issues such as water management, water quality and erosion control.

- Agricultural Water Enhancement Program (AWEP): provides financial and technical assistance to agricultural producers in approved watersheds.

- Environmental Quality Incentives Program (EQIP): provides financial assistance for permanent measures or management strategies that address existing resource concerns.

- Grassland Reserve Program (GRP): offers private landowners the opportunity to protect, restore, and enhance grasslands on their property.

- Farm and Ranch Lands Protection Program (FRPP): provides matching funds to purchase conservation easements to keep productive farmland in agricultural uses.

- Wildlife Habitat Incentives Program (WHIP): provides financial assistance to create, enhance, or maintain five priority wildlife habitat types on nonfederal lands. Creation or improvement of wildlife habitat is generally as effective as buffers at controlling nonpoint source pollution.

- Wetlands Reserve Program (WRP): provides technical and financial assistance to enhance wetlands in exchange for retiring marginal land from agriculture.

- Conservation Security Program (CSP): rewards farmers who have demonstrated high levels of conservation and management on their farms by protecting soil and water quality.

- Conservation Effects Assessment Project (CEAP): a national effort through which the NRCS works with the Department and other partners to monitor and quantify the effects and benefits of conservation practices.

Additional information about USDA-NRCS programs is available on the USDA Web site at http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/.

Farm Service Agency (FSA) Programs

NRCS provides technical assistance to applicants and contract holders working with the FSA Programs, which include the following:

Conservation Reserve Program (CRP): USDA's largest environmental improvement program on private lands allows producers to retire highly erodible or marginal cropland or pastureland and receive rental payments as well as financial assistance to convert the land to grass or trees. Cost-sharing is provided to cover part of the cost to establish conservation measures on the land. This

may include re-establishing native or perennial grasses, planting trees or fencing animals out of streams. Incentive payments are offered in some cases to encourage participation and to protect highly sensitive land surrounding waterways.

Conservation Reserve Enhancement Program (CREP): The New Jersey Departments of Environmental Protection and Agriculture, in partnership with the Farm Service Agency and Natural Resources Conservation Service, signed a $100 million CREP agreement in 2004 to help farmers reduce nonpoint source pollution caused by agricultural runoff in an effort to improve water quality in New Jersey. Under NJCREP, farmers receive financial incentives from the FSA and the NJDA to voluntarily remove marginal pastureland or cropland from agricultural production and convert the land to native grasses, trees and other vegetation. The vegetation can then serve as a buffer to filter or contain agricultural runoff and prevent polluted stormwater runoff generated by farms from reaching neighboring waterbodies.

Through this program, $23 million of State money was matched with $77 million from the Commodity Credit Corporation within USDA. Through CREP, financial incentives are offered for agricultural landowners to voluntarily implement conservation practices on agricultural lands. NJ CREP is part of the USDA's Conservation Reserve Program (CRP). There will be a ten-year enrollment period, with CREP leases ranging between 10-15 years. The enrollment of farmland into CREP in New Jersey is expected to improve stream health through the installation of water quality conservation practices on New Jersey farmland. As of June 19, 2013, there are 192 New Jersey CREP contracts, totaling 703.8 acres with significant potential for future enrollment to achieve nutrient and TSS reductions. Additional information on these and other FSA programs is available on the FSA Web site at http://www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=landing.

Soil Erosion and Sediment Control Act Implementation

The New Jersey Soil Erosion and Sediment Control Act, P.L. 1975, c.251, otherwise known as "Chapter 251" (NJSA 4:24-39 et seq.), is administered by the State's 15 Soil Conservation Districts (SCDs) and overseen by the NJDA to minimize soil erosion from construction sites, reduce nonpoint source pollution from sediment, and enhance water quality and stormwater quality. Conservation practices such as stormwater inlet protection, silt fencing, stabilized construction access, and temporary soil stabilization are just a few of many measures that help reduce soil erosion on active construction sites. The SCDs review development and site plans and to ensure that they are in compliance with standards established by the State Soil Conservation Committee pursuant to Chapter 251. SCDs also conduct a detailed review of Requests for Authorization (RfAs) to discharge stormwater from a developed site, which include stormwater management runoff designs that ensure runoff will not contribute to long-term water quality degradation in the receiving waters. SCD staff routinely inspect active constructions sites to make sure the soil erosion and sediment control measures are carried out in the correct construction sequence on the site. SCD inspectors also perform final site inspections once construction is finished, to ensure that the site has been properly and permanently stabilized. Additional information about Chapter 251 and New Jersey SCDs is available on the NJDA Web site at http://www.nj.gov/agriculture/divisions/anr/nrc/conservdistricts.html.

5.7: Total Maximum Daily Load Program

Total Maximum Daily Loads (TMDLs) represent the assimilative or carrying capacity of the receiving waterbody taking into consideration point and nonpoint sources of pollution, natural background water quality, and surface water withdrawals. A TMDL identifies the sources (point and nonpoint) contributing a pollutant of concern and sets load reductions needed to meet surface water quality standards. Section 303(d) of the federal Clean Water Act requires TMDLs to be developed for the pollutant(s) of concern in waterbodies that cannot meet surface water quality standards after the implementation of technology-based effluent limitations. In each assessment cycle, the Department identifies those TMDLs that are a priority for completing prior to the next cycle. The Department has prioritized a subset of the 1,729 AU/pollutant combinations on the 2012 303(d) List for TMDL development within the next two years (see Appendix D). Appendix J identifies TMDLs completed during the 2010 – 2012 cycle. Additional information about New Jersey's TMDL Program is available on the Department's Web site at http://www.state.nj.us/dep/wms/bear/tmdls.html.

5.8: Coastal Management Program

Concerted coastal management efforts began in New Jersey in 1970 with the passage of the Wetlands Act of 1970, N.J.S.A. 13:9A, followed by the Coastal Area Facility Review Act (CAFRA), N.J.S.A. 13:19, in 1973. In response to the 1972 passage of the federal Coastal Zone Management Act, New Jersey developed and gained federal approval of the New Jersey Coastal Management Program, which addresses the complex coastal ecosystem as a whole. The Coastal Management Program defines goals and standards for the purpose of integrating protection and enhancement of natural resources, appropriate land use and development, and public access to, and use of, New Jersey's coastal resources. The program, which was first approved in 1978, brings together the above laws as well as the Waterfront Development Law, the Freshwater Wetlands Protection Act, the Public Trust Doctrine for access to, and use of, state-owned tidelands, and the regulatory activities of the New Jersey Meadowlands Commission. These laws establish a set of over-arching policies that guide implementation of the New Jersey Coastal Management Program.

A primary mission of the Coastal Management Program is ensuring that coastal resources and ecosystems are conserved as a vital aspect of local, state, and federal efforts to enhance sustainable coastal communities. The coastal zone boundary of New Jersey encompasses the CAFRA Area and the New Jersey Meadowlands District. It also includes coastal waters to the limit of tidal influence, including the Atlantic Ocean (to the limit of New Jersey's seaward jurisdiction); Upper New York Bay, Newark Bay, Raritan Bay and the Arthur Kill; the Hudson, Raritan, Passaic, and Hackensack Rivers, and the tidal portions of the tributaries to these bays and rivers. The Delaware River and Bay, and other tidal streams of the Coastal Plain, are also in the coastal zone, as is a narrow band of adjacent uplands in the Waterfront Development Area outside of the CAFRA Area. Through the Coastal Management Program, the Department manages the State's diverse coastal zone, which includes portions of 17 counties and 245 municipalities. Additional information about New Jersey's Coastal Management Program, as

well as the Assessment and the Strategy, are available on the Department's Web site at http://www.nj.gov/dep/cmp.

5.9: New Jersey Environmental Infrastructure Trust Financing Program

The 1987 amendments to the federal Clean Water Act required states to establish a Clean Water State Revolving Fund (CWSRF) to provide financial assistance for the construction of projects that protect, maintain, and improve water quality. New Jersey's CWSRF program is included in the New Jersey Environmental Infrastructure Financing Program (NJEIFP), a revolving loan program that offers low-cost financing to local government agencies and private water purveyors for the construction of wastewater and drinking water infrastructure, landfill construction and closure, and stormwater management and nonpoint source pollution control projects.

In federal fiscal year 2010, CWSRFs were required to add provisions promoting "green" technologies and establishing a Green Project Reserve (GPR). The GPR provision of the federal budget generally requires States to reserve not less than 20% of the annual federal allocation for CWSRF capitalization grants to address green infrastructure, water or energy efficiency improvements, or other environmentally innovative activities. Projects meeting GPR criteria are subject to all SRF program requirements.

