NEW JERSEY
WATER MONITORING & ASSESSMENT STRATEGY
(2005-2014)

Water Monitoring and Standards Program
NJ Department of Environmental Protection

Bradley M. Campbell, Commissioner

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Development of a comprehensive, statewide monitoring and assessment strategy requires the expertise and vision of multiple individuals. Their participation in preparing this long-term water monitoring direction-setting document is gratefully acknowledged. The NJDEP personnel listed below participated in development of this strategy, including review of the EPA Guidance document (*Elements of a State Water Monitoring and Assessment Program*, March 2003), and as authors and reviewers of various sections. The valuable input of the members of the NJ Water Monitoring Coordinating Council (listed in Appendix 1) is also acknowledged.

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NEW JERSEY WATER MONITORING & ASSESSMENT STRATEGY

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

WATER MONITORING AND STANDARDS PROGRAM

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EXECUTIVE SUMMARY

In March 2003, EPA issued national Guidance which identified the key elements for developing a state Water Quality Monitoring and Assessment Strategy to ensure compliance with Clean Water Act requirements. All states are now required, for receipt of 106 grant funds, to develop a comprehensive, 10 year long-term water monitoring strategy.

As the Guidance details, the monitoring program strategy is to cover all waters of the state (streams, rivers, lakes, reservoirs, estuaries, coastal areas, wetlands and ground water). For each waterbody type, the strategy must include discussions of 9 basic elements: 1. Monitoring objectives, 2. Monitoring design, 3. Core & supplemental water quality indicators, 4. Quality assurance, 5. Data management, 6. Data analysis/assessment, 7. Reporting, 8. Programmatic evaluation, and 9. General support and infrastructure planning.

In development of this strategy for New Jersey, the New Jersey Department of Environmental Protection (NJDEP) has performed an assessment of its ambient water monitoring programs based on the Department's water information needs, the EPA Guidance, and the results of the 1999 EPA audit of New Jersey's (NJ) water programs. The resulting document contains long-term strategies for ambient water monitoring and assessment programs that are in various stages of development – from the existing, well established stream monitoring program to the wetlands monitoring program, which is presently in a research and development stage.

The Strategy document is organized by waterbody type (e.g., rivers and streams, lakes and reservoirs). Within each monitoring area, current ambient monitoring programs are described and each of the 9 elements are discussed, the gaps are identified, as well as the resource and technical support needs to fill these gaps. For programs that cross waterbody types (e.g., Toxics in Fish & Shellfish), a separate program description is included. In developing each of the monitoring program strategies, NJDEP considered the 5 overall assessment-related questions, as well as the Core Indicators contained in the EPA guidance document. Key enhancements and/or opportunities for program efficiencies are also highlighted. Because this document is intended to serve as a 10 year plan for NJ's water monitoring and assessment programs, NJDEP has chosen to present its timelines for addressing these gaps in two 5-year intervals (2005-2009 and 2010-2014) so as to highlight short-term vs. long-term plans and needs. As such, all of the implementation plans, particularly the enhancements, are dependent upon availability of resources and needed technical support. An overall summary table of the key gaps and resource/technical support needs is contained in Appendix 3 of the document.

The main elements of the existing New Jersey water monitoring program include:

For freshwater, New Jersey's program includes quarterly sampling of a 115-station ambient stream network. This stream monitoring is a cooperative program between NJDEP and the United States Geological Survbey (USGS). In 2000, a supplemental ambient network for conventional parameters was initiated to provide monitoring at approximately 90 additional ambient sites. The chemical/physical networks monitor conventional parameters, metals, bacteria, pesticides, volatile organic compounds (VOC's) and sediments. Strategic directions identified for these networks include additions of toxic parameters to the supplemental network sites, continuous temperature monitoring at selected sites, and research to evaluate analytical methods for network use that can achieve lower detection limits for arsenic and mercury. The most significant enhancement, the addition of toxic parameters to supplemental monitoring locations, is being addressed in FY2005.

In 1992, NJDEP reactivated its Ambient Biomonitoring Network (AMNET). The network established sampling stations in every sub-watershed, and has a total of 820 sites. The status of benthic macroinvertebrate

communities is evaluated using EPA's Rapid Bioassessment Protocol (RBP). Each of the five major drainage basins is sampled, on a rotational basis, every 5 years. Visual observation, stream habitat assessments and limited physical/chemical data are also collected. In 2000, a second biological monitoring network was initiated and validated for the northern portion of the state, the Fish Index of Biotic Integrity (FIBI). Using EPA's protocol, the biological health of streams is assessed using fish assemblage information. Primary strategic directions for these areas include the need for technical support in calibration of NJ's impairment scores, source identification monitoring for biologically impaired waters, and development of a fish index of biotic integrity sampling in the southern coastal plain section of the state.

In 2004, NJDEP initiated a renewed ambient lake monitoring network designed to provide the water quality data necessary to assess the ecological health of the State's lentic water resources. This program involves the testing of randomly selected lakes from the state's approximately 1100 named lakes. The water quality measurements conducted at each randomly selected lake include parameters such as dissolved oxygen, pH, nutrients, and chlorophyll a. Such testing will assist New Jersey in determining lake water quality, as needed to meet its Clean Water Act requirements and its Total Maximum Daily Load (TMDL)-related water quality assessment obligations. Currently, the lakes program focuses on the status of lake water quality in the state. The primary strategic enhancement identified would be to develop trends monitoring and assessment capability, preferably through a volunteer lakes monitoring program.

For marine waters, NJDEP conducts water quality monitoring to classify approximately 700,000 acres of marine and estuarine shellfish waters. As part of the National Shellfish Sanitation Program (NSSP), NJDEP collects approximately 15,000 ambient water samples per year from a network of more than 2,500 monitoring stations throughout the State's coastal waters. These stations are sampled between five (5) and twelve (12) times per year. The resulting data are analyzed for compliance with federal standards for shellfish sanitation. Waters not in compliance are closed to shellfish harvest. As part of the NSSP, NJDEP also conducts coastal phytoplankton monitoring every summer in New Jersey's bay and near-shore ocean waters. Key strategic directions for NSSP monitoring include enhancement of limited testing of toxics in shellfish tissue and addressing the need for capacity expansion for microbial source trackdown. This laboratory expansion is being addressed in FY2005.

NJDEP also monitors the condition of the State's coastal waters by measuring basic water quality (dissolved oxygen, nutrients and water clarity) at 260 locations on a quarterly basis. EPA provides assistance with this monitoring and with phytoplankton monitoring in the summer months, as well as support for NSSP sampling throughout the year. NJDEP and EPA Region 2 are jointly evaluating the potential use of aircraft remote sensing to significantly enhance phytoplankton monitoring. EPA's National Coastal Assessment (NCA) research program is performed in partnership with NJDEP and includes measurements of sediment chemistry, sediment toxicity and the benthic community annually at about 50 locations in New Jersey's estuarine waters. Strategic enhancements include transitioning the EPA NCA research program into a state monitoring program, development of ecological assessments for estuarine waters, and developing automated monitoring for dissolved oxygen in the state's coastal waters. The state has submitted a grant proposal to NOAA in FY2005 to develop a component of an Integrated Ocean Observing System which, if funded, would assist in addressing the need for continuous DO monitoring. NJDEP is also considering data generated by its outside partners in the NY/NJ Harbor (NJ Harbor Dischargers Group) and in the Delaware (Delaware River Basin Commission – DRBC) watershed as a possible means to address geographical gaps in the State's coastal water monitoring.

For ground water, New Jersey has developed and now maintains a cooperative network (NJDEP & USGS) consisting of 150 wells screened at the water table that are sampled 30 per year on a 5-year cycle. The goals of the network are to determine the status and trends of shallow ground-water quality as a function of land use related to non-point source pollution in New Jersey. Parameters measured include conventionals (pH, turbidity, temperature, DO), nutrients, VOCs, radioactivity, and pesticides. The primary strategic enhancement for this monitoring program would be the integration of all sources of ground water data – the

network (described above) as well as data collected as a result of the Private Well Testing Act and site remediation-related data.

In addition to the water monitoring networks described above, NJDEP also conducts targeted physical, chemical and biological water monitoring for needs such as further evaluation of waters previously listed as impaired on NJ's Impaired Waterbodies List, TMDL development/implementation, and in response to environmental spills.

NJDEP has also identified key strategic directions for cross-cutting water monitoring programs, such as toxics in fish and shellfish, TMDL development, wetlands, and volunteer monitoring, as well as for water quality assessment and water quality data management. For water quality assessment and data management, these enhancements include integration of all available, high quality data (both DEP and non-department data) into the department's assessment database for use in preparation of the *Integrated Water Quality Monitoring and Assessment Report* as well as the addition of new external water monitoring data (e.g., volunteer monitoring) to STORET through development of a common data exchange element.

Details of evaluations and suggested directions for all programs are contained in the strategy document and a summary of key enhancements is contained in Appendix 3 of this document. Additional information on the water monitoring activities and networks, described in this strategy document, may also be found on NJDEP Water Monitoring and Standards website (http://www.nj.gov/dep/wmm/).

Dam below Batsto Lake, Hammonton, NJ

INTRODUCTION

A. BACKGROUND

The US Environmental Protection Agency (EPA) is required under Clean Water Act §106(e)(1) to determine, prior to awarding a Section 106 grant to the State of New Jersey, that the State is monitoring the quality of its navigable waters, compiling and analyzing data on the water quality, and including those data in the State's section 305(b) report.[1] Historically, EPA has relied on submission of the 305(b) report to determine that the State has satisfied the Section 106(e) eligibility requirement for the award of Section 106 grant funds. As explained in the FY2001 Clean Water Act Section 106 Grant Guidance, EPA Regions have been conducting reviews of State monitoring programs and are working with States to strengthen these programs over time. In 2003, EPA issued national guidance (*Elements of a State Water Monitoring and Assessment Program*, March 2003) to promote consistency in State monitoring programs and to make progress in ensuring that the Section 305(b) process provides nationally comparable data with known accuracy.

In New Jersey, EPA had performed a 1999 audit of the NJ Department of Environmental Protection's (NJDEP) programs since both the States and EPA rely upon the water quality information collected by the States to develop programs for the control and clean-up of water pollution. This audit was one in a series of state water quality audits conducted by the Office of Inspector General (OIG) to "develop a national picture of the performance of state water quality programs." The audit found key deficiencies in the following areas related to NJDEP's ambient water quality monitoring program:

- Adequacy of the NJDEP water quality monitoring network – rivers, streams and groundwater
  - Insufficient number of physical / chemical surface water and ground water monitoring stations, and insufficient frequency of sampling for conventional parameters. In addition, the sampling frequency for metals, pesticides, volatile organic carbon (VOC) compounds, and sediment quality was evaluated as being insufficient to adequately assess the State's waters under the Clean Water Act.
  - Ambient biological monitoring stations are only sampled once every five years on a rotating basin schedule, and were not sufficient to assess all of the waters of the State
- Inadequate monitoring and assessment of NJ public lakes
  - NJ has not routinely performed water quality monitoring so that the status and trends in lake water quality could be assessed and reported.
  - NJ has not identified the sources and causes of pollution related to lake water quality impairments
- Timeliness and adequacy of biennial water quality assessment report (305(b)) and lists of impaired waterbodies (303(d)lists)
  - The reports, in addition to being late, were determined to be incomplete due to the inadequacy of the monitoring data used in the assessment
  - The lists, in addition to being late, were judged as being incomplete due to the inadequacy of the monitoring data used in the assessment

[1] §106(e) of the Clean Water Act provides that ... "the Administrator shall not make any grant under this section to any State which has not provided or is not carrying out as part of its program - the establishment and operation of appropriate devices, methods, systems, and procedures necessary to monitor, and to compile and analyze data on (including classification according to eutrophic condition), the quality of navigable waters and to the extent practicable, ground waters including biological monitoring; and provision for annually updating such data and including it in the report required under [section 305 of this Act]..."

In the time since the 1999 audit, NJDEP has made some incremental progress in addressing a number of the deficiencies noted above:

- Adequacy of water quality monitoring networks (rivers and streams) – In FY2000, NJDEP added approximately 90 stations, statewide, for conventional water column sampling in a Supplemental Network. NJDEP is actively evaluating the addition of metals, VOCs, pesticides and sediment quality monitoring to these supplemental sites in FY2005. Also in FY2005, in order to enhance NJ's assessments of water quality, the frequency of metals monitoring at limited, randomly selected sites has been increased from once per year to twice per year. This testing will be conducted as part of the joint DEP/USGS Cooperative Ambient Stream Monitoring Network (which is discussed, in detail, later in this document).
- Inadequate monitoring and assessment of NJ lakes - In FY05, NJDEP initiated a renewed ambient lakes monitoring program (discussed in detail later in this document). This program involves the testing of randomly selected lakes from the state's approximately 1,200 named lakes. Such testing will assist New Jersey in determining the status and, eventually, trends in lake water quality, as needed, to meet our Clean Water Act requirements and our Total Maximum Daily Load (TMDL)-related water quality assessment obligations. In FY2005, NJDEP has also initiated expansion of laboratory capabilities for tracking sources and causes of microbial water quality impairments, including lakes (discussed in detail later in this document).
- Timeliness of 305(b) report and 303(d) list submissions – Improvements have been made in the completeness of the reports and timeliness of submittals. Limitations to report completeness continue to include availability of monitoring data. A discussion regarding submission of the water quality assessment report and impaired waterbodies list (now known as the Integrated Water Quality Monitoring and Assessment Report) may be found under the general "Reporting" section later in this document.

In addition to participating in formal audits, NJDEP employs a variety of ongoing program evaluation mechanisms which include both periodic internal and external audits, annual program reviews, as well as informal and formal workgroups, which often include our EPA partners and other federal agencies.

B. PURPOSE

The purpose of this long-term monitoring strategy is threefold:

1. Document the State of New Jersey's implementation of EPA's recommended elements of a State water monitoring program, in accordance with the regulations addressing water management plans under Section 106(e) of the Clean Water Act (33 USC 1256(e). All states are expected to provide and carry out a water quality monitoring program for use in compiling the 305(b) report as a condition of the Administrator making Section 106 grants to the State, and
2. Provide a framework for the State to articulate its programmatic and resource needs to implement the elements above, and
3. Serve as a tool to help EPA and the State determine whether NJ's water quality monitoring program meets the prerequisites of CWA Section 106(e)(1).

This Strategy describes how the NJDEP plans to implement its mission and achieve its goals under the Federal Clean Water Act for the period July 2004 – June 2014, in two five year planning phases. All of the implementation plans are dependent upon availability of resources and needed technical support, as articulated in the Strategy.

C. STRATEGY DEVELOPMENT APPROACH

In March 2003, EPA released the first comprehensive set of guidelines for developing or updating state water quality monitoring and assessment programs to ensure compliance with Clean Water Act requirements. The guidelines, *Elements of a State Water Monitoring and Assessment Program*, were developed to recommend the basic elements of an adequate state water monitoring program. Under these guidelines, in order to receive FY04 Section 106 funds, states must commit to develop and/or revise their water monitoring program strategy. A letter confirming the need for development of this strategy, as part of the continued receipt of NJ's section 106 funds, was sent from EPA Region 2 to NJDEP in May 2003 (see Appendix 2). EPA also included in the letter their commitment to work closely with NJDEP in reviewing its monitoring program to determine if adequate progress is being made and whether the program meets the intent of the section 106 funds. As such, a commitment regarding this monitoring program strategy has been included in the NJ's Performance Partnership Agreement (PPA) with EPA Region 2.

As the Guidelines detail, the monitoring program strategy is to cover all waters of the state (streams, rivers, lakes, reservoirs, estuaries, coastal areas, wetlands and ground water). For each waterbody type, the strategy must include discussions of 9 basic elements:

1. Monitoring objectives
2. Monitoring design
3. Core & supplemental water quality indicators
4. Quality assurance
5. Data management
6. Data analysis/assessment
7. Reporting
8. Programmatic evaluation, and
9. General support and infrastructure planning.

The strategy is to be long-term, encompassing a ten-year timeframe, and is to include technical issues and resource needs that are impediments to an adequate monitoring program. The strategy is also to include timelines for planned implementation of various aspects of the monitoring program.

In accordance with these guidelines, NJ has developed a long-term water monitoring and assessment strategy, the scope of which includes monitoring the ambient waters of the state, which is primarily the responsibility of NJDEP to conduct or coordinate with its partners. This monitoring includes water testing associated with aquatic living resources, including shellfish. Unlike some state environmental agencies, NJDEP includes both the environmental regulation, as well as the natural resource programs, within the same agency. Also, unlike many other state environmental agencies, NJDEP has responsibility for implementation of the water monitoring portion of the National Shellfish Sanitation Program for the state. For both non-tidal rivers and streams, and groundwater monitoring, NJDEP works cooperatively with its partner, the NJ District of the US Geological Survey (USGS) to perform a significant portion of this monitoring. These important cooperative water testing programs are included in NJ's strategy.

While most of the ambient water monitoring in NJDEP is done by the Water Monitoring and Standards Program, there are other programs in the department that also perform ambient water monitoring and these are included in this Strategy as well. The Strategy also contains several other NJ water monitoring partnerships conducted outside of NJDEP, including EPA's National Coastal Assessment Program, NJ Department of Health & Senior Services' (NJDHSS) Lakes Bathing Beach Monitoring, and the NY/NJ Harbor Dischargers Ambient Monitoring program.

NJDEP plans to re-evaluate this Strategy every three (3) years and will include updates on any progress that is able to be made in implementing the Strategy in its annual progress reports, submitted to EPA Region 2 as part of the Performance Partnership Agreement.

D. ORGANIZATION OF STRATEGY DOCUMENT

The Strategy document is organized by waterbody type (e.g., rivers and streams, lakes and reservoirs, etc.). Within each monitoring area, current ambient monitoring programs are described and each of the 9 elements are discussed, the gaps are identified as well as the resource and technical support needs to fill these gaps. For programs that cross waterbody types (e.g., Toxics in Fish & Shellfish), a separate program description is included at the end of the document. In developing each of the monitoring program strategies, NJDEP considered the 5 overall assessment-related questions (listed below) as well as the Core Indicators contained in the EPA guidance document. Because this strategy is intended to serve as a 10-year plan for NJ's water monitoring and assessment programs, NJDEP has chosen to present its timelines for addressing these gaps in two 5-year intervals (2005-2009 and 2010-2014) so as to highlight short-term vs. long-term plans and needs.

Assessment-related questions to be considered in Strategy development:
1. What is the overall quality of the waters of the State?
2. To what extent is water quality changing over time?
3. What are the problem areas and areas needed protection?
4. What level of protection is needed?
5. How effective are clean water projects and programs?

MONITORING GOALS & OBJECTIVES

A. NJDEP MONITORING PROGRAM STRATEGY

As described above, the State of New Jersey has developed a comprehensive monitoring program strategy that is designed to serve its water quality management needs and addresses all State waters, including streams, rivers, lakes, reservoirs, estuaries, ocean, wetlands, and groundwater. This strategy describes how the State plans to address each of the remaining nine elements. The monitoring program strategy is a long-term implementation plan and includes a timeline for completing implementation of the strategy. The strategy is comprehensive in scope and identifies the technical issues and resource needs that are currently impediments to an adequate monitoring program. The strategy includes three general types of approaches:

(1) LONG –TERM AMBIENT MONITORING

Long-term ambient monitoring strategies employed by the NJDEP are comprised of multiple water quality assessment techniques including: fish population surveys for the Fish Index of Biotic Integrity (IBI), habitat assessments, biological monitoring, collection of physical/chemical data on a variety of matrices (fresh and marine waters, ground water, sediment), and sediment toxicity testing. Such monitoring is generally conducted through statewide or broad scale networks, and over extended periods of time.

(2) TARGETED WATER QUALITY MONITORING

The NJDEP conducts a variety of targeted monitoring efforts related to impairment, source identification and Total Maximum Daily Load (TMDL) development and verification, including the identification of pollution sources in the coastal and freshwater environment (discharges, stormwater, marinas), and the verification of bacterial contamination in fresh non-tidal waters. Such monitoring is limited geographically and conducted for defined periods of time.

(3) VOLUNTEER MONITORING

Through its volunteer monitoring program, the NJDEP is reaching out to residents of each watershed across the state and utilizing the services of these citizen scientists who monitor their backyard stream, neighborhood marsh or other surface water body for various chemical, biological and/or physical parameters. By recruiting and training these individuals, a more comprehensive approach is taken and more of the state's waterways can be tested. Many of these volunteers are represented by organizations that have their *own* long standing monitoring programs throughout NJ; these groups participate in the Department's volunteer monitoring program through an umbrella advisory council called the Watershed Watch Network (WWN).

A four-tiered approach (http://www.nj.gov/dep/watershedmgt/volunteer_monitoring.htm) has been developed to facilitate the appropriate use of data generated by WWN member organizations and incorporate this data into various applications at the state level, such as supplementing Total Maximum Daily Load (TMDL) pollutant source track down assessments. Quality controls are designed into the system via increasingly rigorous requirements (e.g., an EPA-approved Quality Assurance Project Plan, Department-sponsored training and use of certified labs for analysis of samples) as the tiers progress. The intended use of the data changes accordingly, from education and stewardship to indicators and regulatory response.

B. NJDEP MONITORING OBJECTIVES

The State of New Jersey has identified monitoring objectives critical to the design of an efficient monitoring program that is effective in generating data that serve management decision needs. The State plans to implement a monitoring program that reflects a full range of water quality management objectives including, but not limited to, Clean Water Act goals.

(1) ESTABLISHING WATER QUALITY STANDARDS AND CLASSIFYING WATERS

- NJ's monitoring programs will provide data of sufficient quality, frequency, and scale to permit the definition and publication of reasonable, clear and predictable scientifically based standards.

(2) DETERMINING WATER QUALITY STATUS AND TRENDS

- Under Section 305(b) of the Federal Clean Water Act, the State of New Jersey will, on a biennial basis, determine to what extent its waters meet the objectives of the Act, attain applicable state water quality standards, and provide for the protection and propagation of balanced populations of fish, shellfish and wildlife (40 CFR 130.8). Furthermore, the State will assess and report on the extent to which pollution control programs have improved water quality for the purposes of, "the protection and propagation of a balanced population of shellfish, fish and wildlife and….

recreational activities and on the water" (40 CFR 130.8(b)(2) and 130.8(b)(1)). In addition, under Section 319(h)(11) of the Act, the State of New Jersey will report on any reductions in non-point source loadings or related improvements in water quality. New Jersey seeks to determine the status and trends in the water quality in its lakes, under Section 314(a)(1)(F) of the Act. The State also plans to identify emerging environmental issues related to new pollutants or changes in land use within its watersheds.

(3) IDENTIFYING IMPAIRED WATERS AND WATERS NEEDING PROTECTION

- The State of New Jersey, under Section 303(d) of the Act, will identify both impaired waters and those waters currently of high quality, which need to be protected from degradation.

(4) IDENTIFYING CAUSES AND SOURCES OF IMPAIRMENT

- The State of New Jersey will, in order to protect and restore its waters, conduct monitoring and assessment programs designed to identify the causes and sources of impairment.

(5) IMPLEMENTING WATER QUALITY MANAGEMENT PROGRAMS

- The State will conduct monitoring aligned with the level of protection determined necessary to protect water quality. For example, the State will use data from its monitoring programs to conduct the triennial reviews of the NJ Surface Water Quality Standards, conduct use attainability analyses, develop and adopt revised designated uses and water quality criteria, establish water quality based effluent limits in NJPDES permits, establish total maximum daily loads (TMDLs), and assess the appropriateness of non-point source best management practices.

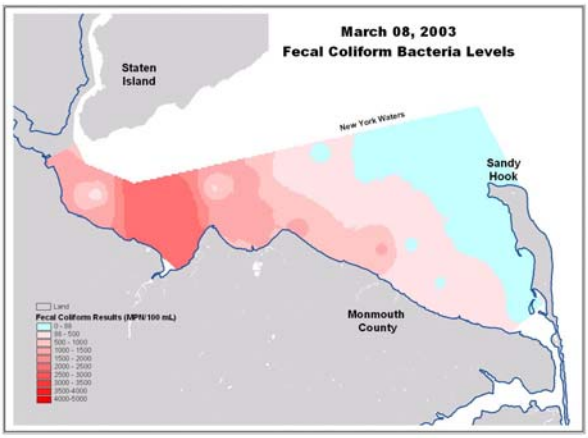
(6) EVALUATING PROGRAM EFFECTIVENESS

- The State will conduct monitoring designed to evaluate the effectiveness of the Section 319 (non-point source control), Section 314 (Clean lakes), Section 303(d) Total Maximum Daily Loads (TMDLs), water quality standards modifications, and the NJPDES compliance programs.

(7) RESPONDING TO ENVIRONMENTAL SPILLS

- The State will conduct intensive monitoring in response to spills and unpermitted discharges that impact its waters. Some monitoring can occur on a large scale such as response to inundation of sanitary systems during coastal flooding events. Other monitoring will take place in localized areas suspected of impacts from a spill. Spill response monitoring is used to verify model predictions of the spill impact and to assess the degree to which waterbodies are recovering from spill events (see example).

Example Spill Impact Monitoring



(8) INFORMING THE PUBLIC ABOUT THE CONDITION OF NEW JERSEY'S WATER RESOURCES

- Information and data from New Jersey's water monitoring programs will be used to inform the public, in various ways, about the ambient condition of the state's water resources.

MONITORING PROGRAM DESIGN

A. NJDEP MONITORING DESIGN

There are three basic monitoring designs: (1) a fixed station approach, (2) a probabilistically based approach and (3) an approach to address source identification and responses to environmental spills:

1. FIXED STATION DESIGN

   Monitoring designed around fixed stations can be useful in either targeting areas which are subject to pollution, areas which are expected to exhibit either significant improvement or degradation, or in order to detect trends in water quality. However, confidence in the applicability of fixed station data to conduct statewide assessments is limited. NJ ambient water monitoring programs which sample from fixed sites over long periods of time do so to provide information concerning both water quality status and trends.

2. PROBABILISTICALLY-BASED DESIGN

   An alternative approach to fixed stations is to select stations via a probability-based design, which allows a statistically derived estimate of water quality conditions in a selected area even when all waters within that area are not directly sampled. Based upon the natural variability of water quality conditions and the level of sampling effort used, a level of confidence or certainty in this estimate can be determined. Where fixed sites often are used to quantify change at targeted locations, probabilistic sampling emphasizes spatial quantification of water quality conditions.

3. SOURCE IDENTIFICATION AND SPILL RESPONSE

   A different approach is needed for monitoring to identify pollution sources impacting a water body or to measure impacts and recovery of a water body to a spill event. This sampling is normally very intensive, both spatially and temporally in order to characterize the local impact of a short-term pollution event. Sampling stations are established based on the existing knowledge of the pollution source such as from historical water quality monitoring or from model predictions. Often, multiple sampling events are necessary to properly characterize the impact. Sampling design can often be dynamic – adjusting to changing pollution conditions, changing environmental conditions or simply being fine-tuned based on information gleaned from prior sampling events.

These basic approaches can, in the interest of either increased efficiency, or to accommodate multiple purposes, or both, be combined when designing a monitoring program (e.g., the Ambient Surface Water Monitoring Network - a fixed station sampling design which includes both targeted land-use and probabilistic statewide status elements). The NJDEP's diverse water quality monitoring programs (e.g., fixed station, intensive survey, and rotating basin monitoring) integrate multiple designs to meet the full range of

information needs for decision makers. Each monitoring design may require a different number of samples, exhibit a different sampling bias, and have a different basis for sample site selection. Accordingly, maximizing the applicability of the monitoring data requires that the monitoring design be matched to the monitoring goals of a given program. Analysts using data collected for one program's goals to meet the goals of another program (e.g., using statewide status and trends assessment data for validation of TMDLs) need to clearly understand the monitoring design used, including how the strengths and weaknesses of the specific monitoring design could affect the applicability of these data to a given water quality program. The sampling approaches selected for each water quality monitoring program are described later in this document.

CORE AND SUPPLEMENTAL WATER QUALITY INDICATORS

Environmental indicators are direct or indirect measures of environmental quality used to assess the status and trends of environmental conditions. As such, indicators are critical components of the Department's ability to assess overall ambient water quality. An indicator's value is increased to the degree that it is based on readily available, technically sound data that are collected regularly and are sensitive to change (i.e., . indicators that show trends are preferable as they allow for assessment of changes over time).

NJDEP has a variety of water indicators that it uses to express water quality. Some of these indicators are used for specific purposes (e.g., enterococcus for marine bathing beach closings) while others are used regularly (e.g., shellfish harvestable waters) to continually measure New Jersey's ambient water quality. Many of these indicators have been reported in the Department's Environmental Indicators Technical Reports (1998 and 2001) and State of the Environment reports (1998 and 2000) – NJDEP has previously prepared several of these reports and is currently in the process of preparing a new environmental trends report for 2005. Some of these indicators were also previously negotiated and developed, as part of the NEPPS PPA process, as Core Performance Measures.

Specific indicators or parameters used as part of each of the monitoring programs (including those found in Table 1 of the EPA guidance document) are discussed within each of the individual program write-ups.