5.10: Land Acquisition for Water Quality Protection

New Jersey has long recognized the importance of protecting headwater areas of rivers, streams, lakes reservoirs, wetlands and associated buffers and coastal waters safeguards our water supplies and other natural resources, and provided outdoor recreational opportunities. These lands protect ecological resources and water quality, provide water-based recreational opportunities, and serve as linear open space linkages. Land acquisition financed through the NJEIFP must demonstrate a water quality benefit. Preserving open space safeguards water supplies and other natural resources. The NJEIFP works closely with the Green Acres Program to maximize a community's limited funds for land acquisition. Public Law 2002, Chapter 76, directs the Green Acres State Land Acquisition Program to prioritize land for acquisition for the protection of water resources and flood prone areas. As a result of this legislation, Green Acres has revised the ranking system used to evaluate state land projects based on water resource features, biodiversity, and other relevant factors. The Department has awarded over 96.8 million in loans for 25 land acquisition projects from 2001 through 2012, contributing to the acquisition of over 4500 acres of land. Additional information about Clean Water Financing for open space preservation is available on the Department's Web site at http://www.state.nj.us/dep/dwq/cwpl.htm and http://www.nj.gov/dep/greenacres/.

Green Acres Program

The Green Acres Program was created in 1961 to meet New Jersey's growing recreational and conservation needs. As the principal land acquisition agent for the Department, Green Acres acquires land for state parks, forests, natural areas, and wildlife management areas. The Program also provides matching grants and low interest (two percent) loans to municipal and county

governments, and matching grants to nonprofit organizations to acquire open space and develop outdoor recreational facilities. To date Green Acres has protected more than 673,173 acres of open space and developed hundreds of parks, bringing the statewide system of preserved open space and farmland to more than 1.47 million acres. While the protection of water resources through land preservation has been a goal of Green Acres since its inception, the legislation further focuses Green Acres preservation efforts on lands that protect important water resources. Additional information about New Jersey's Green Acres Program is available on the Department's website at: http://www.nj.gov/dep/greenacres/.

Acquiring available, ecologically sensitive lands along the Barnegat Bay and its tributaries is Action Item 5 from the Governor's ten point action plan as it is a cost-effective and critical measure to further prevent degradation to the Bay's water and ecological quality. Green Acres has acquired over 3,350 acres in the Barnegat Bay watershed alone since 2011. Many of the land acquisitions include additions to State wildlife management areas. Continuing actions include targeting and additional 1,015 acres in the watershed for future acquisition.

5.11: Source Water Assessment

The 1996 Amendments to the Safe Drinking Water Act required all states to establish a Source Water Assessment Program (SWAP). The purpose of SWAP is to provide for the protection and benefit of public water systems and to increase public awareness and involvement in protecting the sources of public drinking water. New Jersey's SWAP Plan incorporates the following four fundamental steps:

1. Determine the source water assessment area of each ground and surface water source of public drinking water.
2. Inventory the potential contamination sources within the source water assessment area.
3. Determine the public water system sources' susceptibility to regulated contaminants.
4. Incorporate public education and participation.

Source water assessments provide the foundation for source water protection. Source water protection focuses on preserving and protecting the public drinking water source, particularly from the contaminants to which the source is most vulnerable, as identified in the source water assessments. The information developed from the SWAP provides communities with the tools necessary to begin protecting their valuable drinking water source. Additional information about the Source Water Assessment Program is available on the Department's Web site at http://www.nj.gov/dep/swap/index.html.

5.11: Water Education and Outreach

In recognition that some water pollution problems, such as nonpoint source pollution, require approaches other than the traditional regulatory approach (i.e., discharge permits with numeric effluent limitations), the Department administers a cadre of non-regulatory programs and initiatives for water quality restoration, protection, and enhancement; however, some of the Department's water pollution control programs also employ non-regulatory elements, such as

education and outreach, either in lieu of, or in tandem with, other permit requirements. The Department also administers a number of water-focused public education and outreach programs.

- The New Jersey Watershed Ambassadors Program is an environmentally-oriented AmeriCorps program that places a trained Watershed Ambassador in each of New Jersey's twenty watershed management areas. These Ambassadors work with and train local volunteers to monitor local rivers using state and federally-approved visual and biological monitoring techniques. They also provide information and education on watershed stewardship through presentations, training, and partnership events at community organizations and schools. Additional information is available on the Department's Web site at http://www.nj.gov/dep/wms/bear/americorps.htm and the AmeriCorps Web site at http://www.nationalservice.gov/programs/americorps/americorps20.

- The *Clean Water Raingers* publications offer educators free teaching materials and other resources for their students as well as background information on watersheds and nonpoint source pollution.

- **"**Project WET" (Water Education for Teachers at http://www.projectwet.org/) is an international program that offers teachers a better understanding of the world's water resources through hands-on, multi-disciplinary lessons. Through teacher workshops on multiple curriculum activity guides related to water resources, NJ Project WET teaches about the importance and value of water in our everyday life while offering specialized programs about New Jersey's water resources and watersheds.

- The Urban Watershed Education Program educates young students living in New Jersey's urban estuaries about the hazards of eating contaminated fish and helps them to enjoy and respect their local water resources by focusing on healthier fishing and shellfishing alternatives in their community. This intensive four-day program gives students the opportunity to experience their local waters first-hand through storm drain marking, water monitoring, aquatic biology, and fishing activities. (See http://www.state.nj.us/dep/dsr/urbanfishing/ for more information.)

- Clean Water NJ is aimed at reducing nonpoint source pollution carried by stormwater runoff by encouraging New Jersey citizens to change behavior that results in water pollution. The campaign includes television commercials, radio ads, posters, a Web site, and educational brochures. The Clean Water NJ Web site (www.cleanwaternj.org) provides information to the general public about "stormwater pollution" and what citizens can do to help reduce it in their homes, cars, and communities. The Web site also provides links to educational resources for teachers and for the general public.

- "SEEDS" is the Department's nationally acclaimed Web site, the "State Environmental Education Directory", which provides educational materials and links to additional educational resources on many environmental topics, including water pollution, conservation, and stewardship. Additional information about SEEDS is available on the Department's Web site at http://www.nj.gov/dep/seeds.

5.13: Regional Water Quality Initiatives

One of the Department's top priorities is comprehensive regional environmental management. The following regional initiatives support the Department's regional focus on water quality protection under the current CWRM approach:

- **Highlands Region Water Resource Protection Program:** The purpose of the Highlands Water Protection and Planning Act (Highlands Act) is to preserve an essential source of clean and plentiful drinking water for one-half of the State's population, and to protect the State's great diversity of natural resources. The Highlands Act establishes a Highlands Preservation Area (Preservation Area) and a Highlands Planning Area (Planning Area), each of roughly 400,000 acres. Additional information about the Highlands Act and its implementation is available on the Department's Web site at http://www.nj.gov/dep/highlands/.

- **Pinelands Protection Program:** The Pinelands National Reserve (PNR) was created by Congress under the National Parks and Recreation Act of 1978. The PNR is the first National Reserve in the nation. The PNR encompasses approximately 1.1 million acres covering portions of seven counties and all or parts of 56 municipalities. The Pinelands Preserve occupies 22% of New Jersey's land area. It is the largest body of open space on the Mid-Atlantic seaboard between Richmond and Boston and is underlain by aquifers containing 17 trillion gallons of some of the purest water in the land. The Pinelands Comprehensive Management Plan sets forth the regulations and standards designed to promote orderly development of the Pinelands so as to preserve and protect the region's significant and unique ecology and natural resources. The Plan is administered by the New Jersey Pinelands Commission. Additional information is available on the Pinelands Commission Web site at http://www.state.nj.us/pinelands/index.shtml.

- **New Jersey Meadowlands:** Also known as the Hackensack Meadowlands, the New Jersey Meadowlands is the largest system of wetlands in New York/New Jersey Harbor Estuary. It contains the largest (8,400 acres) remaining brackish wetland complex in the New York - New Jersey Harbor Estuary. The New Jersey Meadowlands stretch along the terminus of the Hackensack and Passaic Rivers as they flow into Newark Bay, encompassing a range of aquatic ecosystems including fresh water, brackish, and saltwater environments. The New Jersey Meadowlands Commission (NJMC) is the zoning and planning agency for a 30.4square-mile area of the Meadowlands complex, covering parts of 14 municipalities in Bergen and Hudson Counties. Additional information about the NJMC is available on the Commission's Web site at http://www.njmeadowlands.gov/home

- **Barnegat Bay Partnership (BBP):** The Barnegat Bay Partnership (BBP), operates the Barnegat Bay National Estuary Program and is a partnership of federal, state, and local interests overseeing the development and implementation of a management plan for the entire Barnegat Bay watershed. Additional information about the Barnegat Bay Partnership (BBP), including actions, projects, programs, and publications, is available on the BBP Web site at www.bbep.org

- **The Delaware Estuary Program (Partnership for the Delaware Estuary):** The Delaware Estuary Program activities are coordinated by the Partnership for the Delaware Estuary (PDE). The PDE is charged with addressing the full complement of actions called for in the CCMP. Additional information about the Partnership for the Delaware Estuary (PDE), including actions, projects, programs, and publications, is available on PDE's Web site at www.DelawareEstuary.org.

- **New York/New Jersey Harbor Estuary Program (HEP):** The primary focus of the New York/New Jersey Harbor Estuary Program (HEP) is on the core area of the Harbor. Additional information about the New York/New Jersey Harbor Estuary Program (HEP), including actions, projects, programs, and publications, is available on the HEP Web site at http://www.harborestuary.org.

5.14: New Jersey's Wetlands Protection Program

In New Jersey, the chemical, physical, and biological integrity of wetlands is protected under both federal and state laws. Federal protection is provided under sections 303, 401, and 404 of the federal Clean Water Act (the Act). Section 303 provides protection through the antidegradation provisions of the Surface Water Quality Standards. (New Jersey's Surface Water Quality Standards include wetlands in the definition of "surface waters". When USEPA approves the state standards, they become the federal standards for state waters.) Section 401 is designed to allow the state to control any discharges to its waters that 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 USEPA pursuant to Section 404(g) of the Act.

Several New Jersey statutes provide various levels of protection to wetlands, including the Freshwater Wetlands Protection Act (N.J.S.A. 13:9B-1 et seq.), the New Jersey Water Quality Planning Act (N.J.S.A. 588:11A-1) and the New Jersey Water Pollution Control Act (N.J.S.A. 58:10A-1). New Jersey protects coastal resources (including wetlands) under a variety of laws, including the Waterfront Development Law (N.J.S.A. 12:5-3), the Coastal Area Facility Review Act (N.J.S.A. 13:19), and the Wetlands Act of 1970 (N.J.S.A. 13:9A). The Department applies the New Jersey Coastal Permit Program Rules (N.J.A.C. 7:7), the Coastal Zone Management Rules (N.J.A.C. 7:7E), Water Quality Certification (Section 401), and Federal Consistency Determinations (Section 307 of the Federal Coastal Zone Management Act) to determine permitted uses and development of coastal resources. Specific protection is provided for New Jersey tidal wetlands through the Wetlands Act of 1970. Additional information about the Department's Wetlands Programs is available on the Department's Web site at http://www.nj.gov/dep/landuse/fww.html.

Wetlands Monitoring, Assessment and Research

The Department, in collaboration with Rutgers University, has been undertaking research focusing on quantitative wetland biological assessment methods. A goal of this research is to explore development of a wetlands index of biotic integrity (IBI) for New Jersey. To date, research has focused on riparian forested wetlands, primarily vegetative species, and macroinvertebrates, including possibly linking to the Department's macroinvertebrate monitoring network for streams (AMNET). Reports will be available on the Department's web site at http://www.state.nj.us/dep/dsr/wetlands once they receive final approval.

In June 2010, the Department was awarded a new USEPA Wetlands Program Development Grant entitled, "Developing a Wetland Condition Monitoring Network for New Jersey: Application of New Assessment Methods." The key outcome included a statewide wetland monitoring network that complemented the USEPA National Wetland Condition Assessment efforts conducted in 2011, as well greater watershed protection by providing maps and a classification system for vulnerable springs and associated headwater seepage wetlands, new metrics to assess the success of wetland mitigation projects, improved water allocation permitting decisions based on detailed hydrology and condition data from six National Wetland Inventory-type wetlands across HUC 8 watersheds in New Jersey, and public investment in assessing, monitoring and protecting significant wetland resources statewide.

In December 2013, the Department issued the New Jersey Wetland Program Plan 2014-2018 that addresses five core elements, 1) Monitoring and Assessment; 2) Regulation; 3) Voluntary Wetland Restoration, Creation, Enhancement and Protection and Improved Coastal Shoreline Resiliency; 4) Water Quality Standards for Wetlands; and 5) Public Outreach and Education. The first four are defined by USEPA; whereas the fifth element was added by the Department to elevate the importance of cross-program coordination in wetlands monitoring. Detailed information is provided in the Program Plan, which is available on USEPA's Web site at http://water.epa.gov/type/wetlands/upload/njdep-wpp_2014-2018.pdf.

5.15: Water Compliance and Enforcement

Compliance and enforcement plays a critical role within the Department by deterring violations that would otherwise threaten our environment and the health of New Jersey's citizens. To encourage compliance and environmental stewardship, the Department seeks innovative ways to provide incentives, information, and assistance to the regulated community and the interested public. To ascertain compliance, the Department employs site inspections and detailed reviews of reported information. To ensure compliance, the Department puts violators on notice, takes administrative actions, levies penalties, and where necessary, works cooperatively with criminal prosecutors. The Department's Division of Water Compliance and Enforcement is responsible for ensuring compliance with the State's water programs. A particular focus is placed on inspections of wastewater discharge and community drinking water supply facilities.

In 1990, the Legislature enacted substantial amendments to the Water Pollution Control Act (WPCA), commonly known as the Clean Water Enforcement Act, P.L. 1990, c. 28 (CWEA).

The CWEA requires the Department to inspect permitted facilities and municipal treatment works at least annually. Additional inspections are required when the permittee is identified as a significant noncomplier. The CWEA also requires the assessment of mandatory minimum penalties for violations of the WPCA that are considered serious violations and for violations by permittees designated as significant noncompliers. The CWEA requires the Department to submit a report on the implementation of the CWEA's requirements to the Governor and the Legislature by March 31 of each year. The statute also specifies the items that the Department must include in the report. The Department has organized the required information into several categories, including Permitting, Enforcement, Delegated Local Agencies, Criminal Actions, Fiscal, and Water Quality Assessment. Copies of these CWEA reports are available on the Department's Web site at http://www.nj.gov/dep/enforcement/report-cwea.html. Additional information about the Water Compliance and Enforcement is also available on the Department's Web site at http://www.nj.gov/dep/enforcement/water.html.

5.16: Water Quality Assurance Program

The Office of Quality Assurance (OQA) administers the Department's Quality Assurance Program, which is required by USEPA to ensure that environmental data used by the Department is generated, compiled, and reviewed using specific quality assurance/quality control (QA/QC) procedures. These procedures help to ensure that data is of documented quality and suitable for its intended use. OQA is responsible for developing and implementing the Department's Quality Management Plan (QMP) http://www.nj.gov/dep/oqa/qap.html, which defines the Department's mission and planned quality assurance work outputs for the forthcoming fiscal years. The QMP documents the Department's environmental principles and objectives, organizational responsibilities, and policies and procedures for the generation, compilation, review, and use of data of documented quality. The QMP was written to conform to the requirements outlined in the USEPA document, "EPA Requirements For Quality Management Plans", EPA QA/R-2. March 2001. USEPA requires that states receiving federal grants have a QMP with quality assurance work outputs as promulgated in Title 40 Code of Federal Regulations Parts 31 and 35. The Code of Federal Regulations lists both general and specific requirements for a state's environmental program and acceptable quality assurance (QA) for federally funded programs.

OQA is also responsible for certifying that the laboratories which analyze data used by the Department operate using appropriate quality control measures and analytic methods. OQA certifies over 800 laboratories granting nearly 125,000 certifications each year. Certification is available in ambient water quality as well as drinking water, wastewater, soils, solid/hazardous waste, and sludge and air for microbiological, toxicity, inorganic, organic, radon, radiochemical, and biological properties. Most Department programs requiring the collection of data require the use of a certified laboratory for data analysis. Certification is offered through both the State Environmental Laboratory Certification Program and the state-run National Environmental Laboratory Accreditation Program.

The Office of Quality Assurance (OQA) offers certification for environmental testing laboratories to ensure that regulatory decisions made by federal, state, and municipal government agencies are based upon accurate and dependable analytical data. The OQA certifies laboratories

in 36 states, Canada and overseas, and offers certification in: Drinking Water, Solid and Hazardous Waste, Air, Wastewater, Non-potable Water, and Radon. For more information on the Department's Water Quality Assurance program, visit the Department's Web site at http://www.nj.gov/dep/oqa.