QUALITY ASSURANCE AND QUALITY CONTROL MEASURES

The NJDEP administers environmental programs and requires adherence with state and federal regulations that require environmental data to be of documented quality. As such, the Department has the responsibility to ensure that environmental data is generated, compiled and reviewed under specific quality assurance/quality control (QA/QC) procedures to ensure that it is suitable for its intended use.

In order to comply with these regulations, NJDEP implements a Quality Management Plan (QMP), which is overseen by the Department's Office of Quality Assurance. The QMP documents the Department's quality system and describes its quality policies and procedures, roles, responsibilities, and authorities in accordance with "EPA Requirements for Quality Management Plans" EPA QA/R2, March 2001. EPA requires that states receiving federal grants have a QMP with quality assurance work outputs, as promulgated in Title 40

Federal Code of Regulations, Parts 31 and 35. The QMP is supported by project-specific Quality Assurance Project Plans (QAPPs) which detail how specific QA/QC activities will be applied during a particular project.

The NJDEP provides for the validity and integrity of analytical data used by the Department through the administration of the Laboratory Certification Regulations (N.J.A.C. 7:18). All Department programs requiring analytic data for regulatory and enforcement programs utilize laboratories certified by the Office of Quality Assurance which certifies over 800 laboratories each year. The certification is offered through both the State Environmental Laboratory Certification Program and the National Environmental Laboratory Program.
Additional information on specific QA/QC procedures for each particular type of waterbody monitoring can be found in the subsequent chapters of this document.

DATA MANAGEMENT

NJDEP is committed to recording water monitoring data electronically and in a timely manner; integrating its data in a way that allows for efficient storage, retrieval, and evaluation of data; and reporting and sharing its data with EPA, other states and government agencies, regulated entities, constituents and the general public. The Department's enterprise data management solution (NJEMS – New Jersey Environmental Management System) supports the collection and review of permit applications, as well as emission statements, testing documents, monitoring reports and enforcement actions for multiple program areas and media. There are needs within NJDEP, to integrate the readily available data from NJEMS with data from other environmental data management systems (STORET, NWIS) for use in the Department's Integrated Water Quality Monitoring and Assessment Report and for reporting to EPA via its Assessment Database.

Current Systems
NJDEP utilizes multiple electronic systems for storing and retrieving its monitoring results. These systems include:

- NJ STORET - (NJDEP's local implementation of EPA's STOrage and RETrieval water quality database) for a substantial portion of New Jersey's ambient water quality monitoring data.
- USGS NWIS - (National Water Information System) for results from cooperative monitoring efforts with the New Jersey District of the USGS.
- NJBMS - (New Jersey Beach Management System) for beach monitoring data.
- NJEMS - (New Jersey Environmental Management System) for creating/modifying permits, creating inspection checklists and recording inspection results, creating violations and enforcement actions, and managing reporting data and automating compliance verification.
- EQuIS - (Environmental Quality Information System) for site remediation groundwater data.
- PWTA - (Private Well Testing Act database) for results for monitoring required under the Private Well Testing Act
- NJ SDWIS - NJDEP's local implementation of EPA's Safe Drinking Water Information System

NJDEP currently does not use EPA's Assessment Database (ADB) for reporting 305(b) water quality assessment information, as, in its initial design, it was not compatible with the Department's method for listing waterbody/parameter combinations. The Department will be evaluating the recently upgraded version of the ADB, which was re-designed to take into account waterbody/parameter combinations, to determine whether the database can report out information summaries necessary to answer management questions. Although the Department has not used ADB for reporting to EPA in the past, the Department

has provided EPA's consultant (Research Triangle Institute) with the necessary data in Excel for uploading into the national assessment.

Water Quality Information

NJ STORET is used to store data from New Jersey's water quality monitoring activities, including:

- The supplemental Ambient Stream Monitoring Network
- 303(d)/TMDL related monitoring (surface water and sediment)
- multi-day data sonde/data logger results
- AMNET benthic macroinvertebrate monitoring and habitat assessment
- Fish Index of Biotic Integrity (IBI) population studies and habitat assessments
- Ambient lake monitoring studies
- Shellfish Growing Waters Classification monitoring
- Marine Water Nutrient Monitoring
- Stormwater monitoring in estuarine and fresh waters
- Individual results from long term (9-months) data sondes/loggers in New Jersey's bays

Information not currently stored in NJ STORET

- Fish tissue analysis
- Results from 319(h) grant monitoring
- Results from volunteer monitoring, and some additional external monitoring partners

Data Entry

Currently, results and metadata are manually entered into STORET through the Data Entry Module and through the STORET Interface Module (SIM) after extensive, manual reformatting of files exported from the state laboratory and those created in Excel and Access by the field staff. NJDEP is working toward providing a web solution for laboratories and field staff to submit water analysis data to the department. Once that solution is place it can be enhanced to include NJSTORET data.

The NJ District of the USGS receives both field and laboratory results from the NJ state lab and enters those results into NWIS. Although a pilot flow of data from NJ NWIS to NJ STORET was developed, the resources for that solution are no longer available and it was decided (with EPA Region 2's concurrence) that entering the same data points into two systems was inefficient and could lead to bias when the data was retrieved from both systems and combined.

NJDEP does not currently capture and make available results from 319(h) grant monitoring, volunteer monitoring or other data generators (academic, quasi- and inter-governmental entities). The past practice has been to suggest the groups obtain and run their own local copy of STORET. For various reasons, this has not been a universally successful strategy. The Data Management/Data Exchange subcommittee of the NJ Water Monitoring Coordinating Council is seeking to define common exchange elements and is evaluating multiple solutions including the upcoming SIM-Web (a Web-based version of SIM that doesn't require a copy of STORET) to meet this need. All work related to define the common data exchange elements will use the Environmental Data Standards Council (EDSC) standards where they exist and will notify EDSC where standards do not already exist.

For the purposes of NJDEP's Integrated Assessment of ambient water quality, the Department has requested data from external sources in a specific format. In the next 5 years, it is intended to put these requirements into MOUs, 319(h) contracts and other agreements with other data generators.

NJDEP is developing a process to allow laboratories and water companies to submit drinking water data to NJEMS, NJ SDWIS and PWTA. The Department is also investigating a similar solution based on the eDWR schema, to move data from the state Laboratory Information Management System (LIMS) into NJ STORET. If resources are available, that data flow will be added in the next 5 years.

Over the next five years NJDEP intends to implement a process by which all persons/entities wishing to submit ambient water data to NJDEP will be able to do so through a web-based interface. From this interface, data will flow to the appropriate database using EDSC approved data standards and approved XML schemas over the National Environmental Information Exchange Network (Exchange Network). Ambient water data will also flow between NJDEP and EPA using these same standards, schemas, and network.

Geospatial Data

Most of NJDEP's GIS data layers are now available for download from NJDEP's website. Many of these layers are available for viewing in the very successful i-MapNJ series of interactive mapping applications. I-MapNJ is an easy to use viewer that runs in the Explorer browser and allows non-technical individuals to view and query many of the NJDEP's GIS datasets. Staff at the NJDEP use ESRI's ArcGIS suite of GIS software. The public has the option of using i-MapNJ, or the free download viewer, ArcExplorer software from ESRI. NJDEP offers i-MapNJ training classes for NJDEP staff and the public.

By Administrative Order (No.1994-15), NJDEP requires GIS products to conform to its Mapping and Digital Data Standards document. GIS data must also be consistent with the Content Standard for Digital Geospatial Metadata (CSDGM) set by the Federal Geographic Data Committee (FGDC). The NJDEP currently uses ESRI's ArcCatalog and other online metadata tools to view, create, edit, import, and export FGDC compliant metadata for geospatial data sets. NJDEP's use of these Federal standards facilitates data input into the NJDEP GIS, distribution of data on the NJDEP website, and with posting metadata in standard geospatial clearinghouses as the New Jersey Geographic Information System (NJGIN) and the Federal Geospatial One Stop (GOS). GIS data and program data are stored in NJEMS which allows the NJDEP to integrate spatial data with program data. Much of these data are shared back with the regulated community and public as appropriate through DEP Data Miner, an Internet application that supports the NJ Open Public Records Act (OPRA).

NJDEP has contracted with the NJ District of the US Geological Survey and has coded its 1:24,000 scale digital hydrography (the current DLG derived hydro) with NHD attributes. The Department is currently delineating new hydro lines statewide from the 2002 digital color infrared (CIR) imagery (1:2400) and is evaluating the conflation of NHD data to this new coverage. The NJDEP also intends to code all monitoring stations in STORET with some of the more useful NHD attributes, but STORET Technical Support has yet to develop guidance for entering NHD information into STORET.

Data Retrieval and Analysis

NJDEP plans to use the results from all appropriate NJDEP databases, data available from STORET, NWIS as well as the ADB for the varied data analysis and trend assessments required. NJDEP's Division of Watershed Management (via a contractor) has modified EPA's BASINS program to facilitate spatial retrievals of current data from NJ STORET and USGS NWIS and to facilitate water quality analysis, modeling and TMDL development. There are still formatting and conversion issues that prevent the Department from accessing all the data from national STORET for analysis. NJDEP will continue to work to resolve these issues over the next 5 years.

The Department has taken steps to integrate data selection and display through NJDEP's reporting tools Business Objects and Web Intelligence as well as linking these reporting tools to iMap NJ to allow for spatial analysis of data retrieved through these tools.

The applications that are currently being tested will allow NJDEP to develop reports for internal use and post them for public access through the Department's online reporting tool, NJDEP Data Miner. NJDEP is also finalizing an ESRI Internet Map Services (ArcIMS) application that links to Web Intelligence/DEP Data Miner and will also allow users to select and view data from multiple NJDEP data sources (NJ STORET, NJEMS, EQuIS) along with over 70 departmental GIS layers in a Web browser based environment.

Data Exchange

All data exchanges from NJDEP to EPA are currently handled by exporting data from the specific database and transferring the export file to EPA's databases (STORET, SDWIS and PCS) via email or FTP. NJDEP has implemented a node on the Exchange Network and is working to send Extensible Markup Language (XML, a simple, very flexible text format for the exchange of a wide variety of data) flows to EPA's Beach Reporting System (PRAWN), Permit Compliance System (PCS), Facility Registration System (FRS), National Emissions Inventory (NEI), and RCRA data between now and June 30, 2005 depending on the flow. The Department has received FY04 Challenge Grant monies for a flow to EPA SDWIS, and hopes to submit a proposal for FY05 Network Exchange Grant monies to develop a critically needed exchange between NJDEP and EPA STORET.

Over the next 1-5 years, NJDEP plans to enhance the data exchange between EPA, other states and partners using the Exchange Network, XML and approved data standards. During the period of implementation of the above plan and immediately afterwards NJDEP will evaluate its configurations in terms of accessibility, performance, quality of the data and availability of the data for reports and analysis. The Department will also look at the process outside the system in terms of additional data that has been identified for further analysis, new legislative mandates, new EPA requirements and technological advances that have been made to enhance the system. It is difficult to plan beyond 5 years in the IT world because technology and user needs increase so rapidly. However, NJDEP will use the next five years to implement the plan described above and develop a plan to enhance the system for the following five years.

Resource and Technical Support Needs

1. Development and Support of CDX and STORET – NJDEP intends to work closely with EPA to identify opportunities to enhance STORET to make it a more comprehensible, user-friendly system that is easier to put data in and get data out. NJDEP intends to develop XML data exchange to flow data between NJSTORET and STORET FED through CDX on the Exchange Network utilizing EDSC approved data standards and approved XML schemas and is currently looking for funding opportunities to support the project.
2. Data Reporting – NJDEP may need funding to design and develop complex integrated reports from these systems if they cannot be developed in-house. These will include applications and queries for data analysis, including statistical summaries of the data and for identifying violations of the Surface Water Quality Standards, (which is dependent of the stream classification). Programming support is also needed that takes the end point of values from the Multiple Antibiotic Resistance (MAR) test and determines if the bacteria are likely from a human or animal source (Note: NOAA has such an approach).
3. Internal Database – NJDEP needs an integrated data source for monitoring results from fish tissue, EQuIS, DMR, NJEMS and DFW fish tracking database as well as externally generated (contractor, volunteer, local group) data.

4. Geospatial Data Development – Significant funding will be necessary to code the new 2002 hydrography GIS data layer (streams and open waters in NJ) with Surface Water Classifications, names, National Hydrographic Dataset (NHD) attributes and shellfish growing water classifications. EPA also needs to devote resources to developing and producing a version of the NHD Toolkit which will allow batch processing of GIS data for monitoring stations so that it will be easier to enter data with NHD attributes into STORET.
5. Data Logger Files – EPA needs to dedicate space on their STORET Web Server for permanent display of data logger results. A permanent location would allow NJDEP to specify that Web page on our departmental Web pages and make that information available to the public. This would ensure that data access is direct and simple for the user.
6. Non-STORET Data Submission – EPA needs to provide resources and technical support for the development of easy, low cost solutions to enable organizations not running STORET to submit ambient water quality data to NJDEP.
7. NJDEP Data Entry into NJ STORET – NJDEP may need funding and technology support from EPA to improve the flow of NJDEP generated data into NJ STORET (from sample collection to STORET data entry.) Areas to be addressed include: integrated and paperless recording of station locations, field measurement/observations; paperless analysis requests; automated turn-key solutions for transmitting sample from the lab to STORET and development of efficient batch procedures to edit, append and delete project, station and result information in NJ STORET. EPA also needs to finalize guidance for entering NHD information into STORET.
8. Commitments - NJDEP will need to maintain a long-term commitment of staff resources from within its programs and from within NJDEP's Office of Information Resource Management to support these important water monitoring data management efforts.

Additional information on the use of STORET or other NJDEP or federal databases as the repository for data generated by the various monitoring programs described within this strategy may be found within the individual monitoring program description.

DATA ANALYSIS / ASSESSMENT

Under Section 303(d) of the CWA, the Department is required to assess all readily available water monitoring-related data, including data generated by governmental and non-governmental entities. Every 2 years, the Department solicits data from the various Divisions within the Department as well as entities outside of the Department including other public entities (e.g., counties, Delaware River Basin Commission, Interstate Environmental Commission, and neighboring states), academia and volunteers. The Department provides notice of the request for data in the New Jersey Register and the Department's website prior to developing each Integrated Report.

Examples of data assessed by the Department include physical, chemical (both conventional and toxic), water column, fish tissue, benthic macroinvertebrate, fish assemblage, habitat and bathing beach data. In determining which data are appropriate and readily available, the Department takes into consideration quality assurance/ quality control, monitoring design, age of data, accurate sampling location information, data documentation and use of electronic data management. The Department has developed an Integrated Water Quality Monitoring and Assessment Methods Document which provides an objective and scientifically-sound waterbody assessment methodology including:

- A description of the data that the Department will use to assess surface waters;

- The quality assurance requirements of the data; and,

- A detailed description of the methods used to evaluate the attainment of water quality standards.

The Methods Document, as well as the 2004 Integrated Water Quality Monitoring and Assessment Report (which contains the 303(d) list of impaired waterbodies), are available at www.state.nj.us/dep/wmm/sgwqt/wat.

The data assessment of shared waters in the Delaware River/Estuary is conducted by the Delaware River Basin Commission (DRBC). DRBC has a Methods Document describing the procedures used to assess the shared waters of the Delaware which is available at www.state.nj.us/drbc/2004AssessMethod031104.pdf.

Strategic Assessment Enhancements
Planned actions to improve assessment decisions include:

- **Benthic Macroinvertebrates.** The Department determined that its current multi-metric assessment tool, based on benthic macroinvertebrates, was not appropriate for several locations. The Department is working with the Pinelands Commission and EPA Region 2 to develop a multi-metric assessment for Pinelands waters, headwater streams with a watershed of less than 6 square miles, and sites located downstream of impoundments. These impairments will continue to be listed on Sublist 3[2] until a new designated use assessment can be completed. The Department is working with EPA to evaluate and integrate Tiered Aquatic Life Uses (TALU) into its classification system. This will improve aquatic life use assessment decisions.

- **Lakes.** The Department has recently initiated a monitoring program to assess the eutrophic status of lakes statewide based upon probabilistic methods recommended by EPA. Many lakes currently listed on Sublist 3 do not have data available to assess current status. Lakes will remain on Sublist 3 until new data become available and the designated uses can be assessed.

- **Insufficient data**. The Department randomly selects 40 stations from a network of over 800 Ambient Biological Monitoring Network (AMNET) locations to monitor for chemical/physical parameters (statewide status sites). Initially, quarterly sampling was conducted for one year. As a result, these sites had insufficient data for water quality assessments and were placed on Sublist 3. The Department has extended the sampling at each location to ensure that a minimum of eight samples are collected so that an assessment can be made. Locations with insufficient data will remain on Sublist 3 until enough data are available to assess.

- **Metals**. Surface Water Quality Standards for several metals are below the method detection limit (MDL) currently employed by NJDEP and USGS. Sites have been listed on Sublist 3 if current sampling has detected no metals but the detection limits are higher than our SWQS. The Department is currently discussing various analytical options with the USGS that could be applied to the Ambient Stream

[2] Sublist 3, of the Integrated Water Quality Monitoring and Assessment Report, contains waters with insufficient or no data and/or information to determine if any designated use is attained. Waters are listed here where data or information to support an attainment determination for any use are not available, consistent with the requirements of the state's assessment and listing methodology. This category also includes locations where there are sufficient data to make assessments, however, criteria or guidelines for making a use attainment assessment are currently not available.

Monitoring Network (ASMN) in order to lower the current levels of detection for these selected metals so that enhanced assessment decisions can be made. There are also historic metals listings for which new base flow data shows no exceedances and the Department has identified these for additional high flow monitoring.

- **Pathogens.** The Department has listed waters impacted by Combined Sewer Overflows (CSOs) on Sublist 3 although current water quality data collected did not indicate exceedences of the current criteria. The Department has determined that the current "center channel" monitoring does not adequately evaluate the impact of CSOs near shore where recreational activities are more likely to occur. The New Jersey Harbor Dischargers Group (NJHDG) has initiated monitoring intended, in part, to address this gap (see section, later in this document, describing the ambient monitoring performed by the NJHDG). The Department anticipates reassessing these waters in 2006 based on this new sampling effort.

- **Benthic assessment for coastal waters.** Data are presently being collected in New Jersey's estuarine waters through EPA's National Coastal Assessment (NCA) Program, and the Department anticipates expanding this monitoring to include the nearshore ocean waters, if resources are available, through NCA. The Department is developing estuarine and marine macro-invertebrate indices to measure and assess aquatic life impacts using these data.

- **NJDEP Site Remediation Program data.** There are ambient surface water quality data collected at some sites. As these data become available electronically, they can be used to confirm previous 303d listings which were based on proximity to hazardous waste sites rather than water quality data and to target areas for additional data collection.

- **Ambient NJPDES data.** Ambient data are collected as part of the permit requirements, often when an increase in discharge flow is requested. The Department will use these data, as appropriate, for the Integrated Report.

- **Sediment Data.** The Department does not have, at this time, a methodology to interpret sediment quality data, in the absence of sediment criteria. The Department needs to research methods for interpreting sediment data in order to consider this information in the Integrated Report.

MONITORING PROGRAM COORDINATION, COMMUNICATION, AND COLLABORATION

A. NJDEP MONITORING COORDINATION & COLLABORATION

Coordination among the numerous groups and agencies performing ambient water monitoring in NJ is accomplished through multiple mechanisms, including several important standing councils/committees which involve state, federal, local and academic partners. These include:

- NEW JERSEY WATER QUALITY MONITORING COORDINATING COUNCIL

  The New Jersey Water Monitoring Coordinating Council was established on October 24, 2003 as part of NJ's celebration of World Water Monitoring Day. The Council serves as a statewide body 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 will address the biological, chemical, physical and ecosystem aspects of water monitoring, including surface and ground waters, freshwater, estuarine, and marine environments in New Jersey.

The Council is comprised of 30 members, representing 12 different agencies/organizations. These include NJDEP, US Geological Survey, Delaware River Basin Commission, EPA Region 2, Interstate Environmental Commission, NJ Marine Sciences Consortium, Rutgers University – Institute for Marine & Coastal Sciences, Cooperative Extension Service, and Meadowlands Environmental Research Institute, NJ Water Resources Research Institute, NOAA, Pinelands Commission, NJ Water Supply Authority, and Monmouth County Health Department.

The full Council meets approximately 3 times/year to exchange information, exchange technical presentations, as well as address common issues/problems related to ambient water monitoring in New Jersey. The Council Charter (including membership list) is included as an Appendix to this strategy document. The Council has also established a website which is used as a mechanism to share NJ-related water monitoring information (www.state.nj.us/dep/wmm/wmcchome.html).

- AMBIENT SURFACE WATER MONITORING NETWORK WORKGROUP

The Ambient Surface Water Monitoring Network Workgroup is comprised of NJDEP and USGS staff involved in monitoring and data assessment for this cooperative network. The workgroup was established in 1996 to redesign the existing monitoring network. Subsequent to the redesign, the workgroup meets as needed (generally quarterly) to consider refinements to the monitoring design to reflect findings in data assessment, respond to water management information needs, address emerging water quality issues, and to incorporate new sampling and analytical methodologies.

- AMBIENT GROUND WATER MONITORING NETWORK WORKGROUP

The Ambient Ground Water Quality Monitoring Network workgroup is comprised of staff from the NJDEP New Jersey Geological Survey (NJGS), the Bureau of Fresh Water & Biological Monitoring (BFBM) and the United States Geological Survey (USGS). NJGS is responsible for oversight of the network design, maintenance and data assessment, while BFBM and USGS are both involved in performing monitoring and laboratory analysis for the network. The workgroup was established in 1999 to redesign the existing monitoring network and currently meets annually to discuss network design, sampling and current and emerging water quality issues.

- AMBIENT BIOLOGICAL MONITORING NETWORK WORKGROUP

The New Jersey Biological Technical Workgroup consists of members from NJDEP, EPA, and USGS. The Workgroup is charged with evaluating the assessments of stream segments listed in Category 3 (Insufficient Data) of the Integrated Water Quality Monitoring and Assessment Report and makes recommendations on collecting sufficient data to assess use attainment. The Workgroup's purpose also encompasses all technical support functions related to the use of biological monitoring data in the Integrated Assessment; and functions in a support role in developing biological monitoring protocols and biological TMDLs for those stream segments listed as impaired in Category 5 (Impaired waterbodies).

- INTERSTATE SHELLFISH SANITATION CONFERENCE

New Jersey has been a member of the Interstate Shellfish Sanitation Conference (ISSC) since it was formed in 1982. The ISSC mission is to foster and promote shellfish sanitation through the cooperation of state and federal control agencies, the shellfish industry, and the academic community. To achieve this mission the ISSC:

- Adopts uniform procedures, incorporated into an Interstate Shellfish Sanitation Program, and implemented by all shellfish control agencies;

- Gives state shellfish programs current and comprehensive sanitation guidelines to regulate the harvesting, processing, and shipping of shellfish;

- Provides a forum for shellfish control agencies, the shellfish industry, and academic community to resolve major issues concerning shellfish sanitation;

Informs all interested parties of recent developments in shellfish sanitation and other major issues of concern through the use of news media, publications, regional and national meetings, internet, and by working closely with academic institutions and trade associations.

The ISSC promotes cooperation and trust among shellfish control agencies, the shellfish industry, and consumers of shellfish; and insures the safety of shellfish products consumed in the United States.

NEW JERSEY WATER QUALITY MONITORING PROGRAMS

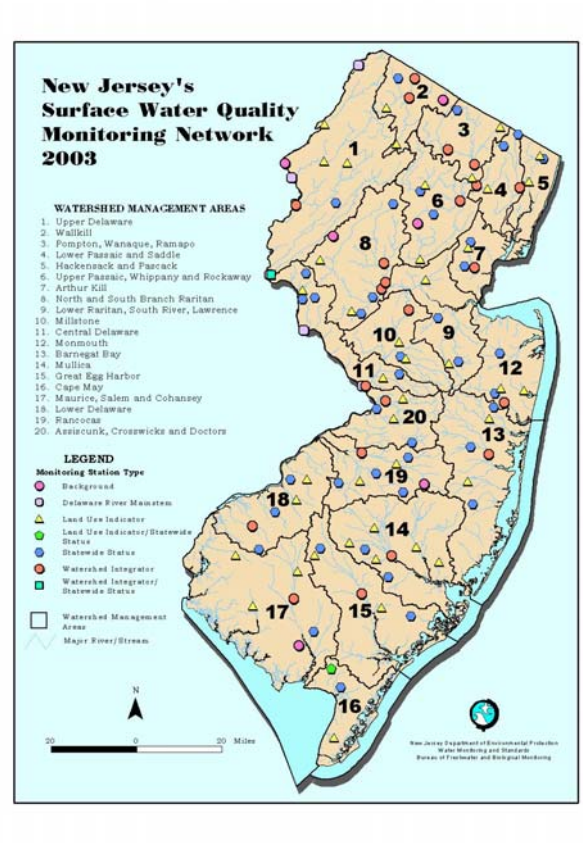
The following sections of New Jersey's long-term strategy describe the 9 elements of a state monitoring program by waterbody type and monitoring area. Additional information on the monitoring networks described below, including monitoring results as well as a networks reference guide, is available via NJDEP's Water Monitoring & Standards webpage (http://www.state.nj.us/dep/wmm/publications.html).

A. NON-TIDAL RIVERS AND STREAMS

1. AMBIENT STREAM MONITORING NETWORK (ASMN)

Monitoring Objective

The Ambient Stream (Surface Water) Quality Monitoring Network (ASMN) is a cooperative DEP/USGS program, established in the mid-1970's. A major redesign of this chemical/physical parameter network occurred in 1997. The revised network was specifically designed to address non-tidal surface water quality issues in each of the state's 20 watershed management areas through the following objectives: (1) track status and trends in ambient water quality; (2) establish background water quality; (3) obtain water quality data that can be correlated with specific land uses (urban/suburban, agricultural and undeveloped); and (4) coordinate water chemistry and biological networks.



Monitoring Design

The network is comprised of 4 station types: (1) *background/reference* – waterways located in undeveloped watersheds (generally county, state or federal parks and forests), (2) *land use indicator sites* – waterways which reflect a dominant land use (urban/suburban, agricultural or undeveloped) within a watershed management area, (3) *watershed integrator sites* – waterways which reflect large drainage areas and multiple pollution sources and (4) *statewide status sites* – 40 sites probabilistically reselected every two years from NJDEP's 800 station biological (macroinvertebrate - AMNET) network. The network consists of 115 stations, which are sampled quarterly.

Quality Assurance

A Quality Assurance Project Plan (QAPP) is developed annually for the Ambient Surface Water Monitoring Network. Components of the QAPP include: (1) annual field audits of sample collection

procedures by USGS QA Personnel (2) annual analysis of proficiency samples (pH, specific conductance and turbidity) by all field staff (3) standardized, composite sampling procedures (4) quarterly split sample and replicate sample analysis (5) annual equipment blank analysis and (6) standardized data validation procedures for all data (Methods for Quality-Assurance Review of Water-Quality data in New Jersey, USGS open-file report 02-383).

Core and Supplemental Water Quality Indicators

Core parameters monitored include the following:

- Measured quarterly –
  Flow, field parameters, total and filtered nutrients, filtered common ions

- Measured five times within 30 days, as needed, for surface water quality criteria assessments–
  Bacterial indicators

- Measured annually at selected sites –
  Diurnal dissolved oxygen (DO), filtered organic pesticides, total recoverable metals, volatile organic compounds, sediment metals and sediment polyaromatic hydrocarbons.

Data Management

Network data are available from the following sources: (1) the USGS computerized data system, NWIS (http://nj.usgs.gov), (2) EPA's computerized data system, STORET, and (3) USGS annual reports *Water Resources Data – New Jersey*.

Data Analysis / Assessment

The data collected via this Network are used in assessments for the *New Jersey Integrated Water Quality Monitoring and Assessment Report*

.

Reporting

The data are reported for each water year (October 1st to September 30th) in USGS' annual reports entitled, *Water Resources Data – New Jersey*. In addition, the NJDEP provides the results of this monitoring via the *Integrated Water Quality Monitoring and Assessment Report*. Additional information on this monitoring network is available from the Bureau of Freshwater & Biological Monitoring's webpage http://www.state.nj.us/dep/wmm/bfbm.

Program Evaluation

The ASMN has a standing workgroup which meets quarterly to review network design and consider emerging data needs. The workgroup is comprised of NJDEP and USGS staff involved with data collection and data assessment. Examples of workgroup modifications to the network include: (1) the addition of diurnal D.O. monitoring (2) expansion of metals monitoring (3) expansion of pesticide monitoring and (4) the addition of *E.coli* monitoring.

- Monitoring Timeline
  This network has four specific sampling periods annually. Samples are collected in Feb/March, May/June, Aug/Sept and Nov/Dec for routine parameters. Supplemental parameters (pesticides, VOC's, metals and sediments) are collected from targeted sites during specific sampling periods. This targeting approach results in supplemental monitoring at a full range of network station types, specifically:
  - Background or reference stations
  - Agricultural land use stations
  - Suburban land use stations

- Urban land use stations
- Watershed integrator stations, and
- Statewide status (randomly selected) stations

Bacterial monitoring occurs only during the primary contact season, May – September. Diurnal D.O. monitoring occurs only during critical summer low flow periods.