Chapter 6: Special State Concerns

6.1: Barnegat Bay

The New Jersey Legislature passed the Barnegat Bay Act in 1987 (P.L. 1987, c. 397) requiring a study of the nature and extent of extensive the impacts that development was causing on the bay. The Act, P.L. 1987, Chapter 397, created the Barnegat Bay Study Group and mandated a study of the Bay and its watershed. A citizen advisory group was formed to identify the issues and objectives of most concern to the residents of the Barnegat Bay watershed and define the focus of the plan.[17] The work of the Group resulted in a three-part study of Barnegat Bay:

- Profile of the Barnegat Bay
- Management Recommendations for the Barnegat Bay
- A Watershed Management Plan for the Barnegat Bay

Subsequently, the Barnegat Bay Watershed Association was formed and, in July 1995, USEPA accepted the nomination of the Barnegat Bay into the National Estuary Program (NEP).[18] As part of the NEP, USEPA was required to coordinate the development of a Comprehensive Conservation and Management Plan (CCMP) to restore and protect the ecological health and biological integrity and diversity of the Barnegat Bay Estuary. In 1997, the Barnegat Bay National Estuary Program was renamed the "Barnegat Bay Partnership". The Final CCMP for the Barnegat Bay Estuary was approved in May 2002. The Barnegat Bay Partnership (BBP) has since completed two Strategic Plans through a collaborative effort between federal, state, and local partners to identify program priorities and refocus partnership efforts on implementing the CCMP. The 2008-2011 Strategic Plan identified the following five priorities: 1) improving and strengthening working relationships and partnerships to focus on priority issues; 2) understanding of the bay's condition and addressing the causes of water quality degradation within the ecosystem, especially eutrophication in the bay and stormwater and nonpoint source pollution in the watershed; 3) addressing water supply and flow issues; 4) preventing habitat loss, especially of submerged aquatic vegetation, and supporting habitat restoration; and 5) improving understanding of, and addressing, fisheries declines.[19] The 2012-2016 Strategic Plan builds on the progress made under the first and refines the priorities as: 1) improve water quality throughout Barnegat Bay by focusing on causes of water quality degradation, especially eutrophication, stormwater, and other sources of pollution; 2) ensure adequate water supplies and water flow for ecological and human uses that will support a sustainable watershed; protect, restore, and enhance habitats, especially submerged aquatic vegetation, marshes, shellfish, and large terrestrial tracts; 3) protect, restore and enhance healthy populations of finfishes, shellfishes, and other wildlife by increasing our understanding of the dynamics of fish communities and other biota; and 4) identify and promote holistic and collaborative approaches

[17] Barnegat Bay Partnership (bbp). Final Comprehensive Conservation and Management Plan. May 2002. Available on the BBP Web site at http://bbp.ocean.edu/pdffiles/barnegatbay/chapter_1.pdf. Viewed on July 16, 2014.
[18] Ibid.
[19] Barnegat Bay Partnership Web site at http://bbp.ocean.edu/pages/131.asp. Viewed July 16, 2014.

to land-use planning, and practices that will improve soil function and hydrology that will restore and enhance water quality and quantity.[20]

On December 9, 2010 the Governor of New Jersey announced the Barnegat Bay Action Plan to address the ecological health of the 660-square-mile Barnegat Bay watershed. Based on the issues identified in the CCMP and a broader stakeholder process, the Action Plan recognizes that there are multiple stressors potentially responsible for the observed conditions of the Bay, including water quality, and identified several areas that would be the focus of immediate action:

1. Close Oyster Creek Nuclear Power Plant
2. Fund Stormwater Runoff Mitigation Projects
3. Reduce Nutrient Pollution from Fertilizer
4. Require Post-Construction Soil Restoration
5. Acquire Land in the Watershed
6. Special Area Management Planning
7. Adopt More Rigorous Water Quality Standards
8. Educate the Public
9. Fill in the Gaps on Research
10. Reduce Water Craft Impacts

There has been growing concern about the health of the Bay based on observed loss of sea grasses such as eel grass and widgeon grass, collectively referred to as submerged aquatic vegetation (SAV), episodic blooms of macro algae and brown tides, decline of hard clams, and increasing numbers of invasive species such as sea nettles. The full suite of stressors and biological, chemical, and physical processes responsible for these observations is not entirely known. Alteration of the shoreline, hydrologic modification, resource harvesting, boating, the effects of the Oyster Creek nuclear generation facility, and declining water quality are all suspected causes.

Numeric water quality standards already exist for some parameters in estuarine waters; and on December 21, 2010, the Department adopted narrative nutrient criteria for coastal waters. However, developing numeric translators for narrative nutrient criteria is a complex and challenging task that not yet been completed. To develop narrative criteria translators and to determine if existing numeric criteria are protective of designated uses in the Barnegat Bay requires a better understanding of the complex processes that define water quality in the Bay. To that end, and in support of Action Item 7, the Department launched a comprehensive ambient water quality monitoring initiative in the Bay on June 6, 2011. The Department engaged multiple partners to carry out New Jersey's most comprehensive water quality monitoring project to date, generating over 5,000 water samples collected over a two-year period.

The monitoring initiative was designed to determine the locations and extent of water quality impairments, and to calibrate and validate modeling tools used to define the relationship between pollutants loads and water quality. These relationships will be used in combination with the

[20] Barnegat Bay Partnership Web site. http://bbp.ocean.edu/pages/131.asp. Viewed on July 16, 2014.

findings of ecological research conducted under Action Item 9. Ten research projects are expected to provide information that will clarify linkages between water quality and the health of the various plant and animal communities that define the health of the Bay. This information will be used to interpret the narrative criteria and to determine if new or revised numeric water quality criteria are appropriate for Barnegat Bay.

The new water quality data being generated under Action Items 7 and 9 will also be used to establish the baseline conditions of the Bay and to assess these conditions against current water quality standards and confirm the nature and extent of water quality impairment. This assessment will direct action, including possible establishment of a TMDL, needed to restore water quality in the Bay.

Additional information and current status of Action Item 7 is available on the Department's Web site at http://www.state.nj.us/dep/barnegatbay/plan-wqstandards.htm. Information and status regarding all ten Action Items is available on the Department's website at http://www.state.nj.us/dep/barnegatbay/index.htm.

6.2: Nutrient Control Initiatives

New Jersey is working to refine nutrient criteria to inform longer term management strategies and is taking immediate action to reduce sources of nutrients, which represent one of the most common sources of water quality impairment in New Jersey waters.

Nutrient Criteria Enhancement Plan

In 2001, USEPA developed ecoregion nutrient criteria under Section 304(a) of the federal Clean Water Act (see 66 F.R. 1671) and recommended that states either adopt these criteria, adopt their own numeric criteria, or develop numeric translators for narrative criteria, based on USEPA guidance. New Jersey's Surface Water Quality Standards at N.J.A.C. 7:9B (SWQS) already contain numeric and narrative nutrient criteria for freshwaters. Due to a lack of sufficient nutrient and ecosystem response data, nutrient criteria have not yet been developed for the State's coastal waters. In addition, significant data and research developments have recently expanded the knowledge base about the general and site-specific factors that cause or contribute to nutrient impairment in New Jersey's waterways since these criteria were promulgated. Therefore, the Department developed a Nutrient Criteria Enhancement Plan to enhance New Jersey's existing nutrient criteria to better address the sources and causes of nutrient impairment and its adverse impact on the beneficial uses of the State's waters and to guide development of nutrient criteria in other waters.

This Plan was prepared with the input of a multi-program, departmental Nutrient Assessment Team that also included a representative of the U.S. Geological Survey. The Plan provides a detailed description of the Department's strategy for enhancing the existing nutrient criteria for freshwaters and developing new nutrient criteria for other (estuarine, marine) waters of the State. Nutrient criteria development requires an understanding of the complex causal relationships between nutrient over-enrichment, various response variables, and documented impacts on

attainment of designated and existing uses of New Jersey waters. Nutrient criteria (which may include numeric criteria and numeric translators of narrative criteria) will be developed to address and prevent nutrient-related use impairment in New Jersey waters. New Jersey's Plan outlines the following steps to support and enhance nutrient criteria development:

1. Enhanced monitoring and data collection on nutrients and response variables;
2. Research on causal relationships for nutrients and response variables; selection of appropriate indicators of aquatic life use impairment;
3. Development of new assessment methodologies to define thresholds of use impairment based on ecosystem response variables;
4. Development of new/enhanced criteria; and
5. Promulgation of the new criteria through amendments to the Surface Water Quality Standards and implementation of the new assessment methodology through the Integrated Assessment process.

Fertilizer Law

One of the primary sources of nutrients in New Jersey's waters is stormwater runoff from residential and commercial lawns containing fertilizer. Generally, excess nitrogen is a threat to coastal water (estuaries) quality while excess phosphorus is a greater concern for fresh water quality.[21] Both nutrients are also important for plant growth and health.
In 2007, the Department began working with the lawn care industry to voluntarily reduce the content of phosphorus in fertilizer by 50%. New Jersey's 2009-2010 Annual Nonpoint Source Report documented a statewide phosphorus reduction of 172,000 lbs/yr in federal fiscal year 2008, which is mainly attributed to the Department's "Healthy Lawns Healthy Water" campaign, in conjunction with 319(h) nonpoint source pollution control grant projects. The New Jersey Department of Agriculture also reported a declining trend in tons of fertilizer used between 2008 and 2012, based on New Jersey fertilizer sales data.

On January 5, 2011 the fertilizer reduction initiative was elevated to a new level when Governor Chris Christie, in support of Barnegat Bay Action Item No. 3, signed into law one of the most restrictive fertilizer content standards in the nation for nitrogen and phosphorus. The New Jersey Fertilizer Law (P.L.2010, c. 112) is implemented in three phases. Phase I went into effect when the law was signed and requires the use of best management practices to reduce the impacts of fertilizers on waterways, and public education regarding correct fertilizer use. Phase II commenced in 2012 with the creation of a certification program for professional fertilizer applicators and lawn care providers. To date, over 1,500 professionals have been tested and are certified through the New Jersey Agricultural Experiment Station at Rutgers, the State University of New Jersey. An additional 700 staff and seasonal employees have been trained by a certified professional. Phase III began in 2013 and requires manufacturers to reformulate fertilizers with reduced nitrogen and zero phosphorus content, except in certain situations such as when

[21] Rutgers, New Jersey Agricultural Experiment Station, Cooperative Extension. "Quick Facts: 2011 New Jersey Fertilizer Law". Viewed on Web site http://snyderfarm.rutgers.edu/pdfs/Fertilizer_Law_A2290_QuickFacts.pdf on July 16, 2014.

establishing a new lawn or turf, or when a soil test indicates a need for additional phosphorus. (This requirement is not applicable to home gardens.) Additional information about the fertilizer law and its implementation is available on the Department's Web site at http://www.nj.gov/dep/healthylawnshealthywater/.

Chapter 7: Cost/Benefit Analysis

Although the value of water quality protection is hard to quantify, it is obvious that water quality conditions impact the dollars expended on water-related activities such as recreational boating, swimming, and fishing; dollars generated by commercial fisheries, including shellfish, and the seafood industry; as well as the economic benefit generated by jobs, housing, retail sales, and tourism associated with these industries. Good water quality provides economic benefits associated with recreation, tourism, and marine industries, as well as the resultant tax revenues, and reduces the costs of treatment required to meet drinking water standards for potable water supplies. Therefore, protecting, restoring, and maintaining water quality in all our waterways has a direct and positive impact on the State's economy.

While water of adequate quality and quantity is important for all types of ecosystems, it is particularly important for aquatic ecosystems. Aquatic ecosystems provide a number of long-term economic benefits to society, including ecosystem "services" such as temporary storage of flood waters by wetlands, water purification from wetlands, and numerous others. In 2007, the Department estimated the economic value of New Jersey's aquatic ecosystems at more than 19 billion dollars (see Table 7.1).[22]

Table 7.1: Annual Ecosystem Service Values for Aquatic Ecosystems in New Jersey

Ecosystem Type	Total Acres as of 2002	Ecosystem Service Value (2009 $/acre/yr)	Ecosystem Service Value (2009 $/yr)
Freshwater wetlands	814,479	$13,141	$10,703,270,530
Estuaries	455,700	$13,238	$6,032,469,106
Saltwater wetlands	190,520	$6,965	$1,326,936,744
Coastal shelf	299,835	$1,476	$442,455,715
Beaches/dunes	7,837	$47,879	$375,227,660
Open fresh water	86,232	$869	$74,939,057
Riparian buffers	15,146	$3,842	$58,190,205
Total	**1,869,749**		**$19,013,489,018**

These estimated values make it clear that water of a quality and quantity sufficient to support these ecosystems in a state of healthy functioning is an essential part of a natural environment that provides extremely large economic benefits to New Jersey.

[22] NJDEP. Valuing New Jersey's Natural Capital: An Assessment of the Economic Value of the State's Natural Resources April 2007. Available at www.nj.gov/dep/dsr/naturalcap. Table 7.1 is based on data from Table 4 of Part II this report. Dollar amounts were converted from 2004 to 2009 dollars using the change in the Consumer Price Index for All Urban Consumers published by the U.S. Department of Labor's Bureau of Labor Statistics at http://www.bls.gov/cpi/.

In 2008, the Department estimated the cost of protecting New Jersey's water resources as more than 17 billion dollars – the highest in the nation. This estimate was derived from the Clean Watersheds Needs Survey (CWNS) conducted every four year pursuant to CWA Sections 205(a) and 516. The CWNS is a comprehensive assessment of the capital needs required to meet the CWA's water quality goals. Under the CWNS, USEPA and states collect information about publicly-owned wastewater collection and treatment facilities, stormwater and combined sewer overflows (CSOs) control facilities, nonpoint source (NPS) pollution control projects, and decentralized wastewater management. This information includes estimated needs (costs) to address water quality impairment or public health concerns related to water quality. USEPA compiles the CWNS results to document national needs in a Report to Congress. The report provides Congress, as well as state legislatures, with information to assist their budgeting efforts. The data are also used to help measure environmental progress, provide information to the public, and to assist local and state governments implement water quality programs.

New Jersey's 2008 CWNS utilized the Innovative Method option offered by USEPA. This approach included: demonstrating needs utilizing TMDLs, 303(d) Listings, and regulations; choosing best management practices (BMPs) appropriate to address the identified needs (i.e., constructed wetlands, porous pavement, peak reduction, rain gardens and Special Water Resource Protection Area projects); determining an eligible cost for each BMP (USEPA required three actual costs or engineering estimates for each BMP); and applying the needs/costs statewide. USEPA required that information and costs be provided on a HUC 14 subwatershed basis, based on appropriate land uses. Regional costs were adjusted by utilizing location factors. Additional information about the CWNS is available on USEPA's Web site at http://water.epa.gov/scitech/datait/databases/cwns/index.cfm.

While these cost estimates may seem overwhelming, the economic benefits, as documented above, far outweigh the costs, as shown in Table 7.1. Improved water quality, achieved through the investments identified in the CWNS, will result in an increase in the number of recreational freshwater fishing licenses issued by the State, increased marine fishing and shellfish harvesting, and a decrease in closures at New Jersey's ocean and bay beaches; all of which provide economic benefits associated with recreation, tourism, and marine industries, as well as the resultant tax revenues.

Additional economic benefit is realized from the natural services that help protect and maintain water quality in New Jersey's, including wetlands; marine ecosystems; forests; urban green space; beaches and dunes; agricultural land, cropland, and pasture; and open fresh water and riparian buffers. All contribute to ecosystem services ("ecoservices") such as temporary storage of flood waters by wetlands, long-term storage of greenhouse gases in forests, dilution and assimilation of wastes by rivers, recreational opportunities, and numerous others. All of these services provide economic value to human beings and offset the significant costs borne for their protection.

Chapter 8: Public Participation

Summary of the Public Participation Process for the 2012 Integrated List

The Integrated Report combines the reporting requirements of Sections 305(b) and 303(d) of the federal Clean Water Act. The Integrated List component of the Report, which categorizes the results of use assessments for all the State's assessment units as not supporting, fully supporting or insufficient information, satisfies the reporting requirements of Section 305(b) formerly addressed by the Statewide Water Quality Inventory Report. The 303(d) List component of the Report, which satisfies the reporting requirements of Section 303(d), includes the assessment units identified as not supporting one or more designated uses, the pollutants causing non-support of those assessment units, and their priority ranking for TMDL development. The requirements identified in this section regarding public participation, the USEPA approval, and adoption apply only to the 303(d) List component of the Integrated Report.

The Department is required under 40 CFR 130.7(b)(6) to provide a description of the methodology used to develop the 303(d) List. This Methods Document lays out the framework for assessing data and categorizing assessment units as fully supporting, not supporting or insufficient information for the Integrated List. The Department develops a draft Methods Document that is made available for public review and comment through public notification, as outlined below. After finalizing the Methods Document, the Department assesses the data in accordance with those methods and develops the Integrated Report, which includes the draft Integrated List, draft 303(d) List, and two-year TMDL Schedule. A public notice is published in the New Jersey Register announcing that the draft Integrated List and draft 303(d) List are available for public review and comment. The Integrated List and 303(d) List are revised, as appropriate, after full consideration of comments received.

The public is afforded the opportunity to participate in three key phases of development of the Integrated List: 1) submission of data, 2) review of and comment on the proposed assessment methods; and 3) review of and comment on the proposed Integrated List and 303(d) List. These phases are summarized below.

Public Submission of Data

Public participation begins with a public request for data submissions. The Department provides several avenues for announcing its intent to seek water quality data from the general public, including publication of a notice in the New Jersey Register, posting on the Department's Web site, and electronic announcement sent to subscribers of the Department's Listservs (see the Department's Web site at http://www.nj.gov/dep/wms/subscribe.htm).

A public notice regarding data submittal requirements for the 2012 303(d) List and Integrated Report was published in the New Jersey Register on April 4, 2011 (see 43 N.J.R. 887(a)). The public notice (and other notifications) specified that, for the 2012 Integrated Report, the Department was seeking data collected by December 31, 2010 that met all Department data requirements, was collected in compliance with a Department-approved (and signed) Quality

Assurance and Quality Control Plan, was available to the public (i.e., not proprietary in nature), and was submitted electronically via the Department's Water Quality Data Exchange (WQDE) System or through USEPA's Water Quality Exchange (WQX) system. The deadline for submitting data for consideration in the development of the 2012 Integrated Report was July 1, 2011.