- Implementation Plans:
  - 2005 - 2009 Plan
    - Continue collection of existing core and supplemental indicators as appropriate
    - addition of periphyton chlorophyll 'a' monitoring at selected stations
    - explore need for development of monitoring approach for pharmaceuticals and/or other emerging contaminants
    - obtain lower reporting levels for selected parameters (i.e., Hg and As)
    - add 3 additional background sites to the ASMN
    - increase number of random sites to the ASMN for statewide status assessments
    - expand data summary reports
    - develop continuous water temperature monitoring
    - increase geographic cover and % of waters assessed through monitoring
  - 2010 - 2014 Plan
    - Continue collection of existing core and supplemental indicators as appropriate
    - develop resample procedures for unexpected data results
    - evaluate possible advantages of increasing sampling frequency
    - utilize improving GIS data layers to optimize monitoring locations
    - consider need for expanding bacterial monitoring beyond the primary contact season

General Support and Infrastructure Planning

RESOURCE	Current FTE	Current Annual Cost ($)	FTE & Program Improvement (5 yr.)	Annual Cost & Planned Program Improvement Five (5) Year[3]	FTE & Program Improvements (10 yr.)	Annual Cost & Planned Program Improvements Ten (10) Year[4]
Staffing	2.8	154,000	3.8	223,892	0	235,087
Operating		30,000	5,000	35,250	0	37,013
Laboratory Operating		684,000	85,000	807,450	0	847,823
Research Costs		0	0	0	0	0
TOTAL COST		868,000		1,066,592		1,119,923

[3] Adjusted for inflation @ rate of 1.0% per year from current annual cost

[4] Adjusted for inflation @ rate of 1.0% per year from current annual cost

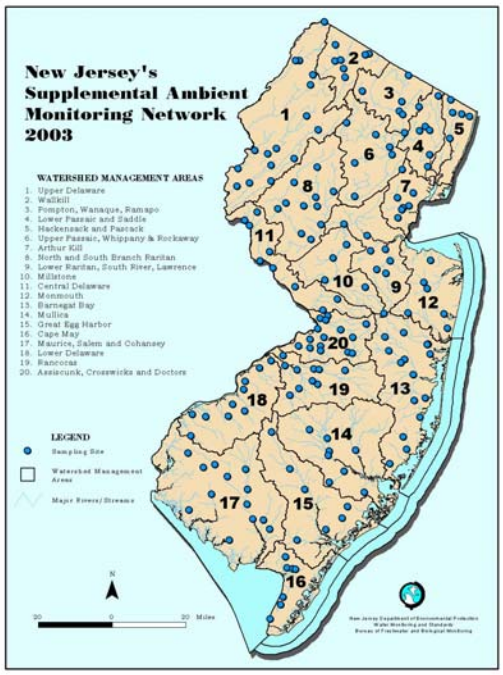
2. SUPPLEMENTAL AMBIENT SURFACE WATER MONITORING NETWORK

Monitoring Objective

The objectives of the Supplemental Ambient Surface Water Monitoring Network are to: (1) supplement the waters monitored and assessed through the NJDEP/USGS Ambient Stream Network; (2) limited expansion of ambient monitoring into selected Delaware River tidal tributaries; and (3) to identify waterways requiring TMDL assessments.

Monitoring Design

Site selection and monitoring for this Network began in 2000. Over a four year period, 178 sites are being sampled 8 times (quarterly, for two years). Station siting criteria prioritized: (1) locations at the most downstream portion of USGS' Hydrologic Unit Code (HUC) 11watershed areas; (2) locations where NJDEP has collected biological (macroinvertebrate) data and (3) if possible, local background conditions.



Quality Assurance

A Quality Assurance Project Plan is developed annually for the Supplemental Ambient Surface Water Monitoring Network. Components of the QAPP include: (1) all chemical analysis is performed at a laboratory certified by NJDEP's Office of Quality Assurance (2) replicate samples are collected at 10 % of network sites and are used to assess the combined effects of sample collection and laboratory analysis procedures on data reproducibility (3) standardized compositing techniques are used throughout the network for sample collection (4) unannounced observation of sample collection procedures occur annually and (5) data review / data validation procedures, including data assessment for historical continuity, assessment for replicate sample continuity, assessment for water quality criteria exceedences and proofing all database entries.

Core and Supplemental Water Quality Indicators

The following core parameters are monitored quarterly:

- Field Parameters:

Specific conductance, pH, water temperature, D.O., D.O. saturation, turbidity and stream flow.

- Laboratory Parameters:

  Total suspected solids, total dissolved solids, total phosphorus, dissolved ortho phosphorus, nitrate + nitrite, ammonia, TKN, sulfate, chloride and at selected sites total recoverable iron.

Data Management

Data from this NJDEP network are stored in EPA's STORET database. Additional information regarding this Network is available from the Bureau of Freshwater & Biological Monitoring's webpage (www.state.nj.us/dep/wmm/bfbm).

Data Analysis / Assessment

The data collected via this Network are used in assessments for the *New Jersey Integrated Water Quality Monitoring and Assessment Repor*t.

Reporting

The NJDEP provides the results of this monitoring via the *New Jersey Integrated Water Quality Monitoring and Assessment Report*.

Program Evaluation

This network, while providing much needed additional chemical monitoring geographic coverage throughout the state, does not include bacteriological monitoring, water column toxic monitoring, or streambed sediment quality monitoring. To fully assess the lotic surface waters of the State, these parameters need to be added. At the same time, the probabilistic component of the NJDEP/USGS Cooperative Ambient Stream Monitoring Network (ASMN) is in need of expansion. If the additional operating funds could be dedicated, both of these deficiencies in the physical / chemical monitoring component of NJDEP's ambient monitoring program could be successfully addressed in a resource efficient manner.

- Monitoring Timeline
  This network has four specific sampling periods annually. Samples are collected in Feb/March, May/June, Aug/Sept and Nov/Dec for routine parameters. Supplemental diurnal dissolved oxygen monitoring is collected from targeted sites once every four years during critical summer low flow periods. Barring additional funds being dedicated to this network, monitoring for the Supplemental Ambient Surface Water Monitoring Program, over the next five years, is expected to occur on the following timeline:
  - October 1, 2004 - September 30, 2006 - monitor first set of ~89 stations quarterly for the core and supplemental indicators (parameters) listed above.
  - October 1, 2006 - September 30, 2008 - monitor second set of ~89 stations quarterly for the core and supplemental indicators (parameters) listed above.

- Implementation Plans:
  - 2005 - 2009 Plan
    - Continue collection of existing core and supplemental indicators as appropriate
    - Add heavy metals, toxic compounds and bacteriological parameters to indicator suite
    - Addition of periphyton monitoring at selected stations
    - Develop continuous water temperature monitoring
  - 2010 - 2014 Plan
    - Continue collection of existing core and supplemental indicators as appropriate
    - Evaluate possible advantages of increasing sampling frequency
    - Utilize improving GIS data layers to optimize monitoring locations
    - Consider expanding bacterial monitoring beyond the primary contact season

General Support and Infrastructure Planning

RESOURCE	Current FTE	Current Annual Cost ($)	FTE & Program Improvement (5 yr.)	Annual Cost & Planned Program Improvement Five (5) Year[5]	FTE & Program Improvements (10 yr.)	Annual Cost & Planned Program Improvements Ten (10) Year[6]
Staffing	3.5	180,000	0.5	220,500	0	231,525
Operating		152,000	0	159,600	0	167,580
Laboratory Operating		71,000	330,000	421,050	0	442,103
Research Costs		0	0	0	0	0
TOTAL COST		403,000		801,150		841,208

3. AMBIENT BIOLOGICAL MONITORING NETWORK (AMNET)

Monitoring Objective

The Ambient Biomonitoring Network (AMNET) is one of the NJDEP's major ongoing ambient monitoring programs. This statewide network of over 800 stations employs sampling and taxonomic analysis of in-stream macroinvertebrate communities to assess the ecological condition at each station.

The major goal of AMNET is to maintain a network of stream biological monitoring sites that adequately represent benthic macroinvertebrate community health in New Jersey's major drainage basins and NJDEP's Watershed Management Areas (WMA). AMNET was designed to address that goal through the following objectives: (1) track status and trends in ambient benthic community health; (2) establish background biological quality; (3) obtain biomonitoring data that can be correlated with specific land uses (urban/suburban, agricultural and undeveloped); and (4) coordinate water chemistry and biological networks.

Monitoring Design

Establishment of the AMNET system in 1992 was facilitated by EPA's introduction of the Rapid Bioassessment Protocols (RBP); protocols which decreased the per station level of effort so that biological surveys with large number of sites could be completed with less resources. Sites in each of the five NJ Water Regions (Upper Delaware, Northeast, Raritan, Atlantic, and Lower Delaware) are sampled on a five-year rotational schedule. The sampling frequency reflects a realistic temporal lag between cessation of an environmental perturbation and recovery of the impacted biological community.

Site Selection:

To ensure enough flow for sampling, sites on Stahler "First-Order" streams are situated at least three miles downstream of headwaters (first order streams are those with no tributaries). Since most streams at this level have very little, or only intermittent flows, most of the monitoring sites have

[5] Adjusted for inflation @ rate of 1.0% per year from current annual cost

[6] Adjusted for inflation @ rate of 1.0% per year from current annual cost

been situated on second-order and higher streams. To maximize data correlation, wherever possible AMNET stations have been co-located with existing stations of the ambient Surface Water Chemical Monitoring Network, which is administered jointly by NJDEP and the USGS. Site selection was designed so as to not be unduly biased by known sources of contamination (e.g. point-source discharges, agricultural operations) and/or significant natural features such as wetlands, parks or wildlife management areas. AMNET site locations were determined via the Global Positioning System (GPS) using Trimble Pathfinder units and the appropriate correction sources utilized by NJDEP. All positions were logged into the NJDEP Geographical Information System (GIS).

Quality Assurance

A Quality Assurance Project Plan (QAPP) is prepared prior to sampling each major basin in the state. A comprehensive collection of over 50 major references (including books and monographs), by recognized experts in invertebrate taxonomy, is maintained in the laboratory. To keep abreast of taxonomic advances, new references are added when appropriate. Laboratory staff attend training seminars given by recognized experts in pertinent areas of invertebrate taxonomy. Also, the International Taxonomic Information System (ITIS) is periodically monitored for changes in nomenclature or groupings). For verification, 10% of the samples are sent to a qualified independent consultant for parallel identifications. A macroinvertebrate specimen reference collection is maintained in the laboratory.

Core and Supplemental Water Quality Indicators

Core Indicators:

- Benthic macroinvertebrate identification and count on 100 subsample
- Semi-Quantitative Habitat Assessment

Supplemental Indicators:

- General Water Quality Parameters -
  - pH, Dissolved Oxygen, Temperature, Conductivity (available on all sites starting with the second "round" of sampling)
- Morphological Abnormalities
- Sediment Toxicity – selected sites only

Data Management

Data from this Network are stored in EPA's STORET database. Additional information regarding this Network is available from the Bureau of Freshwater & Biological Monitoring's WebPage (www.state.nj.us/dep/wmm/bfbm/publications.html

Data Analysis / Assessment

Benthic Community Analysis:

Data analysis is an important part of the RBP protocol, developed under EPA auspices as an expedient and cost-effective monitoring tool. It recognizes a multiple approach, utilizing several "biometrics," that measure different components of community structure, including population and functional parameters, each with a different range of sensitivity to pollution stresses. The use of a variety of biometrics assures a more robust or valid assessment; therefore, an anomaly in any one metric is less likely to invalidate the study findings. The results from each metric are integrated through a common scoring criteria to determine a final numerical rating and consequent biological condition category. The final numerical rating is referred to as the "New Jersey impairment score" (NJIS). This provides the analyst with an easily communicated evaluation of relative impairment, referred to in the study reports as the "bioassessment rating." The data collected via this Network are used in assessing progress toward the goals of the Clean Water Act via the *New Jersey Integrated Water Quality Monitoring and Assessment Report*. The information is also key in selecting waterbodies for increased C1 antidegradation protections.

The data collected via this Network are used in assessing progress toward the goals of the Clean Water Act via the *New Jersey Integrated Water Quality Monitoring and Assessment Report*. The information is also key in selecting waterbodies for increased C1 antidegradation protections.

Reporting

In addition to the annual basin reports of results, which are published in both limited hard copy and made available for download via the web, the NJDEP provides the results of this monitoring via the *New Jersey Integrated Water Quality Monitoring and Assessment Report*.

Program Evaluation

While the spatial and temporal distribution of AMNET sampling is adequate to provide biological impact data on a long-term, basin-wide or statewide scale, it is not sufficient to assess the biological impact(s) of any one point source of pollution. Point source assessments are better served by site-specific or intensive surveys of the stream segment in question. Furthermore, while the coverage of the biological monitoring is extensive, it cannot claim, statistically, to monitor 100% of the State's lotic waters; only the addition of a probabilistic component to the current AMNET monitoring network can fully address that assessment need.

Also, biological monitoring cannot replace chemical monitoring, toxicity testing, and other abiotic environmental measurements. Each of these tools provides the analyst with specific information available only through its respective methodology.

- Monitoring Timeline:
  Monitoring for the AMNET program, over the next five years, is expected to occur on the following timeline:
  - April to November, 2004 - Raritan River Basin (Third Round)
  - April to November, 2005 - Atlantic Coastal Basin (Third Round)
  - April to November, 2006 – Atlantic Coastal Basin (Third Round) & Lower Delaware River Basin (Third Round)
  - April to June, 2007 – Lower Delaware River Basin (Third Round)
  - July to November, 2007 - Upper Delaware River Basin (Fourth Round)
  - April to June, 2008 - Upper Delaware River Basin (Fourth Round)
  - July to November, 2008 - Northeast Basin (Fourth Round)

- April to November, 2009 - Raritan River Basin (Fourth Round)
- April to November, 2010 - Atlantic Coastal Basin (Fourth Round)

- Implementation Plans:
  - 2005 - 2009 Plan:
    - Continue the ongoing monitoring activity through the fourth round of statewide monitoring.
    - Adopt revised NJIS calibrated for assessment of impairment using genus/species level of taxonomic identification which will allow for increased resolution of benthic impairments and align this biological indicator with the newly created Fish IBI indicator by the addition of a fourth category of impairment (Non, *Slightly*, Moderately, and Severely Impaired).
    - Adopt Pinelands-specific NJIS for those AMNET stations located within this unique ecosystem so that this biological indicator can be properly and constructively applied to this NJ ecosystem as the current NJIS does not work well in these waters.
    - Develop and adopt an NJIS calibrated for headwater ecosystems.
    - Design and implement source identification and track-down intensive surveys for stream stations demonstrating severe impairment consistently over two rounds of statewide monitoring.
    - With the assistance of EPA - ORD, Corvallis, evaluate the application of the EPA - GRTS probabilistic design to add a set of randomly selected AMNET biomonitoring sites to the existing network of AMNET stations. Develop an implementation plan if approach is adopted.

  - 2010 - 2014 Plan
    - Continue the ongoing monitoring activity through the sixth round of statewide monitoring.
    - Design and implement source identification and track-down intensive surveys for stream stations demonstrating moderate impairment consistently over two rounds of statewide monitoring.

General Support and Infrastructure Planning

RESOURCE	Current FTE	Current Annual Cost ($)	FTE & Program Improvement (5 yr.)	Annual Cost & Planned Program Improvement Five (5) Year[7]	FTE & Program Improvements (10 yr.)	Annual Cost & Planned Program Improvements Ten (10) Year[8]
Staffing	2.5	130,500	1.5	216,825	0	227,666
Operating		12,300	150,000	170,415		178,936
Laboratory Operating		5,200	260,000	278,460		292,383
Research Costs			30,000	30,000	10,000	10,000
TOTAL COST		148,000		695,700		708,985

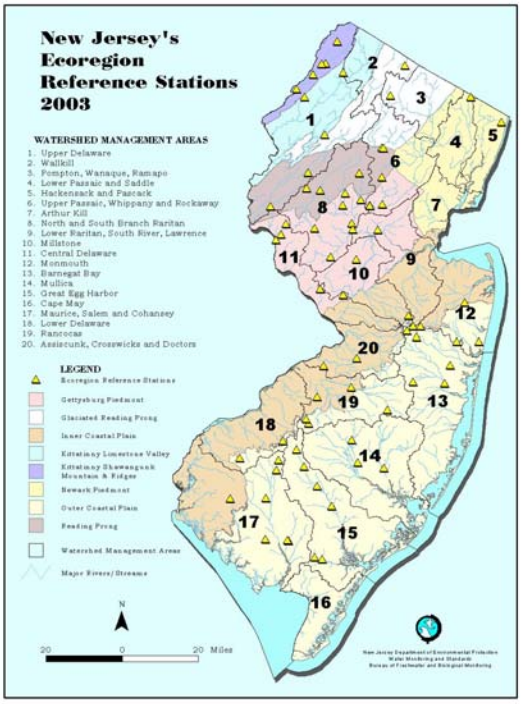
[7] Adjusted for inflation @ rate of 1.0% per year from current annual cost

[8] Adjusted for inflation @ rate of 1.0% per year from current annual cost

4. ECOREGION REFERENCE STATIONS

Monitoring Objective

The Ecoregion Reference Station Program (ERS) is used to support surface water quality and biological monitoring activities of the Water Monitoring and Standards (WM&S) Program by providing a network of biologically "non-impaired" (minimally-impacted) reference stations for each of the eight (8) ecological regions identified within the State. Ecoregion boundaries generally conform to those of the eight physiographic provinces depicted in the New Jersey State EcoMap. The "Fall-Line" (red to brown interface on the map) marks the transition zone from the "high-gradient" streams of the northern upland regions, to the "low-gradient" streams of the southern Coastal Plain regions.



Originally introduced by EPA in the 1980's, the Ecological (Eco) Region concept accepts the premise that waterbodies reflect the character of the land they drain, and that where sites are physically comparable, chemical and biological conditions should also be comparable. As such, reference sites within a given ecoregion can serve as benchmarks, or yardsticks, for all other stations within the same ecoregion. The reference stations are, therefore, powerful tools in assessing the results from both biological and chemical monitoring stations in the other WM&S networks. Ecoregion sites are now among the over 800 AMNET stations, and they serve as a reference database for the AMNET assessments.

Monitoring Design

This network supports a number of water quality programs including the development of the *New Jersey Integrated Water Quality Monitoring and Assessment Report*. Reference site selection is based upon a number of factors, including but not limited to: good water quality, presence of pollution intolerant benthic macroinvertebrate species, stable stream banks and channels, the absence of excessive suspended solids/siltation, and the absence of upstream point or non-point sources of pollution. Since the inception of the program in 1989, seventy-three (73) biological reference stations have been incorporated into the network, after extensive biological monitoring at each station.

Quality Assurance

A Quality Assurance Project Plan (QAPP) is prepared prior to sampling each major basin in the state. A comprehensive collection of over 50 major references (including books and monographs), by recognized experts in invertebrate taxonomy, is maintained in the laboratory. To keep abreast of taxonomic advances, new references are added when appropriate. Laboratory staff attend training seminars given by recognized experts in pertinent areas of invertebrate taxonomy. Also, the International Taxonomic Information System (ITIS) is periodically monitored for changes in nomenclature or groupings). For verification, 10% of the samples are sent to a qualified independent

consultant for parallel identifications. A macroinvertebrate specimen reference collection is maintained in the laboratory.

Core and Supplemental Water Quality Indicators

Core Indicators:

- ❑ Benthic macroinvertebrate identification and count on 100 subsample
- ❑ Semi-Quantitative Habitat Assessment

Supplemental Indicators (at all monitoring stations):

- ❑ General Water Quality Parameters -
  - pH, Dissolved Oxygen, Temperature, Conductivity
- ❑ Morphological Abnormalities

Data Management

Data from this Network are stored in EPA's STORET database. Additional information regarding this Network is available from the Bureau of Freshwater & Biological Monitoring's WebPage (www.state.nj.us/dep/wmm/bfbm/publications.html

Data Analysis / Assessment

Benthic Community Analysis:
See section description for Ambient Biological Monitoring Network

Reporting

Periodically the bureau issues reports of results, which are published in both limited hard copy and made available for download via the Bureau's website at http://www.state.nj.us/dep/wmm/bfbm/downloads.html/. In addition NJDEP provides the results of this monitoring via *the New Jersey Integrated Water Quality Monitoring and Assessment Report*.

Program Evaluation

It is anticipated that the ecoregion report will be revised to include 30 additional sites (already sampled and analyzed) bringing the total discussed in the report from 43 to 73. The ecoregion boundaries used in the original report will be updated to reflect current boundaries.

- ❑ Monitoring Timeline:
  Currently new stations are not being added to this network

- ❑ 2005 - 2009 Plan
  - Issue a revised, updated report on the Ecoregion Network during SFY 05 - 06

- ❑ 2010 - 2014 Plan
  - Nothing at this time

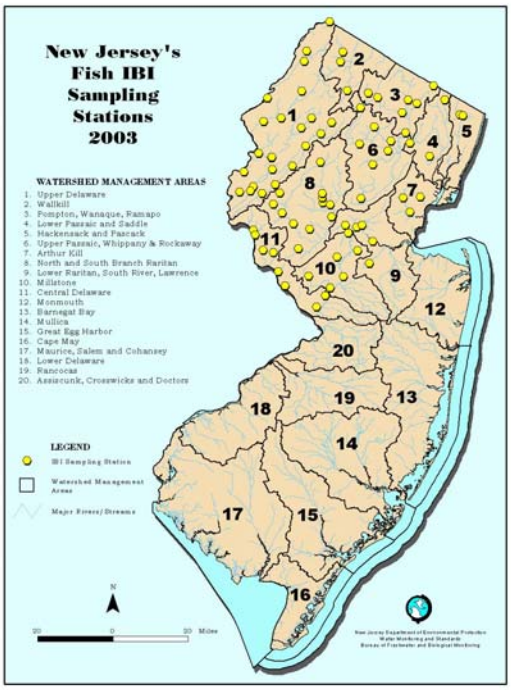
General Support and Infrastructure Planning

RESOURCE	Current FTE	Current Annual Cost ($)	FTE & Program Improvement (5 yr.)	Annual Cost & Planned Program Improvement Five (5) Year[9]	FTE & Program Improvements (10 yr.)	Annual Cost & Planned Program Improvements Ten (10) Year[10]
Staffing	0.3	19,700	0	20,685	0	0
Operating		300	0	315	0	0
Laboratory Operating		0	0	0	0	0
Research Costs		0	0	0	0	0
TOTAL COST		20,000		21,000		0

5. NJ FISH INDEX OF BIOTIC INTEGRITY NETWORK

Monitoring Objective

The Bureau of Freshwater and Biological Monitoring began implementing a Fish Index of Biotic Integrity (IBI) sampling program in 2000. The objective is to assess stream quality using the IBI. The IBI evaluates environmental conditions based on assessments of fish populations and thus provides the EPA recommended second trophic level of biological assessment critical to an accurate determination of environmental impairment.



Monitoring Design

Once fish from sample collections have been identified, counted, examined for disease and anomalies, and recorded, several biometrics are applied to evaluate biotic integrity. Fish community analysis is accomplished using a regional modification of the original IBI (Karr *et. al.* 1986)[11]. The modified IBI uses the following ten biometrics: 1) total number of fish species, 2) number and identity of benthic insectivorous species, 3) number and identity of trout (non-stocked) and/or sunfish species, 4) number and identity of intolerant species, 5) proportion of individuals as white suckers, 6) proportion of individuals as generalists, 7) proportion of individuals as insectivorous cyprinids, 8) proportion of individuals as non-stocked trout or proportion of individuals as piscivores (excluding American eel), 9) number of

[9] Adjusted for inflation @ rate of 1.0% per year from current annual cost

[10] Adjusted for inflation @ rate of 1.0% per year from current annual cost

[11] Karr, J.R., K.D. Fausch, P.L. Angermeier, P.R. Yant, and I.S. Schlosser. 1986. *"Assessing biological integrity in running waters: a method and its rationale"* Illinois Natural History Survey, Champaigne, IL, Special Publication 5.

individuals in the sample and , 10) proportion of individuals with disease or anomalies. WM&S is collecting samples in the northern part of the State, north of the fall line. At the same time, NJDEP's Division of Fish and Wildlife is collecting fish assemblage samples in the southern portion of the state to calibrate the IBI protocol for these waters of the state.

Quality Assurance

A Quality Assurance Project Plan (QAPP) is developed annually for the Fish IBI Network. Components of the QAPP include: (1) description of field sampling methodology (2) description of methodology for operation of field meters used to collect in-situ data (temperature, pH, D.O, and conductivity (3) description of independent quality control procedures by outside experts to confirm field identifications of approximately 10% of specimens collected during the year. (5) review and approval by Departmental Office of Quality Assurance program to assure consistency with EPA requirements.

Core and Supplemental Water Quality Indicators

Core Indicators:

- Fish identification and count
- Semi-Quantitative Habitat Assessment

Supplemental Indicators (at all monitoring stations):

- General Water Quality Parameters -
  - pH, Dissolved Oxygen, Temperature, Conductivity
- Morphological Abnormalities and Diseases

Data Management

Data from this Network are stored in EPA's STORET database. Additional information regarding this Network is available from the Bureau of Freshwater & Biological Monitoring's WebPage (www.state.nj.us/dep/wmm/bfbm/publications.html

Data Analysis / Assessment

Once fish from sample collections have been identified, counted, examined for disease and anomalies, and recorded, biometrics, as modified by *Kurtenbach, 1996* will be applied. The modified IBI uses the following ten biometrics: 1) total number of fish species, 2) number and identity of benthic insectivorous species, 3) number and identity of trout and/or sunfish species, 4) number and identity of intolerant species, 5) proportion of individuals as white suckers, 6) proportion of individuals as generalists, 7) proportion of individuals as insectivorous cyprinids, 8) proportion of individuals as trout OR proportion of individuals as piscivores (excluding American eel), 9) number of individuals in the sample and , 10) proportion of individuals with disease or anomalies.

An IBI is an index that measures the health of a stream based on multiple attributes of the resident fish assemblage. Each site sampled is scored based on its deviation from reference conditions (i.e., what would be found in an unimpacted stream) and classified as "poor", "fair", "good" or "excellent". In addition, habitat is evaluated at each site and classified as "poor", "marginal", "suboptimal" or "optimal".

Data provided by the IBI are becoming another component of the NJDEP's suite of environmental indicators. The data will help to measure water quality use attainment and the Department's success in attaining the Clean Water Act goal of "fishable" waters as elaborated in the *New Jersey Integrated Water Quality Monitoring and Assessment Report*. IBI data will also be used to develop biological criteria,

prioritize sites for further studies, provide biological impact assessments, and assess status and trends of the state's freshwater fish assemblages. Currently, IBI data collected from northern New Jersey are used in an approach to nominate candidate waters for upgrade to a Category One antidegradation classification (NJAC 7:9B) based on exceptional ecological significance.

Reporting

Periodically, NJDEP issues reports of results, which are published in both limited hard copy and made available for download via the Bureau's webpage at http://www.state.nj.us/dep/wmm/bfbm/downloads.html/ In addition NJDEP provides the results of this monitoring via the *New Jersey Integrated Water Quality Monitoring and Assessment Report*.

Program Evaluation

- Monitoring Timeline:

  IBI sampling will take place in the daytime, June through early October, during normal or low flows, and never under atypical conditions such as high flows or excessive turbidity caused by significant precipitation. Waters stocked with trout or known or suspected to have naturalized populations of trout will be sampled between July 1 and August 30

- Implementation Plans:
  - FY2005 - 2009 Plan
    - Monitoring will continue at the established network sites in the northern section of the state. The network consists of 100 fixed stations, which will be monitored on a five-year rotation (twenty stations per year).
    - Review will continue on data collected by Division of Fish and Wildlife to determine if the network should be expanded to the southern portion of the state. If this is determined to be appropriate, sampling will continue at the expanded network, with forty stations per year being sampled.
    - Review will continue on the Headwaters IBI Project, to determine if additional network stations should be established in headwater areas. If this is determined to be appropriate, an additional network of approximately one hundred stations will be established. These stations will be sampled on a five-year rotating schedule, at the rate of twenty stations per year.

  - FY2010 - 2014 Plan
    - Monitoring will continue at the established network sites in the northern section of the state. The network consists of 100 fixed stations, which will be monitored on a five-year rotation (twenty stations per year). If previous period (2005-2009) review has determined it is appropriate, monitoring will also continue at the established stations in the southern portion of the state (twenty stations per year) and at the headwater stations (twenty stations per year).