In determining which data were appropriate and "readily available" for assessment purposes, the Department considered quality assurance/quality control, monitoring design, age of data, accurate sampling location information, data documentation, and use of electronic data management. Data requirements are discussed in detail in Chapter 3 of the Methods Document (see Appendix F). Data that was rejected for quality concerns or other reasons are identified in Appendix E. The Department continues to work with data-generating organizations to organize their data, provide training in acceptable sampling techniques, and certify laboratories and field measurement protocols.

Public Review of Draft Documents

Once the Department has completed its review of the data submitted by other entities and incorporates the results as appropriate, the Department provides an opportunity for public review of the Integrated Water Quality Monitoring and Assessment Methods Document and the Draft Integrated List. The Department publishes a notice in the New Jersey Register and on the Department Web site announcing the availability of these documents for public review and comment. Adjacent states, federal, and interstate agencies are also notified, as appropriate.

Methods Document: On December 5, 2011, the Department published a public notice (see 43 N.J.R. 887(a)) announcing availability for review of the draft 2012 Integrated Water Quality Monitoring and Assessment Methods Document. This document includes a description of the quality assurance requirements as well as the rationale for the placement of waterbodies on the Integrated List. The public comment period ended on January 4, 2012. After review and consideration of comments received, the Department published the final 2012 Methods Document concurrent with the draft 2012 303(d) List on July 2, 2012 (see 44 N.J.R. 1918 (b)). The final 2012 Methods Document along with the response to comments is referenced in Appendix F of this report and is available for download from the Department's website at http://www.nj.gov/dep/wms/bwqsa/2012_final_methods_doc_with_response_to_comments.pdf.

303(d) List: The Department is required to propose the 303(d) List of Water Quality Limited Waters (303(d) List) as an amendment to the Statewide Water Quality Management Plan, provide an opportunity for public comment, and adopt the amendment in accordance with N.J.A.C. 7:15-6.4. A public notice announcing the availability for review of the draft 2012 303(d) List, was published in the New Jersey Register on July 2, 2012 (see 44 N.J.R. 1918(b)), and on the Department's Web site, followed by a 30-day public comment period.

The following documents were made available for public review and were published on the Department's Web site at http://www.state.nj.us/dep/wms/bwqsa/2012_integrated_report.htm along with the draft 2012 303(d) List:

- 2012 Integrated Water Quality Monitoring and Assessment Overview
- Draft 2012 Assessment Unit Summary List (Integrated List)
- Draft 2012 303(d) List of Water Quality Limited Waters, Including Priority Ranking
- Draft 2012 303(d) List with Listing Stations (Excel format)
- Draft DDraft 2012 Delisted Waters
- Delisting Justification Document
- Draft 2012 Two-Year TMDL Schedule
- Final 2012 Methods Document

The public comment period closed on August 1, 2012. The 2012 303(d) List and the other documents listed above were revised to address comments submitted by USEPA and other commenters, and were submitted to USEPA for formal approval along with the full Integrated Report. The submittal of the Integrated Report along with its appendices and New Jersey's 2012 Assessment Database (ADB) file to USEPA constitutes the final step in USEPA's review process. Upon receiving approval from USEPA, the Final 2012 303(d) List will be adopted as an amendment to the Statewide Water Quality Management Plan pursuant to N.J.A.C. 7:15-6, a public notice announcing the adoption will be published in the New Jersey Register, and the final versions of the other documents mentioned above will be published on the Department's Web site at http://www.state.nj.us/dep/wms/bwqsa/2012_integrated_report.htm.

Chapter 9: Next Steps

For the 2014 Integrated Report, the Department is considering further enhancements to the Integrated Assessment process, such as a regional or rotating basin approach, measures to enhance the confidence in assessment decisions, and partitioning the 303(d) list to make clear the intended responses to various types of impairments. Specifically, the Department plans to increase the number of samples required to support a listing or delisting decision to improve the robustness of the dataset used in making assessment decisions. Assessment decisions will based on an in depth analysis of more robust datasets and multiple lines of evidence to confirm water quality conditions, including water quality monitoring data and other factors including hydrology, geology, land use, biological habitat conditions, meteorology, restoration activities, point and nonpoint sources, use designation, stream classification, and other environmental considerations relevant to determining overall water quality. This approach will produce a robust assessment of environmental conditions affecting water quality in a selected water region and will allow the Department to target the water resource concerns within that region.

This new Regional Comprehensive Assessment will focus on one of New Jersey's five water regions (Atlantic Coastal, Lower Delaware, Northwest, Raritan, and Northeast) during each Integrated Report cycle. The rotating region/basin approach will result in a comprehensive assessment of the entire state every ten years. The Department will initiate the new Regional Comprehensive Assessment process in the Atlantic Coastal Region for the 2014 Listing Cycle. Partitioning of the 303(d) list will acknowledge that legacy pollutants, arsenic that occurs naturally in excess of SWQS, and watersheds where nonpoint sources not subject to traditional regulatory responses, are a low priority for TMDL development. Instead, other responses would be employed, where active anthropogenic sources need to be reduced.

Appendix A:
2012 Final Integrated List of Waters

This document is available for download from the Department's Web site at http://www.state.nj.us/dep/wms/bwqsa/2012_integrated_report.htm.

Appendix B:

- 2012 Final 303(d) List of Water Quality Limited Waters with Priority Ranking

- Agency Responses to Public Comments Received on the Draft 2012 303(d) List

These documents are available for download from the Department's Web site at http://www.state.nj.us/dep/wms/bwqsa/2012_integrated_report.htm.

Appendix C:

- 2012 Final Assessment Unit-Cause Combinations Removed from the 303(d) List (Delisted Waters)
- 2012 Final Justification for Delisted Waters
- Mapping Supplement to the 2012 Final Justification for Delisted Waters

These documents are available for download from the Department's Web site at http://www.state.nj.us/dep/wms/bwqsa/2012_integrated_report.htm.

Appendix D: 2012 Final Two-Year TMDL Schedule

Assessment Unit	Assessment Unit Name	Parameter
NJ02030103140010-01	Hohokus Bk (above Godwin Ave)	TP
NJ02030103140030-01	Hohokus Bk(below Pennington Ave)	TP
NJ02030103140050-01	Saddle River (Rt 4 to HoHoKus)	TP
NJ02030103140060-01	Saddle River (Lodi gage to Rt 4)	TP
NJ02030103140070-01	Saddle River (below Lodi gage)	TP
NJ02030105020050-01	Beaver Brook (Clinton)	TP
NJ02030105020070-01	Raritan R SB(River Rd to Spruce Run)	TP
NJ02030105020070-01	Raritan R SB(River Rd to Spruce Run)	TSS
NJ02030105020100-01	Raritan R SB(Three Bridges-Prescott Bk)	TP
NJ02030105030060-01	Neshanic River (below FNR / SNR confl)	TP
NJ02030105030070-01	Neshanic River (below Black Brk)	TP
NJ02030105040010-01	Raritan R SB(Pleasant Run-Three Bridges)	TP
NJ02030105040040-01	Raritan R SB(NB to Pleasant Run)	pH
NJ02030105040040-01	Raritan R SB(NB to Pleasant Run)	TP
NJ02030105050020-01	Lamington R (Hillside Rd to Rt 10)	TP
NJ02030105050070-01	Lamington R(HallsBrRd-HerzogBrk)	TP
NJ02030105050090-01	Rockaway Ck (below McCrea Mills)	TP
NJ02030105050100-01	Rockaway Ck SB	TP
NJ02030105050100-01	Rockaway Ck SB	TSS
NJ02030105080020-01	Raritan R Lwr (Rt 206 to NB / SB)	TP
NJ02030105090050-01	Stony Bk(Province Line Rd to 74d46m dam)	TP
NJ02030105090060-01	Stony Bk (Rt 206 to Province Line Rd)	TP
NJ02030105090070-01	Stony Bk (Harrison St to Rt 206)	TP
NJ02030105090090-01	Stony Bk- Princeton drainage	TP
NJ02030105100010-01	Millstone River (above Rt 33)	TP
NJ02030105100010-01	Millstone River (above Rt 33)	TSS
NJ02030105100020-01	Millstone R (Applegarth road to Rt 33)	TP
NJ02030105100020-01	Millstone R (Applegarth road to Rt 33)	TSS
NJ02030105100030-01	Millstone R (RockyBk to Applegarth road)	TP
NJ02030105100050-01	Rocky Brook (below Monmouth Co line)	TP
NJ02030105100060-01	Millstone R (Cranbury Bk to Rocky Bk)	TP
NJ02030105100130-01	Bear Brook (below Trenton Road)	TP
NJ02030105100140-01	Millstone R (Rt 1 to Cranbury Bk)	TP
NJ02030105110050-01	Beden Brook (below Province Line Rd)	TP
NJ02030105110100-01	Pike Run (below Cruser Brook)	TP
NJ02030105120130-01	Green Brook (below Bound Brook)	TSS