General Support and Infrastructure Planning

RESOURCE	Current FTE	Current Annual Cost ($)	FTE & Program Improvement (5 yr.)	Annual Cost & Planned Program Improvement Five (5) Year[12]	FTE & Program Improvements (10 yr.)	Annual Cost & Planned Program Improvements Ten (10) Year[13]
Staffing	3.0	180,000	5.0	504,000	0	529,200
Operating		10,000	13,500	23,500		24,675
Laboratory Operating		10,000	13,500	23,500		24,675
Research Costs		0	0	0	0	0
TOTAL COST		200,000		551,000		578,550

6. 303(D) ELEVATED FLOW METALS MONITORING

Monitoring Objective

NJDEP has, prior to 1998, listed certain waters as impaired for heavy metals on the basis of previously collected monitoring information demonstrating metals contamination in excess of the applicable NJDEP Surface Water Quality Standards (SWQS). However, the data used to classify these waters as use impaired may be:

1. Outdated and not reflective of current water quality conditions;
2. May have a positive bias due to sample collection and analysis techniques now known to be potentially inappropriate for the data quality objectives (generally detection limit of 1 ppb); or
3. May be misleading because total recoverable metals data were compared directly to dissolved metals criteria.

From 1998 – 2001 NJDEP collected samples under stable base flow conditions under the 303d Evaluation Monitoring Program for total recoverable and dissolved metals. Stable base flow was defined as less than long term median flow and less than 30% change from the previous day. Through the Interagency 303d Technical Workgroup, NJDEP, EPA-Region 2 and USGS – Water Resources Division staff agreed that elevated flow data were also needed in order to provide a sufficient basis for de-listing waters, where appropriate.

Monitoring Design

All total recoverable metals data collected under the Ambient Stream Monitoring Network from 1996 to 2001 were screened via a joint NJDEP / EPA – Region 2 workgroup to identify samples collected under elevated flow conditions. The criteria for elevated flow was 10% or greater than long-term daily median flow. A list of stations lacking elevated flow results was developed by the workgroup as targets for supplemental monitoring. Comparison of total recoverable ASMN data to dissolved metals criterion was problematic for some parameters, particularly lead. This project's data quality objective is to collect water column metals data free of contamination at the 1 ppb level. To achieve this objective, "Clean Method" sampling protocols are employed.

[12] Adjusted for inflation @ rate of 1.0% per year from current annual cost

[13] Adjusted for inflation @ rate of 1.0% per year from current annual cost

Quality Assurance

A Quality Assurance Project Plan (QAPP) is developed annually for the 303(d) Elevated Flow Metals Monitoring.

Core and Supplemental Water Quality Indicators

Core parameters monitored include the following:

- Measured at selected sites under elevated flow conditions –
  - Total recoverable and dissolved metals (Arsenic, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, Zinc, Silver, and Thallium), temperature, pH, specific conductance, hardness, and total suspended solids.

Data Management

Monitoring data are available from the EPA – STORET database.

Data Analysis / Assessment

The data collected via this project are used in assessments for the *New Jersey Integrated Water Quality Monitoring and Assessment Report.*

Reporting

NJDEP provides the results of this monitoring via the *New Jersey Integrated Water Quality Monitoring and Assessment Report.*

Program Evaluation

- Monitoring Timeline
  - Pending the availability of operating funding, approximately 70 sites will be sampled annually for the next 3-4 years during elevated flow conditions. Elevated flow conditions are defined as flow being equal to or greater than 10% above long-term daily median flow.
  - Longer term, the scope of monitoring activities will depend on the assessment of data currently being collected. The project goal will continue to be the collection of three (3) baseflow and three (3) elevated flow samples at each site identified as being impaired by metals contamination.
- Implementation Plans:
  - FY2005 - 2009 Plan:
    - Each site will be sampled up to three times, depending upon the presence of Surface Water Quality Standards violations. A violation on any one of the three sampling events will require a site to remain on the 303(d) list and sampling will no longer be required. Sites that do not reveal any violations during the three sampling events will be considered for de-listing from the 303(d) list. There will be a continued search to implement lower detection limit analyses for mercury and arsenic.
  - FY2010 - 2014 Plan:
    - If additional monitoring is needed, each site will be sampled up to three times, depending upon the presence of Surface Water Quality Standards violations. A violation on any one of the three sampling events will require a site to remain on the 303(d) list and sampling will no longer be required. Sites that do not reveal any violations during the three sampling events will be considered for de-listing from the 303(d) list. There will be a continued search to implement lower detection limit analyses for mercury and arsenic.

General Support and Infrastructure Planning

RESOURCE	Current FTE	Current Annual Cost ($)	FTE & Program Improvement (5 yr.)	Annual Cost & Planned Program Improvement Five (5) Year[14]	FTE & Program Improvements (10 yr.)	Annual Cost & Planned Program Improvements Ten (10) Year[15]
Staffing	1.0	91,000	0	95,550	0	100,328
Operating		5,000	0	5,250	0	5,513
Laboratory Operating		50,000	15,000	67,500	0	70,875
Research Costs		0	0	0	0	0
TOTAL COST		146,000		168,250		176,716

7. LOWER DELAWARE NON-POINT SOURCE MONITORING PROJECT

Monitoring Objective

The Lower Delaware Non-Point Source (NPS) Storm-Monitoring Study is the second multi-year nonpoint source investigation to be conducted jointly by the USGS and the NJDEP. Its purpose is to estimate the NPS loads of nutrients, bacteria, and suspended solids from various land use areas in Watershed Management Area (WMA) 17, 18, and 20. The study objectives are to (1) document current water quality before NPS and storm water management strategies are initiated, and (2) develop a water quality model to estimate unit NPS loads of selected constituents associated with different lands uses in WMA 17, 18, & 20. A secondary objective is to further refine protocols developed in the original Toms River NPS Study[16] for automated monitoring equipment (autosamplers, flowmeters and data sondes) for monitoring in-stream water quality during storm flow.

Monitoring Design

Samples will be collected from each site during both base flow and storm runoff conditions during both growing and non-growing seasons. Storm-event monitoring criteria relate to the time of the year. During the Growing season, defined as May through October, the criterion is a predicted amount of rainfall greater than or equal to 1.0 inches over a 24-hour period. During the Non-growing season, defined as November through April, this criterion drops to 0.5 inches over a 24-hour period. Base flow measurements will be taken at each station at dry conditions, which is defined as no rainfall 5 days prior to base flow sample collection. If possible, base flow samples will be taken immediately prior to the storm event, at the time the storm sampling equipment is being set up. Storm events will be sampled when predicted rainfall is expected to meet said accumulation, after a minimum 3-day period of dry conditions. The study will consist of eight sampling events each for base flow and storm runoff over the course of a two-year period. Four of the eight sampling events

[14] Adjusted for inflation @ rate of 1.0% per year from current annual cost

[15] Adjusted for inflation @ rate of 1.0% per year from current annual cost

[16] USGS, 1999. Relation of water quality to land use in the drainage basins of four tributaries to the Toms River, New Jersey, 1994-95. West Trenton, NJ: U.S. Geological Survey.

will be targeted to occur during the growing season, and four during the non-growing season, over the two-year period. A year is defined as including one growing and one non-growing season. After eight sampling events are completed, an assessment will be made whether to perform additional sampling.

Quality Assurance

A Quality Assurance Project Plan (QAPP) has been developed for this project. All laboratories performing analysis for this project are subject to audits and guidelines of the Office of Quality Assurance Laboratory Certification Program as well as internal performance evaluations.

Core and Supplemental Water Quality Indicators

All analytical methods (including field measurements) and method detection limits will conform to approved methods outlined in the Federal Register (40CFR). The following is the list of water quality constituents to be collected for this study:

Core parameters monitored include the following:

- LAB MEASUREMENTS
  - Total Suspended Solids
  - Fecal Coliform (m-FC)
  - E. Coli (m-TEC)
  - Enterococcus(m-E)
  - Orthophosphate(D&P)
  - Hydrolyzable Phosphorus(D&P)
  - Total Phosphorus(D&P)
  - Total Nitrogen
  - Ammonia
  - Nitrate
  - Nitrite
  - BOD5
  - MBAS
  - TOC

- FIELD MEASUREMENTS/ DATA SONDE PARAMETERS:
  - Turbidity
  - pH
  - Specific Conductance
  - Temperature
  - Dissolved Oxygen

Data Management

Data for this project are stored in the USGS NWIS database.

Data Analysis / Assessment

Data will be used to develop a water quality model to estimate unit NPS loads of selected constituents associated with different land uses in WMA 17, 18, & 20. In addition, synoptic sampling will be conducted during storm runoff conditions near the beginning of the baseline characterization phase of the study to verify the modeled land-use to water quality relationships, to identify any anomalies to these relationships in the watersheds being studied, and to identify the major nonpoint

contributing sources thereby allowing for a more focused implementation of Best Management Practices (BMPs).

Reporting

A USGS Water Resources Investigation Report will be issued at the completion of the project.

Program Evaluation

- Monitoring Timeline
  - 2 consecutive years of Characterization Phase sampling; a sampling year is defined as the period incorporating consecutive growing and non-growing seasons)

- Implementation Plans:
  - FY2005 - 2009 Plan
    - After eight sampling events are completed, an assessment will be made whether to perform additional sampling.
  - FY2010 - 2014 Plan
    - Additional NPS monitoring for this program not planned at this time.

General Support and Infrastructure Planning

RESOURCE	Current FTE	Current Annual Cost ($)	FTE & Program Improvement (5 yr.)	Annual Cost & Planned Program Improvement Five (5) Year	FTE & Program Improvements (10 yr.)	Annual Cost & Planned Program Improvements Ten (10) Year
Staffing	3.0	118,000	0	0	0	0
Operating		50,000	0	0	0	0
Laboratory Operating		109,000	0	0	0	0
Research Costs		0	0	0	0	0
TOTAL COST		227,000		0		0

8. VOLUNTEER STREAM MONITORING

The volunteer water quality monitoring community can routinely monitor waterways that the state can not test on a regular basis. The use of volunteer collected data will enable data users to gain a clearer assessment of what is going on in a given watershed due to the large number of rivers and streams that the volunteers routinely monitor at a high frequency. The State does not have the resources to monitor every water body in NJ. The WWN will insure more waterways are monitored in the State.

Monitoring Objectives

The WWN is made up of organizations that have various goals and objectives dependant upon what Tier their program fits into. Programs collect monitoring information to be used for educational purposes, local land use decisions, local, county and state level regulatory responses, baseline and trends assessments.

Monitoring Design

Site Selection

Due to the diversity of the volunteer groups' monitoring objectives, there are fixed stations, intensive and screening level monitoring, judgmental and probability design. The WWN has not identified monitoring programs working on a rotating basin design.

Organizations and volunteers that work within the Watershed Watch Network need to identify the latitude and longitude through the use of USGS topography quadrangles, Geographical Positioning Systems (GPS), or Geographical Information Systems software (http://www.nj.gov/dep/gis). Volunteer organizations can contact a Watershed Watch Network Council member (http://www.nj.gov/dep/watershedmgt/watershed_watch_members.htm) or the volunteer monitoring coordinator to help them identify their exact locations.

NJDEP data users can also request, through the WWN, additional monitoring at a specific site on an as needed basis. These are special projects that the WWN may be interested in monitoring as long as the proper resources and training are provided to the volunteers.

Field and Laboratory Methods

Due to the nature of the numerous volunteer groups' goals and objectives, the monitoring parameters sampled by each program vary to meet their data needs and the original purpose of their monitoring activities. Most volunteers within the state are monitoring biological, physical, habitat, chemical parameters and/or land use.

Field and laboratory methods for special projects will be provided via training, field audits and overall guidance from the volunteer monitoring coordinator, the assistant volunteer coordinator, the river and stream volunteer training coordinator and the quality assurance coordinator.

Field Collection

The field collection methods for each program vary to meet their data needs. The field collection methods for the volunteer monitoring community are varied depending upon equipment, funding, geographical region (low gradient or high gradient steams), purpose of monitoring activities and level of expertise. The Quality Assurance Project Plans (QAPP) of the volunteer organization for their monitoring project go into further detail on the field collection methods. Quality control measures are designed into the tiered volunteer monitoring approach via increasingly rigorous requirements (e.g. an approved Quality Assurance Project Plan, Department-sponsored training and use of certified labs for analysis of samples) as the tiers progress (http://www.nj.gov/dep/watershedmgt/DOCS/volmontiersfinal.pdf).

Sample Sorting & Identification & Analysis

Due to the nature of the numerous volunteer group's goals and objectives, sample sorting identification and analysis in each program may vary to meet their data needs. The sample sorting, identification and analysis varies depending upon equipment, funding, geographical region (low gradient or high gradient steams), and level of expertise.

The QAPP for the individual projects is reviewed by the Office of Quality Assurance, the volunteer monitoring coordinator, the assistant volunteer coordinator, the river and stream volunteer training coordinator and the quality assurance coordinator. Sample sorting, identification and analysis is dependent upon the resources available to the volunteer organization. With the proper funding and resources the WWN would be able to define these requirements further to assure these procedures meet the quality assurance requirements that the data users are looking for.

Core and Supplemental Water Quality Indicators

The monitoring parameters in each program within the WWN vary to meet their data needs. Most volunteers in the state are monitoring biological, physical, habitat, chemical and/or land use. The core set of parameters covered by the volunteer community is dependent upon the monitoring project. Some of the parameters include benthic macroinvertebrates, stream flow velocity, temperature, visual, habitat, DO, pH, turbidity, nitrate-nitrogen, ortho-phosphates, coliform bacteria, alkalinity, TSS/TDS, and salinity.

Quality Assurance

The WWN is in the process of drafting a Quality Assurance Management Plan (QAMP) for the streams and rivers visual, biological, physical and chemical monitoring programs. The QAMP will be complete for rivers and streams monitoring programs by spring of 2005. Quality Assurance Project Plans for the Streams and Rivers, special projects (e.g. assigned streams) will be completed prior to monitoring activities. Procedures manuals, study design workshops, training and other resources will be available for all types of monitoring.

There are many groups within the WWN that already have some form of QAMP and QAPP for special projects. Groups that have received 319(h) monies or are involved in a 319(h) funded project have a QAPP for their monitoring activities that has been approved by the NJDEP Office of Quality Assurance. There are other groups within the WWN council that have worked on projects directly with the EPA. These groups have QAPPs reviewed and signed by EPA Region 2. Other volunteer groups have an internal QAMP or QAPP. An internal QAMP or QAPP means that they have something to follow that defines their goals, objectives, study design, sampling procedures, reporting and data management operating procedures, but the QAMP or QAPP is not signed by an outside entity or data user. Many volunteer programs are operating on a "shoe-string" budget and their resources are stretched thin. The QAMPs and QAPPs are a priority to monitoring groups, but they may not be able to focus on updating them. With the proper funding and resources the WWN would be able to work with individual volunteer programs to assure that their quality assurance procedures meet their intended purpose for their monitoring activities.

Data Management

An online data management system for volunteer collected data is in the preliminary development stage. The system will allow for volunteers who have been trained and certified within a tier to enter data (at the level of rigor needed for that tier) directly on the website form. The data will then be stored in an Access database where it will be reviewed by the volunteer coordinator for accuracy. Once the data are reviewed and approved, the data will then go into STORET.

This system is currently only in the conceptual stage. The goal of this online database is to quickly transfer the results of the volunteers to the NJDEP. The data entered online will be reviewed by the volunteer coordinators to assure the quality before it goes to the NJDEP data users and then into STORET. Currently, the WWN does not have the funding or resources to be able to do these activities.

Data Analysis/Assessment

The WWN will provide volunteers with the necessary resources to analyze and assess their own data for their own defined purposes through training, resource lists already available, and one-on-one work groups with the data users, volunteers and volunteer coordinator. The WWN envisions a website for data management that would be able to also conduct simple statistical analyses, site comparisons, and reports of the data.

The data collected from special projects will be submitted to the data users and water resource managers to allow for consistent data analysis and assessment. Currently, the WWN does not have the funding or resources to be able to do these activities.

Reporting

The WWN will provide training and resources as needed for volunteer groups on how to create reports described by their results. The volunteer community sees the value in knowing what their sample results indicate about their waterway. Currently, many of the volunteer organizations report back to their participants and the local community about the health of the stream.

The data collected for special projects will be submitted to the data users and water resource managers to allow for consistent reporting of the volunteers findings. Volunteer groups collecting at the Tier D level (highest level) will have their data used in the *New Jersey Integrated Water Monitoring and Assessment Report.* Volunteer collected data and reports will be published on the WNN website. An Annual Report will be created and available each year. Currently, the WWN does not have the funding or resources to be able to do these activities.

Programmatic Evaluation

The WWN activities seek external and internal review regularly through the Watershed Watch Network Council. Representatives from the NJDEP, Office of Quality Assurance (OQA), and EPA Region 2 sit on the council. The OQA has involved the WNN in the *Statewide Quality Assurance Management Plan* which was submitted to EPA for review. The OQA now conducts informal reviews of the Network's activities. Once the QAMP and QAPP's for the special projects are drafted, peer reviewed by the council members and approved by OQA, the WWN will be responsible for assuring the program complies with the plans.

The WWN also will conduct an internal annual review specifically to address the overall effectiveness and potential gaps in fulfillment of our mission. The statewide Volunteer Monitoring Summit is where the volunteers can attend and voice their needs, comments and or concerns about the program as well as share successes and network, thereby improving their water monitoring programs.

General Support and Infrastructure Planning

<u>Staffing Needs</u>

The program over the next ten years plans on expanding its monitoring focus to meet the needs of the volunteers and the need for more data collection. The program needs to hire one Assistant Volunteer Coordinator, one Stream and River Coordinator, and one Quality Assurance Coordinator. The Watershed Watch Network will not be able to effectively aid the NJDEP in meeting its water quality goals unless additional staff is hired.

The Stream and River Coordinator would be responsible for following the programs' Quality Assurance Management Plan (QAMP). The Coordinator would also be responsible for citizen's involvement, public relations, training volunteers, equipment calibration and equipment inventory, field visits to volunteer sites, and adopting one stream for monitoring. By adopting a site, the coordinator will set an example through adopting one water body and monitoring it for the purpose of collecting usable data to the highest level of rigor from the NJDEP. This sampling event will also allow for volunteers to meet coordinators out in the field, to review sampling procedures, calibrate equipment or meet their coordinator.

We would also need to hire one Quality Assurance Coordinator who would be responsible for the QAPP development for individual groups, data management including data validation, STORET entry, Annual Reports, and delivering data to the proper data users.

An Assistant Volunteer Coordinator is also needed for research, a volunteer certification program, volunteer database management, equipment management, and larger public relations activities such as press releases, training logistics, and special projects and events such as The North American Dip-in.

The Volunteer Monitoring Coordinator (currently the only FTE) is responsible for the Watershed Watch Network Councils, inter and intra agency meetings, QAMP and QAPP reviewer and signature, trainer, public relations, and general oversight to the whole program. This position involves being the intermediary between the volunteers, the data users, and the national volunteer monitoring community. The Volunteer Monitoring Coordinator is the quality control officer for special projects, responsible for drafting the Annual Report of the volunteer monitoring activities, and quality assurance.

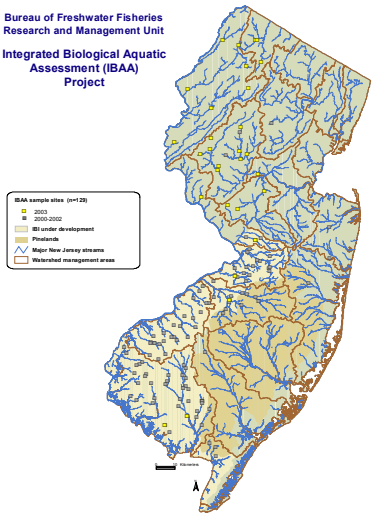
Funding Needs

The Stream and River Monitoring Program would need approximately $30,000 for start up costs. Once equipment is purchased the annual budget for upkeep and maintenance of the equipment is estimated at $6,000 per year. A detailed budget is available upon request.

9. FISHERIES AND OTHER AQUATIC LIFE MONITORING

Integrated Biological Aquatic Assessment (IBAA)

Monitoring Objectives



The Integrated Biological Aquatic Assessment (IBAA) is one of NJDEP's Division of Fish and Wildlife's major ongoing monitoring programs. The IBAA project is addressing critical gaps in the biological assessment of New Jersey's streams. Historically, the primary means of assessing stream health was by means of chemical analysis. In the early 1980's the Division of Fish and Wildlife developed a stream classification system based upon trout suitability. This classification was incorporated in the state's Surface Water Quality Standards and has since played a critical role in protecting trout-supporting waters, primarily located in the northern region. However, this trout-based classification system is not helpful in protecting the Coastal Plain streams of central and southern New Jersey, which have different geological, topographical, chemical, and physical characteristics that are not conducive to supporting trout. As described briefly in the NJ Fish Index of Biotic Integrity Network section, earlier in this document, an Index of Biotic Integrity (IBI) for this region of the state that will identify the health of a stream based on various attributes of the resident fish assemblage, is currently under development by the Division. A total of 97 stream sites have been surveyed in the Lower Delaware River Drainage using an established sampling protocol. In 2004, the Division will complete the development of an IBI for freshwater streams in the lower Delaware.

In addition to IBI development underway in Coastal Plain streams, the Division's Endangered and Nongame Species Program is conducting systematic, qualitative surveys for freshwater mussels, dragonflies and damselflies and stream associated reptiles and amphibians at selected Ambient Biomonitoring Network (AMNET) (see Ambient Biological Monitoring Network section, earlier in this document, for additional information) locations throughout New Jersey. Freshwater mussels, dragonflies and damselflies and stream associated reptiles and amphibians are excellent indicators of water quality. Declines in populations within these groups may serve as early warning indicators of deteriorating water quality. Fish samples have also been taken on sites where mussel and odonata surveys have been collected to provide a holistic look at stream health.

Monitoring Design

For fish, a basis for measuring stream health of waterways was established in 1986 when Karr developed the Index of Biotic Integrity. The index takes into account the complex interactions of the fish community and the surrounding watershed. It views the fish population from a variety of standpoints that include trophic composition, reproductive, tolerance, and/or taxonomic guilds. In 1994, EPA modified Karr's regional framework, for wadeable streams in Illinois, for use in streams in northern New Jersey. Due to differences in topography, geology, chemistry, and habitat between the northern and southern reaches of the stream, which are ultimately reflected in fish populations, this index is not applicable to streams south of the fall line. Prior to the onset of the Integrated Biological Aquatic Assessment, little fisheries information existed on the wadeable streams within the Lower Delaware River Drainage.

For mussels, a two-phase sampling approach was utilized. Freshwater mussels were surveyed using aquascopes, viewing buckets and snorkeling equipment. The survey areas were located 250 meters upstream and 250 meters downstream of the selected AMNET site. If these sites were not accessible, surveys were conducted at the closest accessible road crossing or stream access point. Two hour timed searches in each represented habitat type (riffles, pools and runs) within the 500 meter stretch. If two people were searching a segment, each individual searched one hour, three people searched 40 minutes. If there was only one habitat type at a survey site, two person-hour searches were performed in each of four 125 meter stream sections.

Each site was surveyed by starting at the most downstream segment and working our way upstream so that turbidity from movement did not obscure the view of the substrate. Sites with pH's less than 5.0 were not surveyed because freshwater mussels cannot survive in low pH waters. The substrate was examined for exposed mussels, siphons and mussel trails and shorelines were inspected for shells and relicts (old shells) at all survey sites. Bivalve species were recorded at each survey segment along with lengths and widths (mm) of all live rare mussels, shells and valves. Live specimens were returned, whereas vouchers of shells were taken from selected locations.

The following habitat information was recorded at each survey segment: habitat type, substrate type, water temperature, depth, stream velocity, pH, segment length and width, dissolved oxygen, and boundary coordinates. In addition, an EPA Habitat Assessment Data Field Sheet following Barbour et al. (1999) was completed for each segment surveyed. In anticipation of IBAA surveys, two ENSP biologists attended an EPA sponsored habitat assessment training seminar that focused on evaluating streams.

For Odonata, larvae, exuviae, tenerals (newly emerged adults) and adults in riffle, pool and run segments, using survey techniques developed by Brunnelle (1999) and other regional experts. Exuviae and teneral searches were conducted along the segment shoreline on typical emergent sites such as foliage, rocks and exposed roots. Exuviae were collected for identification in the laboratory.

Adults were netted, identified and released, whereas tenerals were identified through visual observation without netting. In addition, in order to supplement species information, larvae were collected in suitable substrates using a kick net, preserved in 95% ethanol, and identified in the laboratory.

For Herptiles, a search was conducted at each of the freshwater mussel and Odonata habitat segments surveyed. Methods for searching included: 1) visual observations during freshwater mussel and Odonata surveys 2) moving rocks, logs, and stream debris 3) listening for vocalizations. The following data were recorded for all herptiles encountered: species and numbers observed, life stage, and evidence of occurrence.

Site Selection (Freshwater Mussels, Odonata, and Stream-associated Herptiles):

1) Extant Ambient Biomonitoring Network (AMNET) location in a priority WMA (Watershed Management Area).
2) Proximate to known occurrences of endangered, threatened or rare freshwater mussel species locations and or suitable habitats.
3) Proximate to known occurrences of rare Odonata and/or suitable habitats.
4) Pinelands habitat suitable to support a diverse Odonata fauna.

Site Selection (Fishes):

Site selection was a two-phase process. The first phase involved searching multiple databases and maps to determine the extent to which a site meets the following criteria:

1) Designated AMNET site.
2) Located within the Lower Delaware River Drainage.
3) Located outside or along the periphery of the Pine Barrens.
4) Sampled by the Endangered and Nongame Species Program
5) Spatially dispersed throughout the Lower Delaware River Drainage
6) Variety of drainage sizes represented.
7) Ranges of water quality ratings, based on benthic macroinvertebrate sampling, were represented. The second phase of site selection includes on-site reconnaissance to determine if stream conditions are suitable to sampling. These conditions include:
8) Accessibility.
9) Wadeability.
10) Sample stretch devoid of stream confluences, bridges and impoundments.

Field & Laboratory Methods:

Sampling methods followed those outlined by Kurtenbach (Kurtenbach, 1994) and as defined in the EPA manual "Rapid Bioasssessment Protocols for Use in Wadeable Streams and Rivers" (Barbour 1999). All sites were sampled under typical stream flows during the months of June through September. Electrofishing gear was used to provide pulsed direct current to collect fishes at all of the sites sampled. Settings on each of the stream units varied depending on the conductivity at each site, output ranged from 3 to 4 amperes. A typical backpack field crew consisted of three persons, one to wear the backpack and two to net fishes. Stream widths exceeding the capabilities of one backpack unit were either sampled with two backpack teams traveling in tandem or with a two-paddle streamside generator. The type of unit selected was based upon stream width, depth, and contour of the stream environment. One up-stream pass was made through the sample stretch. A block seine was used at the upstream end of each sample stretch when required. The sample stretch length was 150m. Sampling time averaged 2.5 hours per site.

Field Collection (Fishes):
All fish encountered were collected without bias to species or size. Fishes with lengths greater than 20mm were identified to the species level, counted, and examined for disease or anomalies. Anomalies such as visible lesions, tumors, skeletal anomalies, and fin damage may be an indication of impaired conditions. Obvious injuries due to electrofishing were noted, but not considered anomalies.

In addition to fish collection, basic physical and chemical parameters of the stream environment were also determined and recorded on the Bureau's Stream Survey Data Sheet. All physical and chemical data were collected one-time-only, thus no long-term data were collected. Physical parameters included stream depth, stream width, substrate type, and shade index. YSI Model 85 and YSI Model 60 meters were used to determine dissolved oxygen, temperature, salinity, conductivity, and pH. For QA/QC purposes oxygen meters were re-verified on a monthly basis against a Winkler Titration of deionized water samples. The re-verification procedure was also repeated after an atypical field readings to verify the meter was functioning properly. Meters were field calibrated prior to each use according to the manufacturer specifications. Alkalinity and specific conductance data were collected during year two of the study. In-house laboratory staff determined alkalinity via titration. The reference temperature coefficient for specific conductance are 25° C and 1.91% respectively.

Sample Sorting & Identification (Fishes):
Total length measurements were taken on all game species. Data were recorded on the Bureau's Supplemental Field Survey Sheet-Fish Samples. Retained specimens were preserved in 10% formalin solution in the field. Specimens were transferred into a 70% ethanol solution for long-term preservation 2-3 weeks after initial collection.

Habitat Assessment (Fishes):
In accordance with criteria established by EPA (EPA 1999), a low gradient stream habitat assessment was conducted at each of the 64 sampling sites. Data were recorded on the Bureau's Habitat Assessment Data Sheet. The habitat assessment is intended to evaluate various aspects of the aquatic habitat, surrounding terrestrial environment, and potential anthropogenic factors that may impact the aquatic biota of the stream. Ten specific physical parameters are addressed: epifaunal substrate, pool substrate, pool variability, sediment deposition, channel flow status, channel alteration, channel sinuosity, bank stability, vegetative protection, and riparian vegetative zone width. The first five parameters are to be assessed for the environment within the 150 m sampled stretch of the stream. Assessments of the five remaining variables are based not only on the sample stretch, but also the 150 m upstream and downstream portions beyond the sampled area. For example, if a 150 m stretch is sampled, the assessor of the latter variables must consider a total stretch of 450 m. Each variable is then divided into four condition categories: optimal, sub-optimal, marginal, and poor, each with established criteria. Twenty points are allotted for each of the ten variables resulting in a maximum score of 200. The left and right banks of a stream, determined by facing downstream, are assessed separately for bank stability, vegetative protection, and riparian vegetative zone width. Biologists from the Bureau of Freshwater Fisheries have received habitat assessment criteria training from EPA staff.