NJ02030105120140-01	Raritan R Lwr(I-287 Piscatway-Millstone)	TSS
NJ02040206030030-01	Salem R (CountyHomeRd to Woodstown gage)	TP
NJ02040206030040-01	Salem R (CoursesLanding to CountyHomeRd)	TP
NJ02040206030050-01	Game Creek (above Rt 48)	TP
NJ02040206030060-01	Salem R (39-40-14 dam-CoursesLndg)/Canal	TP
NJ02040206030070-01	Game Creek (below Rt 48)	TP
NJ02040206030080-01	Salem Canal	TP

Appendix E: 2012 List of Data Sources

Organization	Organization Type	Data Used for 2012 List?	If not, why not?	Waterbody Name	Monitoring Dates	Parameters
Atlantic County Health Department	County Government	yes	n/a	Atlantic County Ocean and Back Bays	2009-2010	pathogens
Brick Township MUA	Municipal Authority	yes, except for Thallium data	Thallium data was invalid due to sampling, analysis and/or data entry errors	Metedeconk Watershed	2009-2010	conventional chemical/physical
Cape May County Health Department	County Government	yes	n/a	Cape May County Ocean and Back Bays	2009-2010	pathogens
DRBC	Interstate Agency	yes, except for metals	metal sampling did not use 'clean' methods	Delaware River Non-Tidal Tributaries	2009	conventional chemical/physical
DRBC	Interstate Agency	yes, except for heavy metals	metal sampling did not use 'clean' methods	Delaware River Tidal Tributaries	2009	conventional chemical/physical
Great Swamp Watershed Association	Volunteer Monitoring Organization	yes	n/a	Loantaka Brook; Great Brook; GS Natl Wildlife Refuge Tributaries	2009-2010	conventional chemical/physical
Interstate Environmental Commission	Interstate Agency	no	data not available	New York/New Jersey Harbor	2009-2010	pathogens

Monmouth County Health Department	County Government	yes	yes	Monmouth County streams	2009-2010	conventional chemical/physical
Monmouth County Health Department	County Government	yes	n/a	Ocean / Bay Beaches	2009-2010	pathogens
Musconetcong Watershed Association	Volunteer Monitoring Organization	yes	n/a	Upper Musconetcong River	2010	conventional chemical/physical
National Park Service	Federal Government	yes	n/a	Passaic River Basin	2009	conventional chemical/physical
New Jersey Harbor Dischargers Group	Municipal Authority	yes	n/a	New York/New Jersey Harbor and Tidal Tributaries	2009-2010	Sanitary/chemistry
NJDEP BFBM	State Government	yes	n/a	Statewide	2009-2010	diurnal DO, pH, and Temperature
NJDEP BFBM	State Government	yes	n/a	Statewide	2009-2010	macroinvertebrates
NJDEP BFBM	State Government	yes	n/a	Statewide	2009	conventional chemical/physical
NJDEP BFBM	State Government	yes	n/a	Statewide	2009-2010	metals/conventional chemical/physical/pathogens
NJDEP Bureau of Marine Water Monitoring	State Government	yes	n/a	NJ Ocean and Bay Bathing Beaches	2009-2010	pathogens
NJDEP Bureau of Marine Water Monitoring	State Government	yes	n/a	Ocean Bathing Beaches	2009-2010	pathogen geomeans

NJDEP Bureau of Marine Water Monitoring	State Government	yes	n/a	Coastal Waters	2009-2010	conventional chemical/physical
NJDEP Bureau of Marine Water Monitoring	State Government	yes	n/a	Coastal Waters	2009-2010	pathogens
NJDEP Bureau of Marine Water Monitoring	State Government	yes	n/a	Barnegat Bay	2009-2010	diurnal DO and Temperature
NJDEP Office of Science	State Government	yes	n/a	Statewide	2009-2010	fish tissue
NJDEP Volunteer Monitoring Program	Volunteer Monitoring Organization	yes	n/a	Musconetcong Watershed	2009-2010	pH
AmeriCorps NJ Watershed Ambassadors Program	Volunteer Monitoring Organization	no	no approved benthic metric for this data set	Statewide	2009-2010	macroinvertebrates
Ocean County Health Department	County Government	yes	n/a	Ocean County Ocean and Back Bays	2009-2010	pathogens
Pequannock River Coalition	Volunteer Monitoring Organization	no	data not submitted in usable format	Pequannock River and others	2009-2010	diurnal temperature
Pinelands Commission	Regional Government	yes	n/a	Pinelands Waters	2009-2010	pH
Rutgers Cooperative	Academic Organization	yes	n/a	Upper Salem River	2009	conventional chemical/physical

Extension Service						
Rutgers Cooperative Extension Service	Academic Organization	yes	n/a	Musconetcong River	2010	Phosphorus
South Branch Watershed Association	Volunteer Monitoring Organization	yes	n/a	South Branch Raritan River	2010	macroinvertebrates
Stony Brook-Millstone Watershed Association	Volunteer Monitoring Organization	no	no approved QAPP for this data set	Stony Bk, Millstone R watershed: Duck Pond Run and Heathcote Brook	2009-2010	conventional chemical/physical
Upper Raritan Watershed Association	Volunteer Monitoring Organization	yes	n/a	Peapack Brook, North Branch Raritan, Rockaway Creek, and respective watersheds	2009-2010	macroinvertebrates
USEPA	federal government	yes	n/a	Coastal Waters	2009-2010	Sanitary/DO
USGS	federal government	yes	n/a	Statewide	2009-2010	conventional chemical/physical
Upper Raritan Watershed Association	Volunteer Monitoring Organization	yes	n/a	Peapack Brook, North Branch Raritan, Rockaway Creek, and respective watersheds	2009-2010	macroinvertebrates

Appendix F:

- 2012 Final Integrated Water Quality Monitoring and Assessment Methods

- Agency Response to Public Comments on the Draft 2012 Methods

These documents are available for download from the Department's Web site at http://www.state.nj.us/dep/wms/bwqsa/2012_integrated_report.htm.

Appendix G: New Jersey Water Monitoring and Assessment Strategy (2005-2014)

This document is available for download from the Department's Web site at www.state.nj.us/dep/wms/longtermstrategyreport.pdf.

Appendix H:
New Jersey's Ambient Ground Water Quality Monitoring Network

This document is available for download from the Department's Web site at http://www.nj.gov/dep/njgs/enviroed/infocirc/ambient.pdf.

Appendix I:
New Jersey Surface Water Quality Standards,
N.J.A.C. 7:9B

An unofficial version of the Surface Water Quality Standards rules is located on the Department's website at http://www.nj.gov/dep/rules/rules/njac7_9b.pdf. The official version of the rules is available from LexisNexis ®, publisher of the *New Jersey Administrative Code* (N.J.A.C.), at www.lexisnexis.com/bookstore. Additional information about obtaining Department rules is available on the Department's Web site at http://www.state.nj.us/dep/legal/get_rule.htm.

Appendix J: TMDLs Completed 2010 – 2012

Waterbody	Title	Pollutant	Status	Date
Statewide	Total Maximum Daily Load for Mercury Impairments Based on Concentrations in Fish Tissue Caused Mainly by Air Deposition to Address 122 HUC 14s Statewide	Mercury Impairments	Adopted	June 10, 2010
Statewide	Total Maximum Daily Load for Mercury Impairments Based on Concentration in Fish Tissue Caused Mainly by Air Deposition to Address 122 HUC 14s Statewide Addendum of 14 Additional HUC14s	Mercury Impairments	Approved	Sept 14, 2011
Pequest River	Total Maximum daily Loads Report for Phosphorus to Address Four Impaired Assessment Units in the Pequest River Watershed	Phosphorus	Adopted	May 23, 2011
WMA 12, Atlantic Coastal Water Region	Five Total Maximum Daily Loads for Total Coliform to Address Shellfish-Impaired Waters in Watershed Management Area 12 Atlantic Coastal Water Region	Total Coliform	Adopted	October 13, 2011
WMA 13, Atlantic Coastal Water Region	Fourteen Total Maximum Daily Loads for Total Coliform to Address Shellfish-Impaired Waters in Watershed Management Area 13 Atlantic Coastal Water Region	Total Coliform	Adopted	March 18, 2013
Lincoln Park Lake, Overpeck Lake, Verona Park Lake	Total Maximum Daily Loads for Phosphorus To Address 3 Eutrophic Lakes in the Northeast Water Region	Phosphorus	Adopted	June 6, 2013
Northeast Water Region	Total Maximum Daily Loads for Fecal Coliform to Address 32 Streams in the Northeast Water Region	Fecal Coliform	Adopted	June 6, 2013

*Approved by USEPA previously, but adopted during 2010 - 2012

Appendix K: Decisions to Not List Assessment Unit/Pollutant Combinations on the 2012 303(d) List of Water Quality Limited Waters

This document are available for download from the Department's Web site at http://www.state.nj.us/dep/wms/bwqsa/2012_integrated_report.htm.

Appendix L: Additional Acknowledgments

New Jersey Assessment Database Development/
Water Quality Data Screening and Assessment
Jack Pflaumer, Bureau of Environmental Analysis, Restoration and Standards

Data Repository/Water Quality Data Exchange System Administrator
Paul Morton, Division of Water Monitoring and Standards

Comprehensive Water Quality Assessment Team
Dean Bryson, Bureau of Freshwater and Biological Monitoring
Sandra Cohen, Bureau of Environmental Analysis, Restoration and Standards
Debra Hammond, Bureau of Water Quality Standards and Assessment (retired)
Patricia Ingelido, Bureau of Environmental Analysis, Restoration and Standards
Ariane Giudicelli, Bureau of Environmental Analysis, Restoration and Standards
Leigh Lager, Bureau of Freshwater and Biological Monitoring
Paul Morton, Division of Water Monitoring and Standards
Jack Pflaumer, Bureau of Environmental Analysis, Restoration and Standards
Victor Poretti, Bureau of Freshwater and Biological Monitoring

Additional Water Quality Assessment Assistance
Danielle Donkersloot, Bureau of Environmental Analysis, Restoration and Standards
Bruce Friedman, Bureau Marine Water Monitoring
Sarah Helble, (formerly) Bureau of Water Quality Standards and Assessment
Kathleen Hitchner, Bureau of Environmental Analysis, Restoration and Standards
Frank Klapinski, Bureau of Environmental Analysis, Restoration and Standards
Mike Kusmiesz, Bureau of Marine Water Monitoring
Dave McPartland, Bureau of Environmental Analysis, Restoration and Standards
Patricia Michelotti, (formerly) Bureau of Water Quality Standards and Assessment
Paul Morton, Division of Water Monitoring and Standards
Jennifer Noblejas, Bureau of Environmental Analysis, Restoration and Standards
Helen Pang, Bureau of Environmental Analysis, Restoration and Standards
Robert Schuster, Bureau Marine Water Monitoring
Dian Smith, Bureau of Environmental Analysis, Restoration and Standards
Sarah Staab, (formerly) Bureau of Environmental Analysis, Restoration and Standards
Tom Vernam, Bureau of Freshwater and Biological Monitoring (retired)
John Vile, Bureau of Freshwater and Biological Monitoring
Aynan Zaman, Bureau of Environmental Analysis, Restoration and Standards

Assessment Database (NJADB) Input
Sandra Cohen, Bureau of Environmental Analysis, Restoration and Standards
Gigi Mallepalle, Bureau of Environmental Analysis, Restoration and Standards

GIS Mapping and Coverages

Leigh Lager, Bureau of Freshwater and Biological Monitoring
Gigi Mallepalle, Bureau of Environmental Analysis, Restoration and Standards
Sarah Staab, (formerly) Bureau of Environmental Analysis, Restoration and Standards

Contributing Authors (Department of Environmental Protection):

Sunila Agrawal, Air Quality Permitting
Mary Jo Aiello, (formerly) Bureau of Pretreatment and Residuals
Christina Aiello, (formerly) Bureau of Water Quality Standards and Assessment
Jill Aspinwall, Land Use Regulation
Mike Aucott, Office of Science (retired)
Katherine Axt, Bureau of Freshwater and Biological Monitoring
Deborah Bechtel, Bureau of Environmental Analysis, Restoration and Standards
Tom Belton, Office of Science
Alena Baldwin-Brown, Division of Water Monitoring and Standards
Theresa Bottini, Land Use Management
Raymond Bousenberry, New Jersey Geological Survey
Fred Bowers, Bureau of Nonpoint Pollution Control (retired)
Gary Buchanan, Office of Science
Bob Connell, Bureau of Marine Water Monitoring (retired)
Ruth Ehinger, (formerly) Land Use Management
Marc Ferko, Office of Quality Assurance
Bruce Friedman, Bureau of Water Quality Standards and Assessment
Barbara Greenhalgh-Weidman, Bureau of Environmental Analysis, Restoration and Standards
Nancy Hamill, Publicly Funded Site Remediation Program
Bill Heddendorf, Bureau of Marine Water Monitoring
Sarah Helble, (formerly) Bureau of Water Quality Standards and Assessment
Robin Heston, Solid and Hazardous Waste Management
Barbara Hirst, Bureau of Environmental Analysis, Restoration and Standards
Kathleen Hitchner, Bureau of Environmental Analysis, Restoration and Standards
Jeffrey Hoffmann, New Jersey Geological Survey
Kyra Hoffmann, Land Use Management
Steve Jandoli, Green Acres
Victoria Jenkins, Municipal Finance and Construction
Branden Johnson, Division of Water Supply
Eric Knudsen, Green Acres
Al Korndoerfer, Bureau of Freshwater and Biological Monitoring (retired)
Chris Kunz, Bureau of Freshwater and Biological Monitoring
Nancy Lawrence, Green Acres Program
Helaine Liwacz, Bureau of Marine Water Monitoring
Sue Lockwood, Land Use Regulation
Virginia Loftin, Bureau of Marine Water Monitoring
Judy Louis, Office of Science
Tali MacArthur, (formerly) Coastal Management and Watershed Restoration

Bob Mancini, Coastal Management and Watershed Restoration (retired)
Joseph Mannick, Division of Water Quality
William Mates, Office of Economic Analysis
Dave McPartland, Bureau of Environmental Analysis, Restoration and Standards
Mark Miller, Bureau of Nonpoint Pollution Control
Harold Nebling, Water Resource Management
Carol O'Donnell-Kee, Bureau of Freshwater and Biological Monitoring
John Olko, Water Compliance and Enforcement
Tanya Oznowich, Environmental Education
Pilar Patterson, Bureau of Surface Water Permitting
Dave Pepe, Division of Water Quality
Victor Poretti, Bureau of Freshwater and Biological Monitoring
Kerry Pflugh, Constituent Relations
Terry Pilawski, (formerly) Land Use Management
Nick Procopio, Office of Science
Ron Rossi, Division of Water Monitoring and Standards (retired)
Bruce Ruppel, Office of Science
Christine Schell, Office of Climate and Energy
Mike Serfes, New Jersey Geological Survey
Scott Shymon, Municipal Finance and Construction
Mary Smith, (formerly) Office of Constituent Relations
Kim Springer, Coastal Management and Watershed Restoration
Larry Torok, Land Use Regulation
John Tyrawski, Land Use Regulation
John Vile, Bureau of Freshwater and Biological Monitoring
Mike Vrancick, Budget and Finance
Kathleen Walz, Office of Natural Lands Management
Debbie Watkins, Bureau of Marine Water Monitoring
Coleen Weber, Bureau of Freshwater and Biological Monitoring
Katrina Wessling, Division of Water Supply
Anne Witt, Bureau of Environmental Analysis, Restoration and Standards
Dan Zeppenfeld, Municipal Finance and Construction

Other Contributors

Jennifer Adkins, Executive Direction, Partnership for the Delaware Estuary
L. Stanton Hales, Jr., Ph.D., Program Director, Barnegat Bay National Estuary Program
Danielle Kreeger, Science Director, Partnership for the Delaware Estuary
Bob Nyman, USEPA Region 2, Director, NY-NJ Harbor Estuary Program

Cover Photograph

Ariane Giudicelli, Bureau of Environmental Analysis, Restoration and Standards,
Maurice River, AmeriCorps Orientation, September 2013

Photography *(Inside Report)*

Virginia Loftin: *Sea Girt, July 2006*

Division of Water Monitoring and Standards: *Round Valley Reservoir, Clinton Township, August 2007*
Virginia Loftin: *Island Beach State Park, April 2006*
Division of Water Monitoring and Standards: *Brook Trout, November 2007*
Division of Water Monitoring and Standards: *Shellfish, June 2007*
Bureau of Freshwater and Biological Monitoring: *Flat Brook, Walpack Township, July 2007*
Kaycee Coleman: *Big Flat Brook, Stokes State Forest, July 2007*
Virginia Loftin: *Stormwater outfall to Toms River, Beachwood Beach, Beachwood, 2011*
Bureau of Freshwater and Biological Monitoring: *September 2005*
New Jersey Department of Environmental Protection: *Barnegat Bay Lighthouse State Park, Barnegat Light, June 2011*
Virginia Loftin: *Atlantic Ocean*
Division of Water Monitoring and Standards: *Batsto River, New Jersey Pinelands, August 2007*