Quality Assurance

For QA/QC purposes oxygen meters were re-verified on a monthly basis against a Winkler Titration of deionized water samples. The re-verification procedure was also repeated after an atypical field reading to verify the meter was functioning properly. Retained fish specimens were preserved in 10% formalin solution in the field. Specimens were transferred into a 70% ethanol solution for long-term preservation 2-3 weeks after initial collection. Preserved specimens were then re-verified by

personnel at the Academy of Sciences in Philadelphia. For freshwater mussels, voucher specimens were sent to an outside expert for species verification.

Core and Supplemental Water Quality Indicators

Core Indicators (fishes):

- Abundance of each species, species richness (number of species) and abundance (total number).
- Semi-Quantitative Habitat Assessment

Supplemental Indicators:

- General Water Quality Parameters -
  - pH, Dissolved Oxygen, Temperature, Alkalinity, Conductivity, Specific Conductance.
- Anomalies such as visible lesions, tumors, skeletal anomalies, and fin damage.

Core Indicators (Freshwater Mussels, Odonata, Herptiles):

- Abundance of each species, species richness (number of species) and abundance (total number of fish).
- Semi-Quantitative Habitat Assessment

Supplemental Indicators:

- General Water Quality Parameters -
  - pH, Dissolved Oxygen, Temperature, Alkalinity, Conductivity, Specific Conductance.

Data Management

Data collected, from the IBAA, are stored in the Bureau's Fishtrack database.

Data Analysis / Assessment

Development of metrics and scoring criteria currently under development will be completed in 2004. To date, 41 candidate metrics were independently analyzed for correlation with various forms of human disturbance gradients (% of Forest and Wetland (undisturbed), % Agriculture, % Urban, % Impervious, and Road density). Correlation analysis identified 21 metrics which represent a range of categories and respond to a range of human impact gradients. Candidate metrics that correlate to stream size have also been identified using ANOVAs and ANCOVAs. Six metrics have been identified that respond to human disturbances, one of which is dependent on stream size.

Candidate Metrics		**Scoring Criteria**	
	5	**3**	**1**
Number of Native Sunfish Species		Varies with Stream Size	
Percent Pickerels	>10	0<x<10	0
Percent White Suckers	0	0<x<10	>10
Percent Intolerant Fish	>10	0<x<10	0
Number of Tolerant Species	1 or 2	3 or 4	5 or more
Percent Generalists	0	0<x<10	>10

A preliminary scoring criteria was established for these metrics but may be modified depending on additional field data and further analysis. Additional metrics continue to be analyzed for responses to stream habitat quality.

Reporting

Annual IBAA reports are published in limited hard copy and provided to Department of Environmental Protection, Environmental Protection Agency and the United States Geological Survey for review and comment. The year IV report was also provided to and reviewed by James Karr, developer of the Index of Biotic Integrity.

Program Evaluation

- Monitoring Timeline:
  Monitoring for the IBAA program, over the next five years, is expected to occur on the following timeline:
  - December 2004 - Development of IBI for Lower Delaware River tributaries completed
- Implementation Plans:
  - 2005 - 2009 Plan:
    - Peer Review
    - Determine feasibility of incorporating into Surface Water Quality Standards
    - Incorporate into Surface Water Quality Standards

General Support and Infrastructure Planning

A. Current Resource Needs (Bureau of Freshwater Fisheries)

(1) Total Funding - $63,500
(2) Staffing - 1 FTE per fiscal year, 1 seasonal
(3) Total Operating Cost - $5,000
(4) Laboratory Resources - $2,000
(5) Research - $3,000
(6) Program Improvements - $30,000 (includes staff & operating costs /fiscal year) to expand IBI development to Central portion of the State.

B. Current Resource Needs (ENSP)

(1) Total Funding - $63,500
(2) Staffing - 1 FTE per fiscal year, 1 seasonal
(3) Total Operating Cost $5,000
(4) Laboratory Resources $2,000
(5) Research $ 3,000
(6) Program Improvements – Additional $30,000 (includes staff & operating cost / fiscal year)

Classification of New Jersey Waters

Monitoring Objectives

High water quality and habitat standards necessary for the survival and successful reproduction of trout have made these fishes useful bio-indicators of stream health. In 1968, the Division of Fish and Wildlife initiated the process of identifying and classifying New Jersey waters according to their suitability to support trout. Five years later, a classification system for New Jersey waters was developed. Today, waters of the state are classified according to their suitability to support trout and/or trout associated species. Lakes are classified on their ability to support trout year round, whereas streams are classified on the presence of natural reproduction and an incidence of occurrence for trout and/or trout associated species. Classifications for particular stream segments are incorporated into the State's Surface Water Quality Standards through an official rule making

process. The classifications carry varying degrees of protection and antidegradation protection. Ultimately, the more suitable a waterway is to supporting trout the higher the classification and the more protection it will receive. Although a vast amount of work has been accomplished in classifying New Jersey waters, waters continue to be classified today as well as upgraded in classification when justified by additional field investigations.

Monitoring Design

Previously unsampled streams and lakes, and waters whose trout supporting status is believed to have improved are surveyed according to standardized sampling protocols:

Lakes

Lakes are classified as trout maintenance or non-trout according to their ability to support trout year round. Trout survival in lakes is dependent upon summer water quality conditions, which can reach critical levels during the summer months. Lakes are surveyed mid-August when maximum annual temperature levels are reached and dissolved oxygen levels are typically at the lowest levels. To support trout, lakes must have, throughout the year, a layer of water with favorable conditions of temperature (21° C or Less) and dissolved oxygen (4mg/l or greater). Surveyed lakes that meet these criteria are classified as trout maintenance.

Streams

Streams are classified based on the documented occurrence of natural reproduction, and the presence or absence of trout and/or trout associated species. Streams which lack naturally reproduced trout in their first year of life are classified as trout maintenance or non-trout based upon the stream's total fish assemblage.

Trout Production - Young –of-the-year trout must be documented within the sampled stream segment. Young-of-the-year (y-o-y) trout can be visually distinguished from older trout in the field, based upon their size (typically less than 100 mm in length).

Trout Maintenance – Incidence of Occurrence of trout and/or trout associated species >20%.

Non-Trout – Incident of Occurrence of trout and /or trout associated species < 20%.

The *Incidence of Occurrence* was initially developed based upon fisheries data collected during the trout classification study in 1968-1971. It was later modified in 1973 as sampling efforts continued and additional data became available. The number of incidences that the species was found to inhabit a stream with a naturally reproducing trout population was proportionally compared to the total number of stream segments the species was found to occur. The result was an Incidence of Occurrence, expressed as a percentage, for that particular species with reproducing trout populations. The higher the *Incidence of Occurrence* the greater the species "association" with trout.

Field & Laboratory Methods:

Streams are sampled from June through mid September of each year using electrofishing gear. The sampling gear for small streams consist of a battery-powered D.C. backpack unit, having one paddle–type electrode and used by an operator and one or two netters. On larger streams a gas generator is used in conjunction with a conversion box, two electrodes and a five to seven person field crew.

Field Collection:
A 150 meter to 182 meter stretch is sampled. All fish encountered were collected without bias to species or size. Fishes with lengths greater than 20mm were identified to the species level, counted, and examined for disease or anomalies. Anomalies such as visible lesions, tumors, skeletal anomalies, and fin damage may be an indication of impaired conditions. Obvious injuries due to electrofishing were noted, but not considered anomalies.

In addition to fish collection, basic physical and chemical parameters of the stream environment were also determined and recorded on the Bureau's Stream Survey Data Sheet. All physical and chemical data were collected one-time-only, thus no long-term data were collected. Physical parameters included stream depth, stream width, substrate type, and shade index. YSI Model 85 and YSI Model 60 meters were used to determine dissolved oxygen, temperature, salinity, conductivity, and pH.

Sample Sorting & Identification:
Total length measurements are taken on all game species. Data are recorded on the Bureau's Supplemental Field Survey Sheet-Fish Samples. Retained specimens were preserved in 10% formalin solution in the field. Specimens are transferred into a 70% ethanol solution for long-term preservation 2-3 weeks after initial collection.

Habitat Assessment:
In accordance with criteria established by EPA (EPA 1999), a stream habitat assessment is conducted at each site. The habitat assessment is intended to evaluate various aspects of the aquatic habitat, surrounding terrestrial environment, and potential anthropogenic factors that may impact the aquatic biota of the stream. Habitat Assessments are broken down into two types, high gradient and low gradient. Low Gradient Habitat Assessments are conducted for streams in the Coastal Plain, while High Gradient Habitat Assessments are conducted for streams north of the Fall line, in Piedmont, Highlands, and Appalachian Valley and Ridge. Data were recorded on the Bureau's Low Gradient Habitat Assessment Data Sheet and High Gradient Habitat Assessment Data Sheet. Ten specific physical parameters for the low gradient are addressed: epifaunal substrate, pool substrate, pool variability, vegetative protection, and riparian vegetative zone width. The high gradient assessment substitutes pool substrate, pool variability, and channel sinuosity with embeddedness, velocity/depth regime, and frequency of riffles or bends. The first five parameters of each assessment are to be assessed for the environment within the 150 m sample area. For example, if a 150 m stretch is sampled, the assessor of the latter variables must consider a total stretch of 450 m. Each variable is then divided into four condition categories: optimal, sub-optimal, marginal, and poor, each with established criteria. Twenty points are allotted for each of the ten variables resulting in a maximum score of 200. The left and right banks of a stream, determined by facing downstream, are assessed separately for bank stability, vegetative protection, and riparian vegetative zone width. Biologists from the Bureau of Freshwater Fisheries have received habitat assessment criteria training from EPA staff.

Quality Assurance

For QA/QC purposes, oxygen meters are re-verified on a monthly basis against a Winkler Titration of deionized water samples. The re-verification procedure is also repeated after an atypical field readings to verify the meter was functioning properly. Retained fish specimens are preserved in a 10% formalin solution in the field. Specimens were transferred into a 70% ethanol solution for long-term preservation 2-3 weeks after initial collection. Preserved specimens are then re-verified by at the Academy of Sciences in Philadelphia personnel.

Core and Supplemental Water Quality Indicators

Core Indicators:

- Abundance of trout and trout related species.
- Semi-Quantitative Habitat Assessment.

Supplemental Indicators:

- General Water Quality Parameters -
  - pH, Dissolved Oxygen, Temperature, Alkalinity, Conductivity, Specific Conductance.
- Anomalies such as visible lesions, tumors, skeletal anomalies, and fin damage.

Data Management

Data from this project are stored in the Bureau's Fishtrack database.

Data Analysis / Assessment

Table 1 has the assigned *Incidence of Occurrence* (I.O.) value for commonly encountered fish species. A figure of 20% is the minimum occurrence with trout that would classify a species as being "trout-associated". To determine the Incidence of Occurrence of a particular sampled stretch the I.O. value for each species found is added and then divided by the total number of species present. A value of 20% or greater yields a trout maintenance classification and a value less than yields non-trout. If trout are not found, a stream may still qualify for a trout maintenance classification if a significant number of trout associated species are found.

TABLE 1. – Incidence of occurrence of selected species in association with naturally reproduced trout.

Species	Naturally Reproducing Trout Present	Naturally Reproducing Trout Absent	Incidence of Occurrence (%)
Slimy Sculpin	10	1	90.9
Longnose Dace	29	48	37.7
Blacknose Dace	69	146	32.1
Creek Chub	35	79	30.7
White Sucker	51	217	19.0
Fallfish	9	42	17.6
Pumpkin Seed	35	185	15.9
Rock Bass	5	28	15.6
American Eel	30	183	14.1

Tessellated Darter	18	116	13.4
Goldfish	2	16	11.1
Smallmouth Bass	4	37	9.7
Common Shiner	10	100	9.1
Largemouth Bass	9	93	8.8
Redfin Pickerel	7	85	7.6
Brown Bullhead	7	94	6.9
Bluegill	6	86	6.5
Redbreast Sunfish	9	134	6.3
Satinfin Shiner	1	18	5.3
Mudminnow	2	39	4.9
Cutlips Minnow	1	26	3.7
Chain Pickerel	2	56	3.4
Golden Shiner	2	101	1.9
Creek Chubsucker	1	91	1.1
Killifish	0	22	0.0
Stonecat	0	20	0.0
Carp	0	20	0.0
Yellow Perch	0	20	0.0

Reporting

Annual reports are submitted to the United States Fish and Wildlife Service in accordance with grant agreements. Recommendations for upgrades to stream classification are submitted to the Department's Water Monitoring and Standards, Bureau of Water Quality Standards and Assessment. Through an official rule making process, changes to classifications are made to the state's Surface Water Quality Standards.

Program Evaluation

- Monitoring Timeline:

Monitoring for this study will continue to 2006 when the study segment ends. The Division of Fish and Wildlife, Bureau of Freshwater Fisheries considers this an ongoing study and will renew this job for another five year cycle through the Sportfish Restoration Program:

- Renew this study for another five year grant cycle through the Federal Sportfish Restoration Act.
- 2006-2011 – Continued monitoring

General Support and Infrastructure Planning

A. Current Annual Resource Needs through 2006:

State (Hunter and Angler)	Federal	Total FY 04
Total Funding -	$1,250	$3,750	$5,000

State (Hunter and Angler)	Federal	Total FY 05
Total Funding -	$1,250	$3,750	$5,000

State (Hunter and Angler)	Federal	Total FY 06
Total Funding -	$1,250	$3,750	$5,000

(1)	Total Operating Cost	$5,000 per fiscal year
(2)	Staffing -	0.1 FTE (Full Time Employee) and 0.1 (seasonal)
(3)	Total Operating Cost -	$500/ per fiscal year
(4)	Laboratory Resources -	$250/ per fiscal year
(5)	Research -	$250 / per fiscal year
(6)	Program Improvements	$ 60,000 for (1) dedicated FTE and seasonal

This project is funded by New Jersey's licensed sportsmen and matching Federal funds available through the Federal Sportfish Restoration Act.

Trout Production Streams Re-Inventory

Monitoring Objectives

Trout production waters are used by trout for spawning and nursery areas. Trout require superior water quality and pristine habitat. Despite the protection that regulatory programs afford trout waters, it is believed that changes in land use may have impacted the state's coldwater fisheries populations. To determine if this is the case, trout production streams that have historical data (1968-1973) will be re-inventoried. The data will be evaluated to determine if population changes have occurred and to develop specific waterbody management strategies to protect this resource. Population data gathered from these investigations will also be utilized to develop criteria for areas where streams are regulated as Wild Trout Streams. The study is anticipated to be completed in 2006. Data collected are stored in the Division's Fisheries Management Database.

Monitoring Design

Trout production streams previously sampled during (1968–1973) inventory will be re-surveyed according to the following standardized sampling protocol:

Field & Laboratory Methods:
Trout streams are sampled from June through mid September using electrofishing gear. The sampling gear for small streams consists of a battery-powered D.C. backpack unit, having one paddle–type electrode and used by an operator and two netters. On larger streams a gas generator is used in conjunction with a conversion box, two electrodes and a five to seven person field crew. The standard sampling distance is 150 meters.

Field Collection:
All fish encountered are collected without bias to species or size. Fishes with lengths greater than 20mm are identified to the species level, counted, and examined for disease or anomalies. Anomalies such as visible lesions, tumors, skeletal anomalies, and fin damage may be an indication of impaired conditions. Obvious injuries due to electrofishing are noted, but not considered anomalies.

In addition to fish collection, basic physical and chemical parameters of the stream monthly basis against a Winkler Titration of deionized water samples. The re-verification procedure is also repeated after any atypical field readings to verify the meter was functioning properly. Meters are field calibrated prior to each use according to the manufacturer specifications. Alkalinity and specific conductance data are collected during the study. In-house laboratory staff determine alkalinity via titration. The reference temperature coefficients for specific conductance are 25° C and 1.91% respectively.

Sample Sorting & Identification:
Total length measurements are taken on all game species. Data is recorded on the Bureau's Supplemental Field Survey Sheet-Fish Samples. Retained specimens were preserved in 10% formalin solution in the filed. Specimens are transferred into a 70% ethanol solution for long-term preservation 2-3 weeks after initial collection.

Habitat Assessment:
To compliment other Bureau projects, a stream habitat assessment is conducted at each site in accordance with criteria established by EPA (EPA 1999). The habitat assessment is intended to evaluate various aspects of the aquatic habitat, surrounding terrestrial environment, and potential anthropogenic factors that may impact the aquatic biota of the stream. Habitat Assessments are broken down into two types, high gradient and low gradient. Low Gradient Habitat Assessments are conducted for streams in the Coastal Plain, while High Gradient Habitat Assessments are conducted for streams north of the Fall line, in Piedmont, Highlands, and Appalachian Valley and Ridge. Data were recorded on the Bureau's Low Gradient Habitat Assessment Data Sheet and High Gradient Habitat Assessment Data Sheet. Ten specific physical parameters for the low gradient are addressed: epifaunal substrate, pool substrate, pool variability, vegetative protection, and riparian vegetative zone width. The high gradient assessment substitutes pool substrate, pool variability, and channel sinuosity with embeddedness, velocity/depth regime, and frequency of riffles or bends. The first five parameters of each assessment are to be assessed for the environment within the 150 m sample area. For example, if a 150 m stretch is sampled, the assessor of the latter variables must consider a total stretch of 450 m. Each variable is then divided into four condition categories: optimal, sub-optimal, marginal, and poor, each with established criteria. Twenty points are allotted for each of the ten variables resulting in a maximum score of 200. The left and right banks of a stream, determined by facing downstream, are assessed separately for bank stability, vegetative protection, and riparian

vegetative zone width. Biologists from the Bureau of Freshwater Fisheries have received habitat assessment criteria training from EPA staff.

Quality Assurance

For QA/QC purposes oxygen meters are re-verified on a monthly basis against a Winkler Titration of deionized water samples. The re-verification procedure was also repeated after an atypical field readings to verify the meter was functioning properly. Retained specimens were preserved in 10% formalin solution in the field. Specimens were transferred into a 70% ethanol solution for long-term preservation 2-3 weeks after initial collection. Preserved specimens were then re-verified by personnel at the Academy of Sciences in Philadelphia.

Core and Supplemental Water Quality Indicators

Core Indicators:

- Abundance of salmonid and other trout related species, species richness (number of species) and abundance (total number of fish).
- Semi-Quantitative Habitat Assessment

Supplemental Indicators:

- General Water Quality Parameters - pH, Dissolved Oxygen, Temperature, Alkalinity, Conductivity, Specific Conductance.
- Anomalies such as visible lesions, tumors, skeletal anomalies, and fin damage.

Data Management

Data are stored in the Bureau's Fishtrack database.

Data Analysis / Assessment

The data collected during this study will be utilized for trend analysis purposes. Additionally, it will be utilized to establish specific management strategies, including the establishment of criteria for those streams in New Jersey that are designated as Wild Trout Streams.

Reporting

Annual reports are submitted to the Division's Federal Aid coordinator and published in limited hard copy.

Program Evaluation

- Monitoring Timeline:
  - Monitoring will continue June through mid-September 2004, 2005 and 2006. Approximately 15 sites will be re-inventoried per year.
  - Undetermined if this project will be renewed for another five year grant cycle after 2006 to assess current status of trout production streams classified after 1973.

General Support and Infrastructure Planning

This project is funded by New Jersey's licensed sportsmen and matching Federal funds available through the Federal Sportfish Restoration Act.

A. Current Resource Needs through 2006: (annual budget)

(1) Total Operating Cost $15,000 per fiscal year

(2) Staffing - 0.25 FTE (Full Time Employee) and 0.5 (Seasonal)
(3) Total Operating Cost - $500/ per fiscal year
(4) Laboratory Resources - $250/ per fiscal year
(5) Research - $250 / per fiscal year

Other Aquatic Life-Related Monitoring
Other aquatic life-related monitoring performed in rivers and streams includes:
- Effects of Water Quality and Land Use on Wood Turtle Populations

B. LAKES AND RESERVOIRS

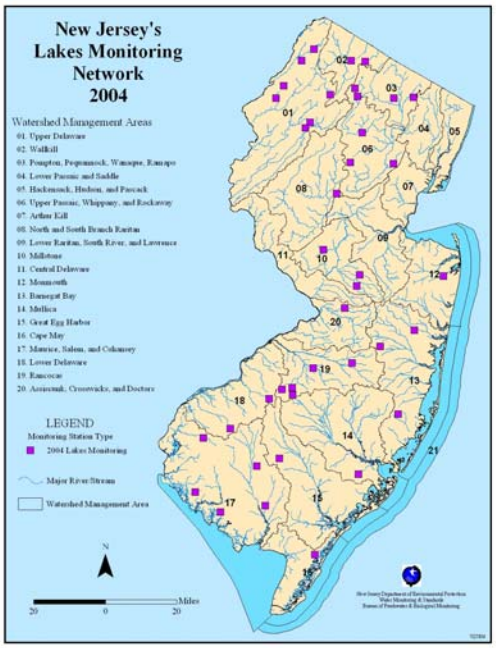
1. AMBIENT LAKE WATER QUALITY MONITORING NETWORK

Monitoring Objective

NJDEP is initiating a renewed ambient lake monitoring network. This program will involve the testing of randomly (probabilistically) selected lakes from the state's approximately 1100 named lakes. Water quality measurements to be taken at each network monitoring station will include parameters such as DO, pH, nutrients, and chlorophyll *a*. Such testing will assist New Jersey in determining the status and trends in lake water quality, as needed to meet our Clean Water Act requirements and our Total Maximum Daily Load (TMDL)-related water quality assessment obligations.

Monitoring Design

Water Monitoring & Standards, Bureau of Freshwater & Biological Monitoring has worked to develop a program that would address not only the deficiencies cited in the 1999 EPA's Office of Inspector General's Audit Report, but also satisfy the specific commitment contained within the State's adopted TMDL documents, and address the needs of the watershed management and water quality assessment (305(b)/303(d)) programs. The Bureau formed an Ambient Lake Water Quality Monitoring Workgroup and tasked it with developing a monitoring network design optimized to address the lake water quality concerns of the various state programs, as well as the deficiencies in the 1999 OIG report. Members of the workgroup included representatives from the Bureau of Freshwater & Biological Monitoring, the Division of Watershed Management- Bureau of Environmental Analysis & Restoration (which is responsible for developing TMDLs), the Bureau of Water Quality Standards & Assessment - Water Assessment Team (which is responsible for generating the *NJ Integrated Water Quality Monitoring and Assessment Report*), and EPA Region 2 - Division of Environmental Science and Assessment, Monitoring & Assessment Branch. Furthermore, EPA- Office of Research & Development, Corvallis, OR. has provided statistical support for the development of the probabilistic selection of monitoring stations. This approach is in keeping with the guidance provided in EPA's publication, "Elements of a State Water Monitoring and Assessment Program," March 2003, which



requires that states develop and implement long-term strategies which include monitoring of all state waterbody types, including lakes.

The final monitoring design is as follows:

- Target Population: All lakes, man-made or natural, excepting public water supply reservoirs, wholly or partially within the State of New Jersey political boundaries. For purposes of New Jersey's Ambient Lakes Monitoring Program (ALMOP) only, a public water supply reservoir is defined as; "An impounded body of water which is managed primarily to provide potable water to domestic drinking water supply, and for which no recreational activities are allowed, management can entail fluctuating water levels and herbicide/algaecide treatments, and whose supply is derived either solely from waterbodies found within its upstream contributing watershed or from outside of the contributing watershed; this includes all pumped storage reservoirs."
- A lake is defined as a permanent body of water of at least two hectares in surface, and a minimum depth of one meter. Lakes are being selected randomly, using the EPA - Generalized Random Tessellation Stratified (GRTS) survey design, but in a manner that equalizes selections over all Omernik level III ecoregions (6 within state). The New Jersey GIS coverage containing approximately 1,100 polygons of named lakes will be used for the selection process.

- Network Stations: The network will consist of 200 lakes, each sampled once every five years, with forty lakes sampled per year. Depending on the lake's size and characteristics, up to four sampling locations will be monitored in each lake. Lakes not exhibiting temperature stratification will be sampled at one meter below the surface, unless the lake is too shallow, in which case the sample will be taken at a depth of one-foot below the surface. Lakes exhibiting stratification will be sampled above and below the thermocline. Depth to bottom will be measured at each station.

- Sampling Frequency: Each lake will be sampled at least three times during the year (Spring, Summer, and Fall), with a fourth winter sampling period being added if weather conditions and resources permit.

- Monitoring Parameters: Total Phosphorus, Total Kjeldahl Nitrogen, Total Nitrite+Nitrate Nitrogen, Ammonia Nitrogen, Dissolved Oxygen, Temperature, Specific Conductance, Alkalinity, Hardness, Secchi depths, and Chlorophyll *a* will be collected and analyzed at each station. Qualitative evaluations of aquatic vegetation will be performed at each lake.

Quality Assurance

A Quality Assurance Project Plan (QAPP) is developed annually for the Ambient Lake Monitoring Network. Components of the QAPP include: (1) description of field sampling methodology (2) description of methodology for operation of field meters used to collect in-situ data (temperature, pH, D.O, and conductivity (3) review and approval by Departmental Office of Quality Assurance program to assure consistency with EPA requirements.

Core and Supplemental Water Quality Indicators

Core Indicators:

- Total Phosphorus
- Total Kjeldahl Nitrogen
- Total Nitrite+Nitrate Nitrogen

- Ammonia Nitrogen
- Dissolved Oxygen
- Temperature
- Specific Conductance
- Alkalinity
- Hardness
- Secchi depths
- Chlorophyll *a*

Supplemental Indicators:

- Qualitative evaluations of aquatic vegetation

Data Management

Data from this Network are stored in EPA's STORET database. Additional information regarding this Network is available from the Bureau of Freshwater & Biological Monitoring's WebPage (www.state.nj.us/dep/wmm/bfbm/publications.html

Data Analysis / Assessment

This data will be incorporated into the *New Jersey Integrated Water Quality Monitoring and Assessment Report,* which is used to assess State waters to assure that attainment of the SWQS is reached.

Reporting

Periodically the bureau will issue reports of results, which are published in both limited hard copy and made available for download via the Bureau's webpage at http://www.state.nj.us/dep/wmm/bfbm/downloads.html/ In addition, the NJDEP provides the results of this monitoring via the *New Jersey Integrated Water Quality Monitoring and Assessment Report.*

Program Evaluation

- Monitoring Timeline:

  Each lake will be sampled at least three times during the year (Spring, Summer, and Fall), with a fourth winter sampling period being added if weather conditions and resources permit.

- Implementation Plans:
  - FY2005 - 2009 Plan
    - Annually, make final selection of forty lakes from candidate list until full compliment of 200 lakes has been probabilistically selected. Conduct water quality monitoring activities at selected lakes.
  - FY2010 - 2014 Plan
    - Annually, conduct water quality monitoring activities at previously selected lakes.

General Support and Infrastructure Planning

RESOURCE	Current FTE	Current Annual Cost ($)	FTE & Program Improvement (5 yr.)	Annual Cost & Planned Program Improvement Five (5) Year[17]	FTE & Program Improvements (10 yr.)	Annual Cost & Planned Program Improvements Ten (10) Year[18]
Staffing	3.0	110,000	0	115,500	0	121,275
Operating		68,000	0	71,400	0	74,970
Laboratory Operating		75,000	0	78,750	0	82,688
Research Costs		0	0	0	0	0
TOTAL COST		253,000		265,650		278,933

NOTE: Appendix 3 contains an estimate of resource needs if the preferred volunteer monitoring approach, below, cannot achieve trends analyses of lakes

2. VOLUNTEER AMBIENT LAKE WATER QUALITY TREND MONITORING NETWORK

Monitoring Objective

The goal of the Lakes Trends Monitoring Project is to identify volunteers that will be able to collect information for NJDEP to use (tier D). With the right volunteers, proper training, equipment and quality assurance the volunteers will aid in developing information on lake water quality trends over time. The Watershed Watch Network (described earlier in this document) has identified all of the potential partners and volunteers that may be interested in participating. Lake Associations, Coalition of Lake Associations (COLA), National Association of Lakes Managers (NALM) and individual lake monitoring groups will be contacted by the end of 2004.

Monitoring Design

The WWN will sample for New Jersey's Ambient Lake Water Quality Monitoring Network.

Site Selection

Initial Site selection by EPA has been completed using a probability design. Field reconnaissance will start as soon as possible by the volunteer coordinator. Both man-made and natural lakes will be included in the sampling. Public lakes will be the focus of the monitoring sites unless a private lake owner grants access rights to the volunteer organization.

Field and Laboratory Methods

The field and laboratory methods have not been finalized to date. These methods will mimic the Bureau of Fresh Water and Biological Monitoring Bureau's methods for data comparability.

Field Collection

The field collection methods have not been finalized to date. The Field collection methods will mimic the Bureau of Fresh Water and Biological Monitoring Bureau's methods for data comparability. We

[17] Adjusted for inflation @ rate of 1.0% per year from current annual cost

[18] Adjusted for inflation @ rate of 1.0% per year from current annual cost

anticipate that once the volunteers have been trained, they will collect samples three to four times per year.

Sample Sorting & Identification & Analysis

The sample sorting, identification and analysis has not been finalized to date. These procedures mimic the Bureau of Fresh Water and Biological Monitoring Bureau's methods for data comparability.

Core and Supplemental Water Quality Indicators

The sample parameters will include Total Phosphorus, Total Kjeldahl Nitrogen, Total Nitrite+Nitrate Nitrogen, Ammonia Nitrogen, Dissolved Oxygen, Temperature, Specific Conductance, Alkalinity, Hardness, Secchi depths, and Chlorophyll *a*. Qualitative evaluations of algal blooms and aquatic vegetation will be performed at each lake over time.

Quality Assurance

The WWN will have an approved QAPP for the Ambient Lake Water Quality Monitoring Network. To date a QAPP has not been created. Once the QAPP is created it will mimic the Bureau of Fresh Water and Biological Monitoring Bureau's study keeping in mind the need for data compatibility.

Data Management

Online data management system for volunteer collected data is in the process of being developed. The systems will allow for volunteers who have been trained and certified within a tier to enter data (at the level of rigor needed for the tier) directly on the website form. The data will then be stored in an Access database where it will be reviewed by the volunteer coordinator for accuracy. Once the data are reviewed and approved the data will then go into STORET.

This system is currently only in the conceptual stage. The goal of this online database is to quickly transfer the results of the volunteers to NJDEP. The data entered online will be reviewed by the volunteer coordinators to assure the quality before it goes to the NJDEP data users and then into STORET. The WWN, in partnership with other NJDEP programs will again need to ensure that data users and volunteer's needs for data management are being addressed.

Data Analysis/Assessment

The WWN will provide volunteers with the necessary resources to analyze and assess their own data for their own defined purposes through training and one-on-one work groups with the data users, volunteers and the volunteer coordinator. The WWN would like to have a website for data management that would be able to also conduct simple statistic, analysis, site comparisons, and reports of the data.

The data collected from this project will be submitted to the data users and water resource managers to allow for consistent data analysis and assessment.

Reporting

The WWN will provide training and resources as needed for volunteer groups on how to create reports described by their results. The volunteer community sees the value in knowing what their sample results show. Currently, many of the volunteer organizations report back to their participants and the local community about the health of the stream.

The data collected for special projects will be submitted to the data users and water resource managers to allow for consistent reporting of the volunteers findings. Volunteer groups collecting at the Tier D level will have their data used in the *New Jersey Integrated Water Quality Monitoring and Assessment Report.*

Volunteer collected data and reports will be published on the WNN website. An Annual Report will be created and available each year.

Programmatic Evaluation

The WWN activities seek external and internal review regularly through the Watershed Watch Network Council. Representatives from the NJDEP, Office of Quality Assurance (OQA), and EPA Region 2 sit on the council. The OQA has involved the WNN in the Statewide Quality Assurance Management Plan was submitted to EPA for review. The OQA now conducts informal reviews of the Network's activities. Once the QAMP and QAPP's for the special projects are drafted, peer reviewed by the council members and approved by OQA, the WNN will be responsible for assuring the program complies with the plans.

The WWN also will conduct an internal annual review specifically to address the overall effectiveness and potential gaps in fulfillment of our mission. The statewide Volunteer Monitoring Summit is where the volunteers can attend and voice their needs, comments and or concerns about the program as well as share successes and network, thereby improving their water monitoring programs.

General Support and Infrastructure Planning

Staffing Needs

The program over the next year plans on expanding its monitoring focus to meet the needs of the volunteers and the need for more data collection. The program needs to hire one Assistant Volunteer Coordinator, one Lakes Coordinator, and one Quality Assurance Coordinator. The Watershed Watch Network will not be able to aid the NJDEP in meeting its water quality goals unless addition staff are hired.

The Lake Coordinator would be responsible for following the programs' Quality Assurance Management Plan (QAMP). The coordinator would also be responsible for citizen's involvement, public relations, training volunteers, equipment calibration and equipment inventory, field visits to volunteer sites, and adopting one lake for monitoring. By adopting a site, the coordinator will set an example through adopting one water body and monitoring it for the purpose of collecting usable data to the highest level of rigor from the NJDEP. This sampling event will also allow for volunteers to meet coordinators out in the field to review sampling procedures, calibrate equipment or meet their coordinator.

We would also need to hire one Quality Assurance Coordinator who would be responsible for the QAPP develop for individual groups, data management including data validation, STORET entry, Annual Reports, delivering data to the proper data users.

An Assistant Volunteer Coordinator is also needed for research, a volunteer certification program, volunteer database management, equipment management, and larger public relations activities such as press releases, training logistics, and special projects and events such as the North American Dip-in.

Funding Needs

The Lake Monitoring Program would need approximately $32,000 for start up costs. Once equipment is purchased the annual budget for upkeep and maintenance of the equipment is estimated at $7,000 per year. A detailed budget is available upon request.

3. LAKE BEACH MONITORING

Monitoring Objective

The New Jersey Department of Health and Senior Services (NJDHSS) regulates public bathing at recreational sites in the State of New Jersey as per the State Sanitary Code, Chapter IX (Public Recreational Bathing), N.J.A.C. 8:26-1 et seq. This monitoring provides information to local and county health departments on bacteriological water quality at public recreational bathing lakes.

Monitoring Design

- Parameter: Fecal coliform bacteria,
- Frequency: Once each week during bathing season
- Geographic Coverage: 370 bathing beaches at 317 public recreational bathing lakes in 15 counties

Core and Supplemental Water Quality Indicators

Fecal coliform bacterial measurements provide an ongoing assessment of the degree of impact of wastes from humans and other warm-blooded animals on lake water quality. In conjunction with other requirements of the State Sanitary Code, Chapter IX (Public Recreational Bathing), N.J.A.C. 8:26-1 et seq., such as shoreline surveys, these bacterial measurements support the designation of New Jersey's public lakes for swimming.

Data Management

Currently, data management is through long-term storage in MicroSoft Excel® spreadsheets. See Resource needs.

Programmatic Evaluation

Measurements of fecal coliform bacteria have provided local, county and state health officials with information regarding the suitability of public lakes for primary contact recreation and protection of public health. This information is submitted to NJDEP on an annual basis and is not available for regular oversight of proper sampling protocol. Lake beaches may not always be sampled adequately to protect public health. Data collected by NJDEP indicates that required re-sampling may not be conducted at a frequency required by the State Sanitary Code. N.J.A.C. 8:26 would have to be amended to require local health officials to report water quality monitoring data, resample results and lake beach closure information to NJDEP on a daily basis during the bathing season.

General Support and Infrastructure Planning

A. Current Resource Needs

Total Funding -	$0 per fiscal year
Staffing -	.25 FTE per fiscal year
Total Operating Cost -	$0 per fiscal year

B. Future Resource Needs (SFY 2015)

Total Funding -	$100,000 per fiscal year
Staffing -	$1.0 FTE per fiscal year
Total Operating Cost -	$45,000 per fiscal year

Resource Needs
DEP needs one FTE to establish a recreational lake reporting program modeled after the Cooperative Coastal Monitoring Program that would have oversight of recreational lake sampling protocol and reporting.

2005-2010
Establish the use of handheld computers to track sampling at lake beaches. Establish a web-based reporting system that would electronically submit monitoring data to NJDEP on a weekly or daily basis as needed. Fund the development of a program to standardize bacteriological water quality monitoring at lake recreational bathing beaches in New Jersey. Fund the development of programs and standardized procedures to notify the public of elevated levels of bacteria resulting in lake beach closings.

4. SAFE DRINKING WATER RESERVOIR MONITORING

Monitoring Objective

Reservoirs used in the provision of drinking water are not part of any regular state supported monitoring program. These reservoirs have had extensive monitoring done by the water systems that own and operate the reservoirs. Water systems carefully monitor the quality of the water used in treatment processes. The monitoring will vary depending on what treatment problems the source water presents.

Some new requirements of the Safe Drinking Water Act will require some ambient monitoring at the raw water intakes to treatment plants for those reservoirs that have intakes. Additionally, there have been a few specific state studies on selected reservoirs.

Monitoring Design

Many reservoirs in New Jersey are used to support provision of an adequate quantity and quality of drinking water. These drinking water-related reservoirs can be classified into several types:

1. Finished (treated) Drinking Water Storage
2. Upstream Storage without an intake
3. Upstream Storage with pumped supply and without an intake
4. Onstream Storage with pumped supply and with intakes
5. Onstream Storage with intakes
6. Offstream Storage (pumped supply) with intakes
7. Offstream Storage (pumped supply) without intakes

Each type can lead to different water quality characteristics, resulting in different monitoring needs. Additionally, for those reservoirs that do not have intakes, the water systems' need for data, to provide current water quality information that affects treatment decisions, is greatly diminished. The monitoring design typically focuses on movement of water to the intake structure, including monitoring at various depths. However, monitoring is not typically designed to cover all the area of the reservoir. Reservoirs without intake structures are likely to have much less data than those that have intake structures.

Core and Supplemental Water Quality Indicators

Core indicators that water systems collect to provide treatment information typically include: pH, temperature, alkalinity, total coliform, iron and manganese (if elevated levels are present in the raw water, as is typical in many New Jersey reservoirs). There are a large number of additional parameters that may

also be monitored. However, reservoir use, water quality, seasonal characteristics and climatic conditions (drought) will affect what monitoring is done and the frequency and location of the testing. These additional parameters can include microbiological indicators such as *Cryptospordium*, *Giardia*, fecal or *E. coli* bacteria, chlorophyll, blue-green algae, and many others. Phosphorous and other measurements that help determine the likelihood of an algae bloom are carefully monitored since the presence of significant quantities of algae can interfere with water treatment processes.

New drinking water regulations require water systems to have effective removal of Total Organic Carbon (TOC). As part of these regulations, water from intake structures will need to be monitored for TOC, alkalinity, and pH on a routine basis.

QA/QC

Water systems determine their own QA/QC needs for most of the sampling. The TOC monitoring must be done using EPA-approved methods. There are no requirements to use certified laboratories for any of this monitoring, however, many water systems laboratories are certified and much of the monitoring is likely to be of good quality.

Data Management

The water systems data are managed by the water systems themselves. Larger systems are likely to have all the information in an electronic data system; smaller systems are not as likely to have the data in such a manner. The TOC data are currently collected in an electronic spreadsheet form and will eventually reside in the Drinking Water Program's SDWIS database.

Data Analysis/Assessment

The water systems' data are analyzed by the water systems for their own treatment purposes. The TOC data are analyzed for compliance with the requirements of the Stage 1 Disinfection Bi-product (DBP) Rule.

Reporting

The data that water systems collect to support treatment of the water are not reported to the state; the TOC data, however, are reported to the state.

Program Evaluation

Although no formal long-term program has existed for these reservoirs, it is likely that a lot of water quality information exists for many of the reservoirs. However, it is unlikely that the information collected routinely is designed for the purpose of a comprehensive and consistent ambient monitoring program. Even the new TOC requirements are only at the intake structure, not anywhere else in the reservoir. Although the Department is aware that some reservoirs have problems with algal blooms and that those reservoirs also have additional monitoring information, the state has discussed, but not had the resources to develop a program to address this issue.

As part of developing a national monitoring program for drinking water reservoirs, there needs to be a study of what water systems' currently do or have done, as well as what water systems' consider to be their ambient water quality issues. This might best be done between EPA and the American Water Works Association Research Foundation. Potential water quality issues, from a drinking water perspective, would be improving control of Disinfectant By-Product (DBP) precursors, conducting studies on currently unregulated contaminants, and developing better methods to predict algal blooms, which affect both DBP's and treatment efficiency as well as their own potential toxic effects. Additionally, any long term monitoring of reservoirs needs to be coordinated with monitoring of ambient surface waters to ensure consistency, since those waters become the reservoir's waters.

5. OTHER RESERVOIR MONITORING

A. SPRUCE RUN – ROUND VALLEY RESERVOIR SPECIAL SAMPLING PROJECT

Monitoring Objective

In 2000, the New Jersey Legislature passed Assembly Bill No. A2793 amending R.S. 58:4-1 to provide for the maintenance of certain water levels in Spruce Run Reservoir in order to maintain recreational activities. These statutory amendments require that the water levels in Spruce Run Reservoir, not be dropped lower than 8 feet from the normal pool elevation between the months of June1 and August 31. Because Spruce Run has been the major source of water to supply the mandatory minimum 90 million gallons a day to the South Branch of the Raritan River for downstream water purveyors and users, the mandated reduction in flows from Spruce Run require make up water be taken from Round Valley Reservoir. Round Valley Reservoir has no contributing waterways and is essentially a pumped storage facility. Water is pumped into Round Valley from the South Branch of the Raritan River on as needed basis, usually during Spring high flow periods. The NJ Division of Fish and Wildlife presently manages an excellent cold water fishery in Round Valley which includes lake trout.. Section 8 (a) of Chapter 58:22-8.1, provides that, "….*the Commissioner of Environmental Protection shall provide for the continuous monitoring of the impacts associated with releasing water from Round Valley reservoir for the purposes of sustaining water recreational activities at Spruce Run Reservoir*…". This monitoring project is the NJDEP's response to this legislative mandate.

Monitoring Design

Four stations were selected for continuous monitoring by a subgroup of individuals from the NJDEP's Bureau of Freshwater and Biological Monitoring, the Division of Fish and Wildlife, the Division of Science, Research and Technology and the New Jersey Water Supply Authority. The first site labeled SB-1, is located on the South Branch of the Raritan River above the Hamden Pump Station from which water is pumped into Round Valley. The remaining 3 stations are located on an east-west transect across Round Valley Reservoir and are designated as RV-1, RV-2 and RV-3. RV-1 is located approximately 200 feet Northeast of the South Tower inflow from the Hamden Pump Station. RV-2 is located approximately mid-way across the reservoir, and RV-3 is located approximately 200 feet from the far easterly shoreline. All stations have been located by GPS and entered into the Bureau's database. Each time the stations are sampled, they are reestablished by GPS. Samples are collected at each station three (3) times a year in April-May; July-August and September-October.

Quality Assurance

A Quality Assurance / Project Plan (QAPP) is developed for the project and is reviewed annually to see if updates are required. The QAPP is reviewed and approved by the NJDEP's Office of Quality Assurance. Components of the QAPP include: (1) all chemical analyses (except analyze immediately) are performed at a laboratory certified by the NJDEP's Office of Quality Assurance (2) Trip blanks and equipment blanks are collected during each sampling run (3) Sample collection and preservation is in accordance with Standard Methods and/or the NJDEP's Field Sampling Procedures Manual (May, 1992) (4) Analyze immediately samples are collected by field meters which have been calibrated to the manufacturer's specifications (5) Data validation is carried out upon receipt of the analytical results.

Core and Supplemental Water Quality Indicators

The following core parameters are monitored:

- Field parameters:
  - Conductivity
  - pH
  - D.O.
  - Temperature
  - Secchi disk
  - Turbidity
  - Flow (South Branch)
- Laboratory parameters:
  - Nitrite N
  - Nitrite-Nitrate N
  - NH3- N
  - TKN
  - Total.P
  - Ortho P
  - Chlorophyll *a*
  - TSS
  - Ca+
  - Hardness

Data Management

Data from this project are stored on the Bureau of Freshwater and Biological Monitoring's local database and is uploaded into the EPA's national STORET database.

Data Analysis / Assessment

The data collected by this project is assessed at the end of each yearly sampling cycle, to track any discernible water quality changes in Round Valley reservoir. These data can be incorporated into the *New Jersey Integrated Water Quality Monitoring and Assessment Report*, which is used to assess State waters to assure that attainment of the SWQS is reached.

Reporting

The NJDEP provides the data when requested to all interested parties.

Program Evaluation

- Monitoring Timeline
  Sampling at Round Valley Reservoir will continue to take place on 3 occasions during the calendar year, one sampling event during each of the periods of April-May, July-August and September-October.

- Implementation Plans:
  - 2005 –2010
    - Continue collection of existing field and laboratory parameters as required by statute.
  - 2011 – 2014
    - Continue collection of existing field and laboratory parameters as required by statute.

General Support and Infrastructure Planning

RESOURCE	Current FTE	Current Annual Cost ($)	FTE & Program Improvement (5 yr.)	Annual Cost & Planned Program Improvement Five (5) Year[19]	FTE & Program Improvements (10 yr.)	Annual Cost & Planned Program Improvements Ten (10) Year[20]
Staffing	0.11	7,486	0	7,860	0	8,253
Operating		514	0	540	0	567
Laboratory Operating		7,686	0	8,070	0	8,474
Research Costs		0	0	0	0	0
TOTAL COST		15,686		16,470		17,294

6. FISHERIES MONITORING

Inventory of New Jersey Lakes

Monitoring Objective

Successful management of New Jersey's warm/cool water fisheries resources in lakes and ponds is based upon specific knowledge of its physical, chemical, biological, and use characteristics. Such knowledge may serve to direct immediate management recommendations or be used as a base upon which to recognize future changes requiring remedial management efforts.

The goal of this project is to develop and implement fisheries management plans for New Jersey's public lakes. The objective is to collect physical, chemical and biological data in order to evaluate the fisheries resources in lakes and ponds and upon which to base fisheries management recommendations.

Monitoring Design

Site Selection:
The following priority scheme is outlined in the Bureau's Warmwater Fisheries Management Plan.

1. Wildlife Management Area, lakes and ponds.
2. New acquisitions by public agencies.
3. Other public lakes that support or with a high potential for supporting a major recreational fishery.
4. Other public lakes that because of their size or productivity will not support a sizeable warmwater fishery.

[19] Adjusted for inflation @ rate of 1.0% per year from current annual cost

[20] Adjusted for inflation @ rate of 1.0% per year from current annual cost

Field Sampling and Methods:

Mapping:
A bathymetric map is developed if one is not available. A portable electronic depth finder is used to map the lake depths.

Water Chemistry:
Surface water samples are collected and transported to the NJ Department of Health & Senior Services for the following analysis: Total phosphorous, T.D.S. and Total Kjeldahl nitrogen. Total Alkalinity is analyzed at the Bureau's office.

Other parameters include: pH, conductivity, dissolved oxygen – temperature profile and transparency (these are measured with Y.S.I. meters and a secchi disk)

Aquatic Vegetation:
Aquatic vegetation species and relative densities are identified by traversing the lake by boat.

Fish Collection:
Collection occurs during the day or preferably at night with a commercial Smith-Root electrofishing boat. One complete lap around the shoreline for lakes up to 400 acres and six hours of electrofishing is representative habitat types for lakes over 400 acres is a standard stretch. All predator species i.e. bass, chain Shoreline seining is conducted at suitable sites using a 20 feet x 4 deep seine and the Swingle Method. All fish species are identified, enumerated and separated by young-of-the-year, intermediate and adult life stages.

Boat electrofishing is conducted during the pickerel, walleye are collected and panfish species, if very abundant, are collected for only a portion of the time. Lengths are taken on all fish. Weights are recorded for all predator species and a subsample for panfish species. Scale samples are taken from all predator species and from only a subsample of panfish when abundant.

Gill nets and/or trapnets are also used to supplement the electrofishing sample. Standard gill nets are monofilament experimental nets 125' x 6' stretch mesh size 1 ½" to 3 ½". Usually two to five gill nets (depending on size of lake) are set perpendicular to shoreline and fished overnight. The standard trap net is the South Dakota style trap net. Similar to the gill nets it is set perpendicular to shore and fished overnight. Lengths, weights and scale samples are taken and recorded the same as stated for electrofishing.

Data Management

All field data are entered and stored in the Bureau's Fisheries Management Database.

Data Analysis

Fish population: Data analysis includes species composition and abundance, CPUE of species by gear type, length frequency distribution, length at age, stock densities (PSD and RSD) and relative weights (W_r), a condition factor.

Reporting

A lake fisheries management plan is written to include all data, analysis, results, discussion and recommendations. Reports are retained at the Division fisheries office and copies submitted to the U.S.F.&W.S. Federal Aid Office. They are available to the general public upon request. These lake assessments are incorporated into the state's water assessment reports.

Program Evaluation

Monitoring Timeline: Ongoing (approximately 3 -5 surveys per year)

General Support and Infrastructure Planning

Current Resources Needs
Total Funding - $40,000 per year (approx. $8,000/lake)

Future Resource Needs (2005-2010)
Total Funding - $45,000 per year (approx. $9,000/lake)

This project is funded by Hunter and Angler funds and matching Federal funds through the Sportfish Restoration Act (75% federal, 25% Hunter and Anglers Fund).

Dissolved Oxygen Temperature Monitoring - Lakes and Reservoirs

Monitoring Objective

As part of the Division of Fish & Wildlife's routine water quality monitoring program, the following lakes and reservoirs, classified as trout maintenance, are monitored annually for dissolved oxygen and temperature during the summer. These waters include; Swartswood Lake, Wawayanda Lake, Lake Aeroflex, Shepherd Lake, Monksville Reservoir, Clinton Reservoir, White Lake, Lake Hopatcong, Little Swartswood Lake and Round Valley Reservoir. The objective is to determine the extent of trout supporting water (D.O.$\geq$ 4 mg/L and temperatures $\leq$ 21^{0}C) during the most critical time of the year.

Monitoring Design

Field Methods:
A Y.S.I model 85 is used to measure the dissolved oxygen and temperature throughout the water column in the deepest part of the lake in mid-August. Readings are taken at regular intervals and vary with depth of the individual lake i.e. greater intervals between readings in deeper lakes. Readings are taken at 5 to 10 foot intervals in the hypolimnion, one foot intervals in the metalimnion and five foot intervals in the epilimnion.

Data Analysis/Assessment

The extent (number of feet) of trout stocking water is determined from the D.O. – Temperature profile for each lake.

Quality Assurance

Dissolved Oxygen meters are re-verified on a monthly basis against a Winkler titration of deionized water samples. The re-verification procedure is also repeated after any atypical field readings to verify the meter is functioning properly. Meters are field calibrated prior to each use according to the manufacturer specifications.

Reporting

Results of the profiles are submitted to the coldwater fisheries biologist and used to direct fisheries management strategies. Any new waterbodies that meet trout maintenance are recommended for upgrade to "trout maintenance" to the Department's Water Monitoring and Standards, Bureau of Water Quality Standards and Assessment.

Program Evaluation

Monitoring Timeline - Ongoing (annually) – August

General Support and Infrastructure Planning

A. Current Resources Needs
1. Total Funding $15,000 per year

B. Future Resource Needs
1. Total Funding $15,000 per year

Funding is provided from Hunter and Angler funds.

Other Aquatic Life-Related Studies

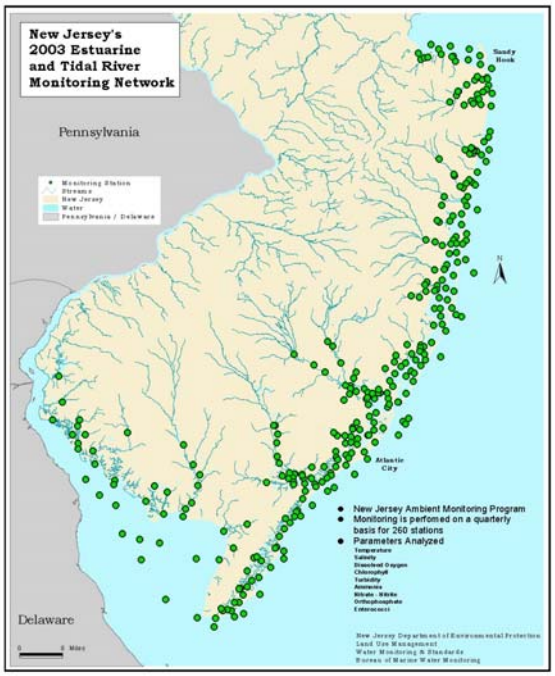
Other aquatic life-related studies performed in lakes includes:
- Round Valley Reservoir Nutrient Study

C. TIDAL RIVERS AND ESTUARIES

1. NJ COASTAL WATER MONITORING NETWORK

Monitoring Objective

The Coastal Water Quality Network was established in 1989 to provide basic water quality information for assessing the ecological health of New Jersey's coastal waters. This long-term monitoring program is intended to provide environmental managers, researchers and the public with accurate, timely and comprehensive information about the condition of the State's coastal waters. Careful assessment of this data will lead to rational goals and policies for coastal water quality management and will provide the means to assess our progress in attaining those goals.



Monitoring Design

- Parameters: temperature, salinity, suspended solids, Secchi depth, dissolved oxygen, chlorophyll *a* and nutrients (ammonia, nitrate, phosphate, total nitrogen and total phosphorus) are measured from surface
- Frequency: water samples collected once each quarter throughout the year.

- Geographic Coverage: All estuarine and near-shore ocean waters with the exception of the Arthur Kill, Newark Bay, Hudson River, Delaware River and Delaware tributaries above the Salem River.
- Automated water quality monitoring buoys with telemetry measure dissolved oxygen, pH, salinity and temperature once every 15 minutes. These data are posted to the Internet for public access. Four buoys are currently in operation in Atlantic and Cape May Counties.

Core and Supplemental Water Quality Indicators

Currently, ecological assessment of New Jersey's coastal waters is achieved by evaluating indicators of eutrophic condition. The only relevant surface water quality standard for the State's coastal waters is dissolved oxygen. However, other indicators are measured to assess eutrophic conditions, including chlorophyll *a*, Secchi depth and nutrients. Physical parameters such as temperature, salinity and suspended solids are also measured since they define habitat conditions in marine waters.

Quality Assurance

A Quality Assurance Project Plan (QAPP) has been developed and is reviewed annually for the Coastal Water Quality Monitoring Network.. All samples are analyzed by the Bureau of Marine Water Monitoring laboratory which is certified annually by the NJDEP Office of Quality Assurance. Data quality for this network are described in the NJDEP's *Annual Quality Assurance Workplan*.

Data Management

Data management is through short-term storage in MS Access databases. Long-term storage and data dissemination is through EPA's STORET system (http://www.epa.gov/storet/). Data dissemination also occurs through the NJDEP Bureau of Marine Water Monitoring web site (http://www.nj.gov/dep/bmw).

Data Analysis / Assessment

Data assessment is performed according to the most current version of Department's *Integrated Water Quality Monitoring and Assessment Methods.*

Reporting

Data generated by this network is reported in the latest version of the *New Jersey Integrated Water Quality Monitoring and Assessment Report* (http://www.state.nj.us/dep/wmm/sgwqt/wat/index.html) as well as in summary reports available from the NJDEP Bureau of Marine Water Monitoring at www.nj.gov/dep/bmw.

Program Evaluation

At the 2004 public hearings on the Governor's Coastal Initiatives, comments were received from the public that the Department should be making assessments and decisions in the coast based on ecosystem health. These comments were supported by recommendations of the Ocean Commission Report (2004) that stated "U.S. ocean and coastal resources should be managed to reflect the relationships among all ecosystem components, including human and non-human species and the environments in which they live." Maintaining ecosystem health is consistent with our obligations under the Clean Water Act to maintain aquatic life uses. In order to maintain and protect ecosystem health, we must first start with the steps listed below:

❖ **Define the primary indicator(s) of ecosystem health**

- **Benthic Community (diversity, richness, abundance)**
- **Pelagic Community (phytoplankton, zooplankton, finfish)**
- **Submerged Aquatic Vegetation (SAV)**

❖ **Establish those indicators as tools for the Integrated Assessment**

❖ **Establish long-term monitoring program for the primary indicators**

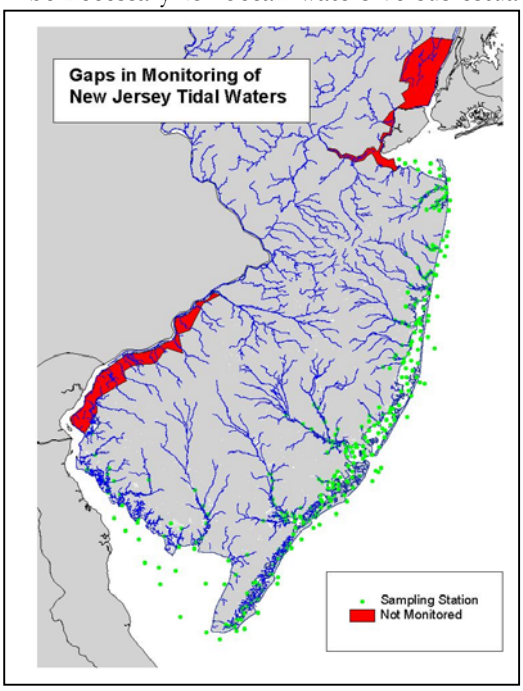
A persistent recurrence of low dissolved oxygen measurements in New Jersey's ocean waters during the summer months has resulted in the NJDEP assessing all of the State's ocean waters as being impaired due to low oxygen.

One important question in evaluating the impact of low oxygen levels is how long organisms are exposed to the low levels. Many aquatic organisms routinely tolerate low oxygen levels for at least 24 hrs. All current oxygen monitoring of New Jersey's ocean waters is performed manually by boat or helicopter sampling. This type of monitoring tells the oxygen level at a single point in time, but provides no information on the short-term duration of the measured oxygen condition. Knowledge of the geographical extent of the depressed oxygen conditions is also very limited due to the nature of the fixed-station monitoring currently being performed.

General Support and Infrastructure Planning

Research Needs

With support from EPA and academia, the NJDEP needs to define the proper indicator(s) of ecosystem health. Both ocean waters and estuarine waters need to be considered since both are interdependent and both are critical to marine fishery resources. However, marine ecosystems are defined by the salinity conditions and in the case of benthic ecosystems, they are also defined by sediment type. This means that different indices will be necessary for ocean waters versus estuarine water. Data collected on estuarine benthic community since 2000 under EPA's National Coastal Assessment (NCA) Program are currently being assessed by EPA and NJDEP staff to determine which indicators of benthic community are most appropriate. However, there is currently no comparable effort to assess the benthic community in the ocean waters off the New Jersey coast. Data need to be collected in the ocean waters similar to that being collected for the NCA Program. Research will need to be performed in ocean waters to identify appropriate indicators of ecosystem health.



Resource Needs

Once appropriate ecosystem indicators have been identified, resources will need to be identified to provide long-term monitoring of those indicators. In the estuarine waters, this will mean continuation of a probabilistic monitoring effort similar to the current NCA Program. The NCA program has been operated by EPA's ORD, but is planned to transition into a monitoring effort by

the coastal states through EPA's Office of Water. Funding comparable to the current level of support for the NCA research program will need to be directed to the State's Water Monitoring programs in order to provide measures of ecosystem health as described above.

The dissolved oxygen impairment of New Jersey's ocean waters described above is one of a number of questions about the State's marine waters that would be better addressed with the implementation of an integrated ocean observing system (IOOS). An IOOS is an integrated and sustained ocean and coastal observing and prediction system. It is composed of many different land-, water-, air- and space-based facilities and technologies. Many of the components in an IOOS already exist in New Jersey. Many of these are in academia (Rutgers University and Stevens Institute). Others are in government (NJDEP, NOAA, NASA). A mechanism is needed to coordinate these components into an integrated system. Such coordination is planned through the New Jersey Water Monitoring Coordinating Council.

As the figure above illustrates, there are some portions of State's tidal waters that are not included in New Jersey's Coastal Water Monitoring Network due to the lack of funding to expand the network beyond those waters monitored for the National Shellfish Sanitation Program. This geographical gap in the State's coastal monitoring may be at least partially addressed by recently developed monitoring efforts. In the Newark Bay/Arthur Kill area, a recently established monitoring effort by the New Jersey Harbor Discharges Group (described below) is expected to provide information on these waters. A recently established monitoring effort by the Delaware River Basin Commission will begin in 2004 to provide information on water quality in the tidal portions of the New Jersey tributaries to the Delaware River.

Resource	Current FTE	Current Annual Costs	FTE & Program Improvement (5 yr)	Annual Cost & Planned Program Improvement Five (5) Year[21]	FTE & Program Improvements (10 Yr)	Annual Cost & Planned Program Improvements Ten (10) Year[22]
Staffing	6.5	313,000	6.5	329,000	8.0	420,000
Operating		46,000		48,000		57,000
Lab Operating		0		0		0
Research Costs		0		100,000		0
TOTAL COST		**$359,000**		**$477,000**		**$477,000**

2. NATIONAL SHELLFISH SANITATION PROGRAM

Monitoring Objective

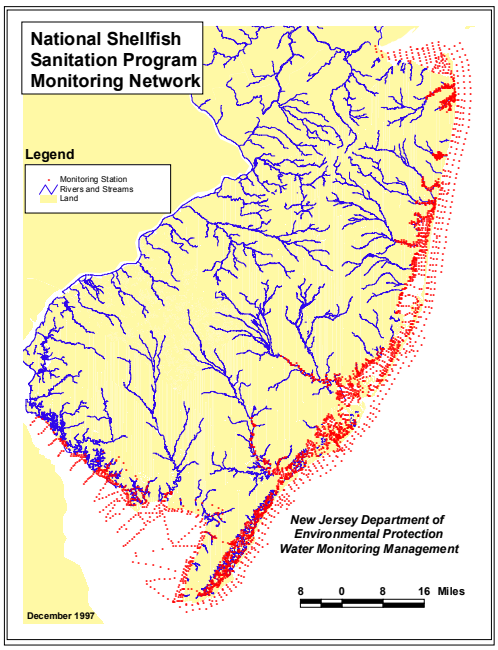
This monitoring supports New Jersey's regulations that establish when and where shellfish (molluscan bivalves) can and cannot be safely harvested for human consumption. The State of New Jersey has monitored its coastal waters for shellfish safety since the early 1900's.

[21] Adjusted for inflation @ rate of 1.0% per year from current annual cost

[22] Adjusted for inflation @ rate of 1.0% per year from current annual cost

Monitoring Design

- Parameters: Total coliform bacteria, fecal coliform bacteria, toxic phytoplankton species, pathogenic *Vibrio parahaemolyticus* in oyster tissue (summer months), and coliphage virus (spill response)
- Frequency: 2 to 12 times per year based on harvest classification and water quality conditions
- Geographic Coverage: Approximately 2,500 active monitoring locations (16 for phytoplankton) covering all estuarine and near-shore ocean waters (up to 3 nautical miles offshore) with the exception of the Arthur Kill, Newark Bay, Hudson River, Delaware River and Delaware tributaries above the Salem River.



Core and Supplemental Water Quality Indicators

Total coliform and fecal coliform bacterial measurements provide an ongoing assessment of the degree of impact of wastes from humans and other warm-blooded animals on coastal water quality. In conjunction with other requirements of the National Shellfish Sanitation Program such as shoreline surveys and hydrographic studies, these bacterial measurements support the classification of New Jersey's waters for shellfish harvesting. All coastal states that produce molluscan shellfish classify their waters using the standards and procedures of the National Shellfish Sanitation Program. The EPA has recognized shellfish water classifications as a primary indicator of coastal water quality on both a national level and a state or local level as well.

Quality Assurance

A Quality Assurance Project Plan (QAPP) has been developed and is reviewed annually for the National Shellfish Sanitation Program. All samples are analyzed by the Bureau of Marine Water Monitoring laboratory which is evaluated annually by the US Food and Drug Administration.

Data Management

Data quality for this network is described in the NJDEP's *Annual Quality Assurance Workplan*. Data management is through short-term storage in MS Access databases. Long-term storage and data dissemination is through EPA's STORET system (http://www.epa.gov/storet/).

Data Analysis / Assessment

Data assessment is according to the most current version of the *Guide for the Control of Molluscan Shellfish,* which is produced by the Interstate Shellfish Sanitation Conference (www.issc.org) in conjunction with the U.S. Food and Drug Administration.

Reporting

Complete intensive sanitary surveys are conducted every 12 years with interim narrative evaluations, reappraisals, completed on a three-year basis. Reappraisal reports are less detailed discussions of the principle components included in the sanitary surveys. In addition, the reappraisal report does not require a full shoreline survey. If major changes to the shoreline or bacterial quality occur, then the intensive sanitary survey report is initiated prior to its l2 year schedule. Annual Reviews are written

on a yearly basis for each shellfish growing area. Reports are available through the NJDEP, Bureau of Marine Water Monitoring web site at www.nj.gov/dep/bmw.

Program Evaluation

Measurements of total coliform and fecal coliform bacteria have provided the backbone of the monitoring component of the National Shellfish Sanitation Program since its inception. However, it is becoming increasingly clear that these traditional measurements are not enough for adequate public health protection. Naturally occurring pathogens (such as *Vibrio parahaemolyticus)* and more frequent algal blooms require non-traditional tools for adequate monitoring. State shellfish control agencies are also being asked to identify pollution sources so that funding and resources can be targeted to those pollution sources that pose the greatest public health threat. New Jersey must continue to develop its use of new tools to address these emerging needs. These include biochemical identification methods for bacteria, viruses and phytoplankton, remote sensing to detect phytoplankton blooms and new monitoring methods and tools to monitor nonpoint source pollution and to track its sources.

Despite requirements in the National Shellfish Sanitation Program that "toxic and deleterious substances" be considered in making shellfish harvest classifications, New Jersey has very limited monitoring for toxic pollutants in shellfish tissue. NOAA's Mussel Watch Program provides limited data for Sandy Hook Bay, Delaware Bay and some of New Jersey's inlets. However, the species monitored ranks low in terms of quantity as a harvested species in New Jersey. Also, there is no monitoring in the State's coastal bays and offshore waters where significant harvest occurs. Short-term monitoring in certain locations has been performed when funds could be identified, but routine, statewide monitoring for toxic pollutants in shellfish tissue has never been in place.

General Support and Infrastructure Planning

Research Needs

Nonpoint sources of pollution are currently being tracked using microbial indicators that distinguish between human and animal sources. Two of the most promising methods for this work are currently being employed in New Jersey on a limited basis. These are F+ RNA coliphage (a viral indicator) and multiple antibiotic resistance (MAR – a bacterial indicator). Continued research to develop a routine laboratory method for serotyping or genotyping coliphage is needed. Development of a national database or library of MAR results is needed so that the different laboratories performing this test can compare results and learn from work in other parts of the country. Continued research on the appropriate antibiotics and their concentrations is needed for the MAR methods.

Continued research is also needed on sensors and algorithms for remote sensing equipment to improve the specificity of remote sensing and to minimize its costs.

Resource Needs

2005-2009

Complete the process of laboratory expansion to handle additional samples for coliphage, MAR and *Vibrio parahaemolyticus*. This will enable more extensive use of coliphage and MAR testing for microbial source tracking. It will also enable more extensive use of *Vibrio parahaemolyticus* monitoring in oyster tissue. These procedures are more intensive than traditional coliform methods and therefore necessitate additional facilities for sample processing. One additional FTE (or 2 hourly employees) will be needed when the expanded laboratory is functional.

NJDEP will continue to participate in the Interstate Shellfish Sanitation Conference's evaluation of Vibrio parahaemolyticus control measures. NJDEP will revise its *Vibrio parahaemolyticus* Control Plan in accordance with the guidance of the ISSC.

In cooperation with NOAA, NASA and EPA, New Jersey is developing techniques for aircraft remote sensing to identify waters with high chlorophyll levels. These areas would be targeted for phytoplankton sampling (including brown tide). Also, New Jersey was one of the first states to employ new biochemical methods for screening samples for certain species of toxic phytoplankton.

2011-2014
Continue to work through the Interstate Shellfish Sanitation Conference to gain acceptance for the use of new indicators and methods for the National Shellfish Sanitation Program. Many new methods such as coliphage analysis show promise to provide an even higher degree of public health protection. Continued research on methods for microbial source tracking will also lead to fewer restrictions on shellfish harvesting in New Jersey's coastal waters.

Resource	Current FTE	Current Annual Costs	FTE & Program Improvement (5 yr)	Annual Cost & Planned Program Improvement Five (5) Year[23]	FTE & Program Improvements (10 Yr)	Annual Cost & Planned Program Improvements Ten (10) Year[24]
Staffing	13	771,000	14	815,700	14	901,000
Operating		108,000		108,060		122,060
Lab Operating		0		0		0
Research Costs		0		100,000		0
TOTAL COST		**$879,000**		**$1,023,760**		**$1,023,060**

3. NON-POINT SOURCE MONITORING – SOURCE TRACKING

Using routine monitoring performed in the National Shellfish Sanitation Program (described above) the NJDEP identifies coastal waters that are impacted by nonpoint pollution sources. The Department then performs targeted monitoring to identify the pollution source(s) responsible for the water quality impacts. The Enforcement and Watershed Management staff in the Department then work with the local governments to correct the problems identified. Follow-up monitoring is performed to confirm that the source was mitigated. While this strategy was primarily developed for coastal waters, it has been successfully implemented in fresh water locations as well.

Monitoring Objectives

To identify nonpoint pollution sources responsible for water quality impairments.
To provide follow-up monitoring to assess the effectiveness of corrective actions.

[23] Adjusted for inflation @ rate of 1.0% per year from current annual cost

[24] Adjusted for inflation @ rate of 1.0% per year from current annual cost

Monitoring Design

While the design of any specific source tracking effort will depend on the specifics of the project such as type of impairment being addressed and the type of impact (stormwater, septics, agriculture), the basic overall design consists of the following steps:

1. Identify use impairments related to water quality and NPS pollution.
2. Trace water quality problem back to its source
3. Correct the problem at its source and monitor effectiveness using evaluation monitoring to measure pollution control.
4. Using the monitoring systems described in 1 and 2 above, trace the water quality improvement back to the removal of the use impairment.

Core and Supplemental Water Quality Indicators

Effectiveness of this monitoring program is dependent on the degree to which water quality impairments are identified and mitigated. Those core indicators of impairment (e.g. shellfish water classification, bathing beach closures, etc) will be the indicators used for this monitoring program as well. This work has so far focused on public health related impairments. Therefore, parameters monitored included fecal coliform bacteria, *E. coli* bacteria, and coliphage virus.

Data Management

Data management is through short-term storage in MS Access databases. Long-term storage and data dissemination is through EPA's STORET system (www.epa.gov/storet).

Data Analysis / Assessment

Data analysis is performed by NJDEP Bureau of Marine Water Monitoring. Data interpolation is performed using a Geographic Information System. Time series plots are produced to evaluate pollution conditions under various rainfall and tide conditions as an aid in identifying sources.

Reporting

Reports on this work are generated by the NJDEP Bureau of Marine Water Monitoring and are available by contacting the Bureau at (609) 748-2000.

Program Evaluation

Evaluation of this program is relatively straightforward based on its monitoring objectives which are 1) to identify non point pollution sources; and 2) measure effectiveness of corrective measures to mitigate those sources. Of the four source tracking projects completed to date, all have succeeded in identifying significant pollution sources. Of those four, one succeeded in removing an impairment and lead to the upgrade of the waterbody's shellfish harvest classification. The other three are awaiting completion of source mitigation activities by local governments. Success at accomplishing the two objectives listed above will continue to be the method of program evaluation for this monitoring effort.

Use of alternate indicators such as coliphage and multiple antibiotic resistance (MAR) testing can play a significant role in microbial source tracking by providing information regarding a human, domestic animal or wild animal source for the pollution. Routine use of these new tools is limited by laboratory capability to perform these tests.

General Support and Infrastructure Planning

Currently there are no routine, dedicated funds for nonpoint source pollution tracking. Projects are undertaken when financial resources become available to support such efforts. The need for source

tracking work has been identified in about 30 locations in New Jersey's coastal waters for public health related impairments. With current staffing levels, the Bureau of Marine Water Monitoring has been able to handle 1-2 projects a year at costs ranging from about $10,000 to $30,000 per year. In order to increase the number of projects per year to be addressed, innovative approaches need to be developed with regard to staffing and overtime for monitoring during non-traditional work hours. For some projects, costs can be reduced by greater use of automated monitoring equipment for storm event monitoring. Approval of use of automatic samplers for microbial sampling is being sought from the Department's Office of Quality Assurance. If approved, use of automated samplers could significantly reduce the cost of microbial source tracking by reducing the need for costly overtime required with manual sampling.

Resource	Current FTE	Current Annual Costs	FTE & Program Improvement (5 yr)	Annual Cost & Planned Program Improvement Five (5) Year[25]	FTE & Program Improvements (10 Yr)	Annual Cost & Planned Program Improvements Ten (10) Year[26]
Staffing	1.0	25,000	2.0	52,500	0	55,000
Operating		5,000		10,500		11,000
Lab Operating		0		0		0
Research Costs		0		0		0
TOTAL COST		**$30,000**		**$63,000**		**$66,000**

4. NATIONAL COASTAL ASSESSMENT PROGRAM

National Coastal Assessment (NCA) is designed to provide a quantitative assessment of the regional extent of environmental problems by measuring status and change in selected indicators of ecological condition. It provides a strategy to identify and bound the extent, magnitude, and location of environmental degradation and improvement on a regional scale.

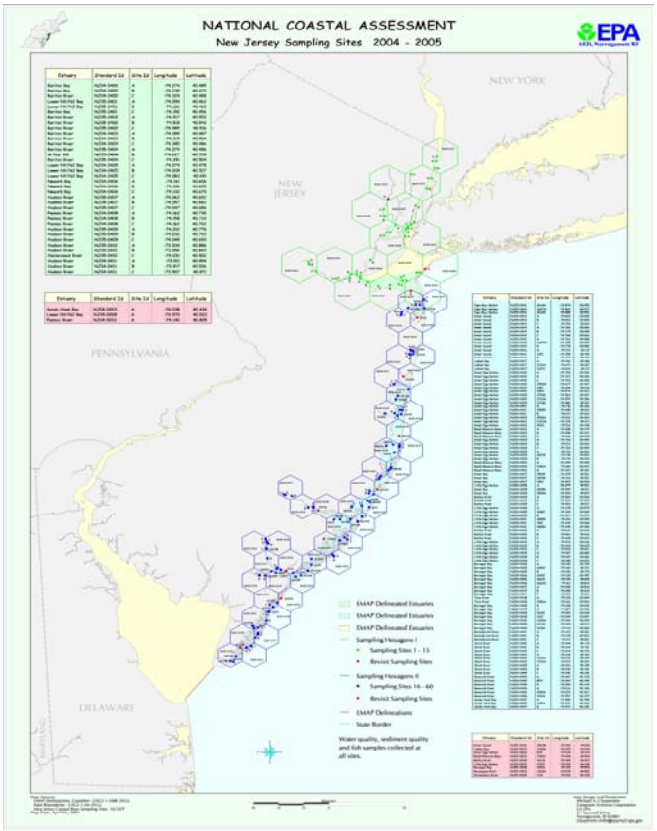
NCA attempts to assess the condition of the Nation's estuarine waters through statistically valid subsampling. Whereas the original EMAP effort was conducted primarily by EPA and contract staff, NCA is being implemented in partnership with the 24 coastal states. This partnership recognizes that each of these entities plays an important role in estuarine monitoring. Wherever possible, existing state monitoring programs are being incorporated into the NCA design. This provides for the maximum utilization of a limited budget, and the flexibility of allowing states to often maintain historical sampling designs. Many of these state programs have been in existence for many years, providing a basis for possible NCA trends analyses. Each state will conduct the survey and assess the condition of their coastal resources independently. These estimates will then be aggregated to assess the condition at EPA Regional, biogeographical, and national levels. Through this partnership EPA hopes to build infrastructure within the coastal states to improve, and make more inter-comparable, the multitude of estuarine monitoring programs throughout the country.

[25] Adjusted for inflation @ rate of 1.0% per year from current annual cost

[26] Adjusted for inflation @ rate of 1.0% per year from current annual cost

Monitoring Objectives

- Assess the health or condition of the estuarine waters of the United States and trace changes in that condition through time
- Assess the health or condition of the estuarine waters of the states of the United States and trace changes in that condition through time
- Utilize the approach to identify reference conditions for estuarine waters in the United States



Monitoring Design

The National Coastal Assessment Program utilizes a probabilistic survey design. This design is intended to allow extrapolation to all resources, to allow assessment of 100% of the state's (nation's) estuarine waters for utilization in the Integrated Assessment of surface waters. It utilizes response indicators to assess ecological condition and diagnostic indicators to help explain conditions. The strata for the probabilistic design are the biogeographic provinces and the substrata are the states. Each state has a minimum of 50 sampling sites.

Core and Supplemental Water Quality Indicators

Core indicators will measure living resources (benthic community composition, benthic community abundance, fish community composition, fish pathologies, fish parasites, fish tissue residue, chlorophyll a, occurrence of exotic species) and habitat (Occurrence of SAV, occurrence of macroalgae, habitat type delineation, qualitative abundance of SAV, qualitative abundance of macroalgae). Supplemental indicators will measure physiochemical quality of the water (temperature, salinity, pH, Secchi depth, water depth), water quality (nitrogen species, phosphorus species, silica, total suspended solids, dissolved oxygen, transmissometry) and sediment quality (metals, PAHs, PCBs, sediment toxicity, total organic carbon, grain size).

Quality Assurance

Field crews will perform the first cut validation of field data to assure that values are in the expected range. Daily QC checks will be evaluated by the Chief Scientist. Field records for calibrations and QC are sent to State QA lead for further review. Laboratories performing analyses for NCA will conduct their internal QA/QC verifications prior to submitting data. Final data packages submitted by labs will include copies of all results (including QC). The State QA lead reviews data for basic

completeness/content and evaluates data for overall quality (accuracy & precision) using NCA quality criteria.

Data Management

State Information Manager checks to ensure data are within specified ranges appropriate for each parameter. Field data are screened for errant or missing information makes corrections on field data sheets and documents in bound logbook. Transcription errors are also measured by evaluation of randomly selected subset of station packages. Regional Information Managers perform a three-tiered data evaluation where:

- Level 1 review examines the database for completeness, format compatibility, and internal consistency.
- Level 2 highlights values that are unusual enough to raise the suspicions of a data user.
- Level 3 review is conducted to evaluate whether data submitted by the states or laboratories are comparable, recognizing that the magnitudes of the values may indeed be different in the various regions.

Data from the NCA surveys are evaluated and appropriately qualified based on the project's Measurement Quality Objectives. These establish the quality goals for the individual measurements taken by the program used in the generation of condition indicators utilized by NCA.

Final data sets are stored in EPA's STORET database.

Data Analysis/Assessment

Regional QA Coordinators will make the initial approval/disapproval of data sets and, when warranted, assign appropriate qualifier codes. After data have been qualified, data analysis and assessments are then jointly developed through the cooperation of state and federal environmental scientists. EPA will be responsible for posting the finalized C2000 data and supporting metadata on the Internet and making them available to interested parties.

Reporting

A National Coastal Condition Report will be produced each year by EPA and will be available at http://www.epa.gov/owow/oceans/nccr/. This Report represents a coordinated effort among EPA, the National Oceanic and Atmospheric Administration, the U.S. Geological Survey, and the U.S. Fish and Wildlife Service. It summarizes the condition of ecological resources in the estuaries of the United States and highlights several exemplary federal, state, tribal, and local programs that assess coastal ecological and water quality conditions.

The State of New Jersey will use data generated by the National Coastal Assessment program, as appropriate, in the estuarine section of the *New Jersey Integrated Water Quality Monitoring and Assessment Report*.

Programmatic Evaluation

Planning and data evaluation meetings are held between EPA, Atlantic Ecology Division, EPA Region 2 and the NJ Department of Environmental Protection each year to assess the existing data and to discuss modifications to future monitoring efforts. EPA also sponsors national EMAP Symposiums where researchers and environmental managers discuss results, lessons learned and future directions for the Environmental Monitoring and Assessment Program (EMAP) of which National Coastal Assessment is a part.

General Support And Infrastructure Planning

The primary support for the National Coastal Assessment is federal funding through EPA's Office of Research and Development. Within two years, EPA plans to fund NCA through the Office of Water and the Regional Offices instead of through the Office of Research and Development. For this monitoring to be continued in New Jersey's waters as a routine sampling and analysis program, funding needs to be transferred to the State at that time. Currently, NJDEP provides laboratory support for water column chemistry analyses and receives funding for these analyses.

Resource	Current FTE	Current Annual Costs	FTE & Program Improvement (5 yr)	Annual Cost & Planned Program Improvement Five (5) Year[27]	FTE & Program Improvements (10 Yr)	Annual Cost & Planned Program Improvements Ten (10) Year[28]
Staffing	2.0	130,000	0	137,000	3.0	215,000
Operating		40,000		42,000		124,000
Lab Operating		120,000		126,000		132,500
Research Costs		0		130,000		0
TOTAL COST		**$240,000**		**$435,000**		**$471,500**

5. HARBOR DISCHARGERS AMBIENT MONITORING

The purpose of this long-term volunteer water quality monitoring program is to develop ambient water quality data for the Hackensack River, New Jersey portion of the Hudson River, Passaic River, Rahway River, Elizabeth River, Raritan River, Newark Bay, Upper New York Harbor, Raritan Bay and the Arthur Kill. As noted in the previous section on the NJ Coastal Water Monitoring Network, these waters represent a gap in the Harbor monitoring effort. NJDEP is in the process of evaluating the QA Project Plan for this work to determine if this monitoring will meet the requirements for inclusion into the State's Integrated Assessment Report and thereby aid in filling this monitoring gap. Among the factors considered in this evaluation will be sampling and analytical quality assurance, data management and timely availability of the data to the public.

This is monitoring will be performed by the New Jersey Harbor Dischargers Group (NJHDG). The NJHDG is under no regulatory obligation to perform this study. Sampling will be conducted so that a long-term understanding of water quality in the New Jersey portion of the New York/New Jersey Harbor (and associated tributaries) can be developed. The study will monitor water quality in ambient waters, which will reflect the overall condition of the waterbodies, and provide a means of tracking the success of pollution abatement initiatives. The data are expected to provide a characterization of the general water quality and variability of receiving waters in the project area.

[27] Adjusted for inflation @ rate of 1.0% per year from current annual cost

[28] Adjusted for inflation @ rate of 1.0% per year from current annual cost

Monitoring Objectives

The objectives of this monitoring are:

1. To provide baseline information on current water quality relative to water quality standards;
2. To identify any changes in water quality over time;
3. To provide a basis for comparing the relative importance of pollution from upstream sources versus pollution from wastewater treatment plants, combined sewer overflows and storm water overflows, and;
4. To document water quality improvements resulting from the implementation of pollution control programs.

Monitoring Design

Thirty-three sampling sites located in the Hackensack River, New Jersey portion of the Hudson River, Passaic River, Rahway River, Elizabeth River, Raritan River, Newark Bay, Upper New York Harbor, Raritan Bay and the Arthur Kill will be monitored weekly from May through September, and twice monthly from October through April. The following water quality parameters will be measured at each site during each sampling event: dissolved oxygen (DO), pH, total suspended solids (TSS), fecal coliform bacteria, *Enterococcus* bacteria, Secchi depth (where applicable), salinity, temperature, total Kjeldahl nitrogen (TKN), ammonia (NH_3), nitrite + nitrate ($NO_3 + NO_2$), total phosphorus (TP), orthophosphorus, 5-day carbonaceous biochemical oxygen demand ($CBOD_5$), chlorophyll a, and dissolved organic carbon (DOC).

Core and Supplemental Water Quality Indicators

Currently, ecological assessment of New Jersey's coastal waters is achieved by evaluating indicators of eutrophic condition. The only relevant surface water quality standard for the State's coastal waters is dissolved oxygen. However other indicators are measured to assess eutrophic condition including chlorophyll a, Secchi depth and nutrients. Physical parameters such as temperature, salinity and suspended solids are also measured since they define habitat conditions in marine waters.

Quality Assurance

A Quality Assurance Project Plan has been developed and is currently under review by the NJDEP Office of Quality Assurance for this project. If changes are made to this plan, it will be resubmitted

for approval. Standardized sampling techniques and analytical methods are used for this project for data comparability.

Data Management

For the sampling and analytical activities associated with the long-term water quality program, all data generated in the field and laboratory will be recorded in logbooks or standardized data forms including: sampling location and date, raw analytical data1 daily sample processing procedures and corrective actions which are implemented, Instrument quality control information will be maintained on file. All data will be maintained on file for a minimum of five years, and all applicable data will be included in the annual report.

Data Analysis/Assessment

Data will be compared with current New Jersey water quality standards.

Reporting

An annual report will be produced and will include the following:

- A general description of the program
- The methods used for sample collection and chemical analysis
- Summary tables of the chemical analysis results and field data in sufficient detail so that an independent analysis can be performed on the data
- Anything unusual about the sampling or analysis, including deviations from specific protocols and any other relevant information;
- Corrective actions
- The implications of the results as they relate to current and past conditions in the harbor.

Programmatic Evaluation

Only certified laboratories participate in analyzing the samples for this program and those laboratories are required to pass performance-testing programs in order to maintain certification. Each certified laboratory is also periodically audited. The findings of these audits, together with the performance testing program results, are used to update each laboratory's certification status.

Performance Audits: All certified laboratories participate in the EPA's Performance Evaluation (PE) studies for each category of certification. Laboratories are required to pass each of these PE studies in order to maintain certification.

System Audits: Periodically, each laboratory receives an onsite audit. The findings of these audits, together with the EPA PE results are used to update each laboratory's certification status.

General Support and Infrastructure Planning

Funding and logistical support for this program will be provided by the New Jersey Harbor Dischargers Group. This organization is a consortium of the following members:

Bergen County Utility Authority
Edgewater Municipal Utility Authority
Joint Meeting of Essex and Union Counties
Linden Roselle Sewerage Authority
Middlesex County Utility Authority
North Bergen Municipal Utility Authority

North Hudson Sewerage Authority
Passaic Valley Sewerage Commissioners
Rahway Valley Sewerage Authority
Secaucus Municipal Utility Authority

6. FISHERIES MONITORING

Anadromous Clupeid Inventory (ACI)

Monitoring Objective

American shad and river herring are of great ecological, recreational, and commercial value to New Jersey and many other Atlantic coast states. The monitoring and restoration of these fisheries is a fundamental aspect in ensuring the population's well-being. The last statewide inventory of anadromous clupeid spawning migrations was completed more than 20 years ago. Given the dramatic increases in water quality and associated return of anadromous clupeids to areas previously classified as extinct, a new statewide inventory of anadromous clupeid spawning migrations is needed to effectively manage this important resource. This documentation will protect spawning migrations, nursery areas, and out-migrations of juvenile clupeids through timing restrictions and project conditions placed on Stream Encroachment and LURP (land use regulation) permits.

Monitoring Design

Site Selection:

Using data collected from the 1972 anadromous fisheries inventory, all waters classified as having extinct spawning migrations of American shad and/or river herring are given priority attention in the sampling protocol. Secondly, attention is given to locations that are potential spawning locations based on habitat and water quality. These potential locations include areas that have been reported through the 1972 study and those that have been determined based on water quality parameters and geographic location to possibly have anadromous clupeid spawning runs. Additionally, more than 30 secondary drainage basins will be sampled that were not sampled during the 1972 study. After these high priority areas have been re-surveyed and the status of the anadromous fisheries categorized, the areas sampled during the 1972 study with "confirmed" spawning migrations will be revisited and the status of the fisheries categorized.

Site selection is also based on temperature and species. Specifically, areas in the southern portion of the state receive attention before those in the northern parts of the state. Typically, spring weather patterns result in average air temperatures that are consistently higher in the southern counties than in the central and northern counties. Areas near the coast are also typically cooler in the early spring. These areas that warm the quickest are the first to be sampled. Progressively as temperatures warm, sampling efforts are moved to the central portion of the state.

The criteria used to categorize a river or stream as having "confirmed" spawning runs is the presence of gravid adults in the sampled area. Sampling is conducted by one or more of the following methods depending on site conditions. All river herring collected are identified to species.

Field and Laboratory Methods

The sampling methods utilized have been detailed in the Anadromous Clupeid Inventory Sampling – Standard Operating Procedures. These procedures are used when sampling during the period of March 25th through June 10th. Temperature, dissolved oxygen, pH, salinity, specific conductance, and conductivity are measured using YSI meters. All water chemistry was taken six inches below the

surface. Stream depth and width, tidal influence, shade index, and percentage of bottom covered with aquatic vegetation are measured objectively by surveying personnel.

Field Collection
Anadromous fishes are collected utilizing a combination of sampling gear types as deemed appropriate by the project coordinator and field sampling crew. The sampling gear to be used is determined by the dynamics of the sampling site and how well those dynamics lend themselves to a particular sampling gear. Sampling gear can be divided into two categories, active and passive capture techniques. These techniques include but are not limited to seines, cast nets, dip nets, electrofishing, anglers creel surveys, gill nets, and fyke traps. Seines are best used below spillways in pools or wadeable scour holes. Cast nets are used when fish are visible and a uniform relatively flat bottom is present. Dip nets with a basket comprised of wire mesh with a 24" diameter are best employed in wadeable streams. Gill nets of 2 ¾ to 3" stretch mesh should be used for river herring and 5 to 5 ½" stretch mesh should be used for American shad. Due to the high mortality associated with gill netting it is used only in relatively deep water that are not suitable for other active and passive sampling gear. Fyke traps are best utilized in streams with slow to moderate flow and a depth of less than two feet. When employing this gear the set time, time of retrieval, date of retrieval, and soak time is to be recorded.

Sample and Sorting and Identification
All captured fish specimens are identified to the species level, counted, and recorded. Alosid species are identified to the species level, measured to fork length, sexed, checked if ripe, and preserved. Two specimens per species per site are retained for QA/QC purposes. Alosid specimens are placed on ice as soon after capture as practical. Specimens are preserved within 24 hours of capture, are wrapped in muffled aluminum foil, sealed with freezer tape and placed in a freezer bag. Specimens are labeled with external tags (jaw tags) and frozen. Sample location, date captured, fish species, and crew are to be recorded on the outside of the bag. When multiple species are collected they are placed in separate bags.

Habitat Assessment
Physical habitat parameters directly influence the utilization of a particular waterbody by anadromous species. Parameters evaluated include steam depth, tidal influence, flow rate, substrate type, in-stream vegetation, and stream shading. A mean stream depth is taken at a location representative of the stream. This area excludes impacted areas, such as bridge crossings. The tidal influence is indicated and tidal stage determined. Flow rates are taken in the center of the stream at a location representative of the stream. A substrate sample using a coring device such as an Eckman dredge is taken once from each location. Additionally, a visual observation is made to determine the percent coverage of aquatic vegetation. Stream bank vegetation and canopy cover is separated in five categories characterized as open, scattered, moderate, complete, and heavy.

Quality Assurance

Two specimens per species per site are retained for QA/QC purposes. A representative sample of fishes collected field sampling are identified in the lab by the project leader. Fish are identified to species and verified by another biologist when identification is in question. Additionally, a reference collection of New Jersey's freshwater fish is maintained in the regional fisheries offices.

Core and Supplemental Water Quality Indicators

Core Indicators:

- The presence of gravid adult clupeids and abundance of fish.

Supplemental Indicators:

- General Water Quality Parameters-
- Dissolved Oxygen, pH, Temperature, Conductivity, Specific Conductance, and Salinity.
- Anomalies such as visible lesions, tumors, skeletal anomalies, and fin damage.

Data Management

Data collected from this project is organized and managed through the Anadromous Clupeid Inventory database maintained by the Bureau of Freshwater Fisheries at the Southern Region Office.

Data Analysis/Assessment

Presence or absence of gravid alosid species. Documentation on confirmed runs is incorporated into fisheries management programs, construction of fish ladders, and dam removal. In addition, documented runs are afforded additional protections through the Department's regulatory processes.

Reporting

An annual report is prepared detailing locations that have been sampled and the current status of anadromous clupeids spawning; this includes a detailed description of locations, sample methods, and species collected. A final report will be prepared at the completion of the project. This report will be used to supplement the report *New Jersey Anadromous Fish Inventory – Information on Anadromous Clupeid Spawning in New Jersey,* which was prepared in 1978.

Program Evaluation

The improvement in water quality as a result of the Clean Waters Act of 1972 provided the catalyst for improvement in New Jersey's aquatic habitats and fisheries resources. New Jersey's anadromous fisheries have directly benefited. This monitoring project provides valuable information on the status of our anadromous fisheries.

Monitoring Timeline

November to October 2004	Sample Extinct and Reported Locations Statewide
November to October 2005	Sample Extinct and Reported Locations Statewide
November to October 2006	Sample Confirmed Locations Statewide, Prepare Final Report

Implementation Plans

2005-2006 Plan:

- Continue monitoring and sampling reported, extinct, and confirmed anadromous clupeid fish locations.
- Continue to experiment with gear type to achieve maximum efficiency.
- Prepare final report of all new confirmed spawning locations and re-confirmation locations.

General Support and Infrastructure Planning

A. Current Annual Resource Needs through 2006:

	State (Hunter and Angler)	Federal	Total FY 04
(1) Total Funding -	$4,750	$14,250	$19,000
(2) Staffing -	One FTE and One seasonal per fiscal year		
(3) Total Operating Cost -	$16,000		
(4) Laboratory Resources -	$500		

(5) Research - $500

This project is funded by Hunter and Angler funds and matching Federal funds through the Sportfish Restoration Act (75% federal, 25% Hunter and Anglers Fund).

Other Aquatic Life-Related Studies

Other aquatic life-related studies performed in tidal rivers and streams include:

- Delaware River Young of Year Recruitment Survey
- Delaware River Adult American Shad Population Estimate
- Juvenile American Shad Outmigration
- Monitoring of Winter Flounder in the Shark and Manasquan Rivers
- Striped Bass and American Shad Tagging Programs
- American Eel Resource Monitoring at Patcong Creek

7. VOLUNTEER MONITORING

Tidal Rivers and estuaries monitoring is a long-term goal of the Watershed Watch Network. The volunteers will be able to monitor and assess the tidal streams and estuary systems within the State through chemical, biological, visual, and physical monitoring. Currently there are many volunteers that have expressed an interest in these types of monitoring however; the program does not have the staff, equipment or financial resource to operate this type of program. To date this is a concept that needs to be expanded upon. Tidal River and Estuaries Monitoring Program will be created once a FTE is secured for this project. The program needs to hire one Tidal River and Estuaries Coordinator, and one Quality Assurance Coordinator. The Quality Assurance Coordinator would be the same FTE for all programs within the WWN. The Watershed Watch Network will not be able to aid the NJDEP in meeting its water quality goals unless addition staff is hired.

D. COASTAL OCEAN WATERS

1. NJ COASTAL WATER MONITORING NETWORK

See discussion above under Section C.

2. NATIONAL SHELLFISH SANITATION PROGRAM

See discussion above under Section C.

3. BEACH MONITORING

Monitoring Objective

This program evaluates coastal water quality represented by enterococcus samples collected from designated public recreational bathing sites on the Atlantic coast and estuary shorelines of New Jersey. Enterococcus samples are also measured at designated environmental sites along the coast

and back bays. The program provides a consistent format for water quality analyses and their application to coastal zone management strategies and real-time response to public health concerns.

Monitoring Design

- Parameters: 186 ocean and 139 bay beaches are monitored for enterococci bacteria.
- Frequency: water quality samples are collected weekly from mid-May through early September.
- Geographic Coverage: All ocean and bay bathing beaches from Raritan Bay to Cape May.

The program runs from May through September (the recreational bathing season). Sampling for the season commences at least two weeks prior to the official start of the season (Memorial Day) in May so as to identify water quality problems that may have developed over the winter. The final required sampling for the season is the Tuesday after Labor Day in September.

Samples are collected once per week as recommended by the U.S. Environmental Protection Agency's *National Beach Guidance and Required Performance Criteria for Grants*, preferably on Monday (or Tuesday if Monday is a holiday). Sampling on these specified weekdays coincides with the period of time immediately after peak usage of and highest stress on the sewage infrastructure.

Each participating health department is responsible for collecting the samples and training all samplers in collection methods as stated in NJDEPE, Field Sampling Procedures Manual (Chapter 7) Trenton, NJ, 1992; and In Chapter IX (Public Recreational Bathing) of the State Sanitary Code, N.J.A.C. 8:26-1 et seq.

Core and Supplemental Water Quality Indicators

Bathing beaches are assessed using concentrations of enterococci bacteria as an indicator of pathogens that may cause illness in swimmers. Physical conditions are also assessed by sanitary survey when bacteria concentrations exceed State standards. Aerial surveillance of ocean bathing beaches is performed six days per week from mid-May through early September.

Quality Assurance

A Quality Assurance Project Plan is developed each year which standardizes the collection and analyses of bacteriological water quality samples and laboratory standard operating procedures. This plan is available for review at www.njbeaches.org.

Data Management

Data quality for this network is described in the NJDEP's *Annual Quality Assurance Workplan*. Short-term data management will be through a web-based reporting system that uses an MS SQL database. Long-term storage and data dissemination will be through EPA's STORET system (http://www.epa.gov/storet/) and on the NJDEP Oracle database. Data dissemination will also occur through the NJDEP Cooperative Coastal Monitoring Program web site (http://www.njbeaches.org) and daily beach conditions are reported through the DEP Sandline at 800-648-SAND.

Programmatic Evaluation

The NJDEP administers the CCMP through the County Environmental Health Act (CEHA), N.J.A.C. 7:18 *et seq.*, to evaluate nearshore coastal water quality. The New Jersey Department of Health and Senior Services (NJDHSS) regulates public bathing at recreational sites in the State of New Jersey as per the State Sanitary Code, Chapter IX (Public Recreational Bathing), N.J.A.C. 8:26-1 *et seq.*

Since 1974, NJDEP has administered the Cooperative Coastal Monitoring Program (CCMP) with the participation of local environmental health agencies. The CCMP assesses nearshore coastal water quality and investigates sources of water pollution. The information collected under the CCMP assists the NJDEP in developing coastal zone management strategies such as land use planning to control pollution from nonpoint sources. The CCMP also enables local health agencies to respond to immediate public health concerns arising from contamination in coastal recreational areas. Under the CCMP, local health agencies monitor concentrations of enterococci in coastal waters. These bacteria are indicators of fecal contamination from various point and nonpoint sources. In order to comply with the EPA BEACH Act, DHSS amended N.J.A.C. 8:26 Public Recreational Bathing rules to change the bacterial indicator to the EPA recommended enterococci for the summer 2004 bathing season. NJDEP has also received an EPA Challenge Grant to create a centralized database that will allow for the timely reporting of water quality conditions at New Jersey's beaches**.**

For recreational bathing stations, if the initial enterococcus concentration is above the primary contact standard of 104 per 100 mL of sample then samples will be collected on subsequent days until the concentration decreases to within the standard. In addition, there is bracket sampling of the stations with elevated concentrations in order to evaluate the extent of the problem. Bracketing of the station means sampling to either side of the station at locations that take into consideration potential pollution sources, nearby bathing or monitoring stations or any other impediment to water flow, to determine the extent of the contamination. Sanitary surveys, as defined in N.J.A.C. 8:26-1.3, are also conducted at the site to determine possible sources of bacterial contamination. Concentrations in excess of the standard at environmental sites do not require resamples. Sampling will be performed regardless of weather or tide conditions as long as the sampler determines conditions to be safe and a representative, valid sample can be collected.

If the result of the microbiological water quality resample is unsatisfactory, or if the sanitary survey discloses any condition which may present an imminent hazard to public health or safety, the bathing beach is closed for bathing. The local health authority immediately notifies DHSS and NJDEP of closings of recreational bathing areas that are monitored in the CCMP. If the overall microbiological water quality data indicates that an area exceeds the bathing water microbiological quality standards as a consequence of certain environmental conditions, that bathing area is kept closed for a period of time following those environmental conditions as indicated by past sampling data. Further, if environmental conditions, such as heavy rainfall, cause sewage and/or stormwater infrastructure failures such as surcharging manholes, then bathing areas having the potential to be affected are closed or sampled at the discretion of the health authority. A bathing beach is not opened until the sanitary survey and, if necessary, appropriate sampling shows the microbiological water quality to be acceptable. The local health authority shall immediately notify the DHSS and NJDEP when a bathing beach that is monitored by the CCMP has been reopened.

General Support and Infrastructure Planning

A. Current Resource Needs
- (1) Total Funding - $482,000 per fiscal year
- (2) Staffing - 3 FTEs per fiscal year
- (3) Total Operating Cost - $25,000 per fiscal year

B. Future Resource Needs (SFY2015)
- (1) Total Funding - $630,000 per fiscal year
- (2) Staffing - 4.0 FTEs per fiscal year

(3) Total Operating Cost - $40,000 per fiscal year

Research Needs

A number of beaches in northern urban parts of the state have been identified as potential bathing areas. Bacteriological information is necessary to determine whether those beaches can be opened for swimming. A sampling and monitoring program would have to be designed that would provide long-term analysis of water quality at potential urban beaches.

Coastal bathing areas occasionally experience bacteria concentrations that exceed state standards with no identifiable source of the contamination. NJDEP laboratory resources are necessary to provide laboratory analysis at intensively monitored bathing areas.

Resource Needs

Currently there is a need for 3 FTEs so the Cooperative Coastal Monitoring Program can expand to include potential urban and Delaware Bay beaches. There would be one supervisor to administer the program and provide daily oversight and program development. There is also a need for two seasonal employees to update web and telephone information lines and perform daily coastal flight duties. An additional FTE would monitor weekly and daily data submission from counties and prepare data for uploading to EPA's STORET database and ensure that all EPA beach grant provisions are being met. The additional FTE would also be available to work on the lake monitoring reporting program if those responsibilities are transferred to NJDEP.

2005-2010

The Cooperative Coastal Monitoring Program should expand to include all potential urban and Delaware Bay beaches and all public recreational lake beaches (see Lakes Beach Monitoring section) in the state. This expansion should provide staff to administer the daily monitoring and reporting needs of the recreational bathing beach program in New Jersey.

4. FISHERIES AND OTHER AQUATIC LIFE MONITORING

Inventory of New Jersey's Coastal Waters (Trawl Survey)

This fisheries stock assessment program of New Jersey's nearshore recreational fisheries resources has been conducted continuously since 1988. The survey area consists of New Jersey coastal waters from the Ambrose Channel (the entrance to New York Harbor), south to Cape Henlopen Channel (the entrance to Delaware Bay), and from approximately the 3-fathom isobar inshore to the 15-fathom isobar offshore, approximately 12 nautical miles from shore. The annual, stratified, random sampling design generally includes 39 stations sampled 5 times each year during sampling cruises occurring in January-February, April, June, August, and October. Prior to trawling at each station, surface and bottom water samples are collected for measurement of salinity and dissolved oxygen, the former with a conductance meter and the latter by the Winkler titration method. Surface and bottom temperatures are measured with a thermistor. The data are used collectively for a stock assessment along the entire Atlantic coast. It is coordinated with the National Marine Fisheries Service, Atlantic States Marine Fisheries Council and the Mid-Atlantic Fisheries Management Council. This project is funded by the Federal Sportfish Restoration Act.

Inventory of New Jersey's Surf Clam (*Spisula soldissimac*) Resource

New Jersey's surf clam population, rebounding from a dramatic decline in 1975 due to anoxic water conditions, is now experiencing unexplained declines in recruitment and adult clams. One theory is small changes in water temperature have caused the decline but other habitat and water quality issues have not been ruled out. Annual sampling occurs from May through August in New Jersey's territorial waters from Cape May to Shark River. In addition to clam surveys, water samples are also collected at the first and last stations sampled on each field day with samples examined for temperature, dissolved oxygen and salinity. The project is funded by the National Marine Fisheries Service.

E. WETLANDS

Monitoring Goals and Objectives

At the current time, scientific methods are being developed and evaluated throughout the United States to determine what methods are appropriate for monitoring and assessing wetland function and quality. New Jersey has an active research program in collaboration with academic partners at Rutgers University and other wetland scientists throughout the region to assess and monitor wetland resources (see citations below for examples of recent research).

New Jersey values all wetlands for the multiple functions they provide for both public health and welfare such as flood retention and erosion control, pollutant filtration, sediment retention, nutrient sinks and sources, water recharge and discharge, as well as ecological values such as critical habitat. New Jersey law recognizes all wetlands and requires permits for impacts to all wetland types and their associated transition areas. The classification of freshwater wetlands in New Jersey has statutory and regulatory implications for certain types of disturbances. For example, New Jersey classifies some wetlands as exceptional resources because they include rare plants and animal species or are hydrologically connected to high quality surface waters and therefore, larger buffers are required by statute. New Jersey also recognizes other wetlands for their ecological value such as vernal pools and limits disturbance within such resources.

Therefore, any additional approaches to characterizing, assessing and monitoring wetlands for New Jersey must be done so as to not contradict the functions and values that are recognized by statute.

New Jersey has the following goals and objectives for a comprehensive wetland monitoring program:

To strengthen regulatory protection for wetlands where research and assessment indicate it is warranted.
-To ascertain the status and trends of wetlands.
-To evaluate the ecological consequences of a given regulatory action or group of actions.
-To evaluate the performance of wetland restoration and compensatory mitigation.

To identify significant and unique wetland areas for preservation and protection.
To identify wetlands for restoration.
-To determine, if establishing designated uses and associated criteria for wetlands would be practicable for New Jersey to help identify areas for preservation, enhancement or restoration or for regulatory purposes.

-To determine if quantitative methods can be developed to assess wetland function in a manner that is practicable for statewide implementation.

-To determine if a method can be developed to relate wetland quality and water quality to watershed preservation, source and causes of impairment, assessment and restoration applications.

-To evaluate the cumulative impacts of wetland loss and restoration relative to ambient water quality conditions.

As research into qualitative methods progresses, it will inform both methods and any additional standards development. If any additional standards are determined to be appropriate, these together with New Jersey's current regulatory framework, can provide measures of wetlands quality status and trends and can serve to identify wetlands in need of protection or restoration. Research underway currently should inform ways in which sources and causes of impairment can be identified. Wetland quality management is currently addressed through multiple programs to mitigate and minimize wetland impacts as well as to preserve, create, enhance, maintain and restore these resources including but not limited to New Jersey's: Land Use Regulation Program, Green Acres Program, Natural Lands Trust, Freshwater Wetlands Mitigation Council, 319 program, Office of Natural Resource Restoration, and landowner incentive programs such as the Conservation Reserve Enhancement Program.

It is the Department's expectation, assuming significant commitment of resources are made available to the State, to have a program designed by 2007 and implementation of such by 2010.

Monitoring Program Design

For many of the program goals and objectives, data can be synthesized for the core indicators cited in the Core and Supplemental Indicators sections. A comprehensive program design at the current time is premature as appropriate methods for wetlands assessment are not yet developed or recommended at the national level. New Jersey is evaluating a series of methods as well as conducting research on development of others to address the following program and goals and objectives:

To determine if quantitative methods can be developed to assess wetland quality in a manner that is practicable for statewide implementation.

To determine if a method can be developed to relate wetland quality and water quality for watershed preservation, source and causes of impairment, assessment and restoration applications.

To evaluate the ecological consequences of a given regulatory action or group of actions.

To evaluate the performance of wetland restoration and compensatory mitigation.

To evaluate the cumulative impacts of wetland loss and restoration relative to ambient water quality conditions.

Citations of recent and ongoing research that will inform development of any additions to New Jersey's wetland monitoring and assessment:

Balzano *et al.* 2002. Creating indicators of wetland status (quantity and quality) freshwater wetland mitigation in New Jersey. Trenton: New Jersey Department of Environmental Protection, Division of Science, Research and Technology.

Ertman, A. *et al.* 2004. DRAFT: Assessing the feasibility of two wetland assessment techniques in the Passaic River Basin, New Jersey. Trenton: New Jersey Department of Environmental Protection, Land Use Regulation Program.

Hasse, J. and R. G. Lathrop, Jr. 2001. Measuring urban growth in New Jersey. A report on recent development patterns ustil9izing the 1986-1995 NJ DEP land use/land cover dataset. New Brunswick: Rutgers University Center for Remote Sensing and Spatial Analysis.

Hatfield, C. *et al.* 2004. Development of wetland quality and function assessment tools and demonstration. Trenton: New Jersey Department of Environmental Protection, Division of Science, Research and Technology.

Hatfield, C. *et al.* 2004. Testing a wetlands mitigation rapid assessment tool at mitigation and reference wetlands within a New Jersey watershed. Trenton: New Jersey Department of Environmental Protection, Division of Science, Research and Technology.

Hatfield, C. ongoing research. Evaluating the relationship between wetland quality, condition and function. Anticipated completion: Spring 2005.

Lathrop, R.G., Jr. 2004. New Jersey land use/land cover update: 2000-2001. Trenton: New Jersey Department of Environmental Protection, Division of Science, Research and Technology.

Lathrop, R.G, Jr. 2004. Measuring land use change in New Jersey: land use update to year 2000. A report on recent development patterns 1995-2000. New Brunswick: Rutgers University Center for Remote Sensing and Spatial Analysis.

Lathrop, R.G., Jr. 2004. New Jersey land cover change analysis project 1972-1984-1995. New Brunswick: Rutgers University Center for Remote Sensing and Spatial Analysis.

New Jersey Department of Environmental Protection. 2001. New Jersey environmental indicators technical report 2nd edition. Land and natural resources indicators. Trenton: New Jersey.

Niles, L.J. *et al.* 2004. New Jersey's landscape project, version 2.0. Trenton: New Jersey Department of Environmental Protection, Division of Fish and Wildlife, Endangered and Nongame Species Program.

New Jersey Department of Environmental Protection. Ongoing. Land use and land cover mapping for New Jersey. http://www.nj.gov/dep/gis/; http://www.nj.gov/dep/gis/stateshp.html. Numerous data sets free for download including 1986, 1995/97 data sets from air photos and 2002 orthophotos; Category 1 waters, Natural Heritage Priority Sites, etc..

New Jersey Department of Environmental Protection. Ongoing. Identification, delineation and faunal surveys of vernal pools in New Jersey. New Jersey Department of Environmental Protection, Land Use Regulation Program and Division of Fish and Wildlife, Endangered and Nongame Species Program. http://www.nj.gov/dep/landuse/fww/vernal/index.html and http://www.nj.gov/dep/fgw/ensp/vernalpool.htm.

Ryan , P. *et al.* DRAFT Assessing the feasibility of using hydrogeomorphic wetlands assessment in New Jersey-riverine forest example. . Trenton: New Jersey Department of Environmental Protection, Land Use Regulation Program.

Walz, Kathleen Strakosch, Scott Stanford, Emily W.F. (Russell) Southgate. 2004. Pine Barren Riverside Savannas of New Jersey. New Jersey Department of Environmental Protection, Division of Parks and Forestry, Office of Natural Lands Management, Natural Heritage Program, Trenton.

Walz, K.S. *et al.* 2001. Identification and protection of reference wetland natural communities in New Jersey: Calcareous sinkhole ponds of the Kittatinny Valley. Trenton: New Jersey Department of Environmental Protection, Division of Parks and Forestry, Office of Natural Lands Management, Natural Heritage Program.

Walz, K.S. *et al.* Ongoing. Classification, protection and monitoring of significant wetland communities in New Jersey: Nontidal floodplain forest communities. Trenton: New Jersey Department of Environmental Protection, Division of Parks and Forestry, Office of Natural Lands Management, Natural Heritage Program.

Walz, K.S. *et al.* Ongoing. Classification, protection and monitoring of significant wetland communities in New Jersey: Coastal plain intermittent pondshore communities. Trenton: New Jersey Department of Environmental Protection, Division of Parks and Forestry, Office of Natural Lands Management, Natural Heritage Program.

Walz, K.S. *et al.* Ongoing. Classification, protection and monitoring of significant wetland communities in New Jersey: sea level fen, tidal freshwater and brackish marsh communities. Trenton: New Jersey Department of Environmental Protection, Division of Parks and Forestry, Office of Natural Lands Management, Natural Heritage Program.

Core and Supplemental Water Quality Indicators

The following core and supplemental indicators related to wetlands monitoring goals should be possible for New Jersey's wetlands as data development and collection proceeds and as available resources permit.

To strengthen regulatory protection for wetlands where research and assessment indicate it is warranted.

-To ascertain the status and trends of wetlands.

Status and trends of freshwater and coastal wetland acres by wetland type and acreage.
Status and trends of wetlands acreage lost to development.
Status and trends of new development within wetland buffer.
Status and trends of wetlands acreage preserved and restored.

-To evaluate the ecological consequences of a given regulatory action or group of actions.

Status and trends of acreage of critical wetland habitat.
Status of vernal habitat acreage.
Status of rare wetland vegetative communities.

Quality Assurance

Not applicable

Data Management

Not applicable

Data Analysis/Assessment

Not applicable

Reporting

Wetlands research reports are posted on the NJDEP website and catalogued in the NJ Environmental Digital Library http://njedl.rutgers.edu/njdlib.

Scientific papers based upon some of the NJDEP sponsored research are submitted for publication in the peer review literature as appropriate.

Digital data sets are available for free download at the NJDEP website http://www.nj.gov/dep/gis/. GIS data available on the NJDEP website are also catalogued at the New Jersey Spatial Data Clearinghouse, https://njgin.state.nj.us/NJ_NJGINExplorer/index.jsp, known now as the New Jersey Geographic Information Network (NJGIN).

Data housed in NJGIN are then harvested by the federal governments to the Geospatial One Stop portal, (GOS) and searchable from this federal website http://www.geodata.gov/gos.

Users have multiple ways of finding these data and viewing them and either downloading the data to a desktop or streaming the data into a work session.

Monitoring Program Coordination, Communication and Collaboration

New Jersey participates on both the Mid-Atlantic Wetlands Working Group (MAWWG) and the National Wetlands Workgroup with our EPA and other state counterparts to share expertise as we all work toward methods development appropriate for each state. New Jersey has also formed its own Wetlands Research Advisors Group to help provide scientific and program peer review to guide monitoring program development. Participants are from throughout NJDEP programs, academic partners, U.S. Geological Survey and EPA Region II 305b coordinator and the Region II Wetlands Program. Finally, within NJDEP, New Jersey has a steering group that draws upon expertise from the following programs: Land Use Regulation (wetlands regulatory program), Water Monitoring and Standards, Natural Heritage Program, and Office of Policy, Planning and Science to guide development of our wetlands monitoring program to fulfill EPA's mandate for such by 2014.

Program Evaluation

New Jersey's strategy involves semi-annual meetings of its Research Advisors and regular meetings of its internal steering group. These meetings will continue to focus on a comprehensive strategy for wetland monitoring by providing a forum to share results of research and applications underway for wetlands assessment. Such results will help the programs refine methods and applications so that long-term monitoring and indicators relative to goals and objectives can be designed and integrated into NJDEP's overall water monitoring program for wetlands.

General Infrastructure Support and Planning

A. Current Resource Needs

As EPA has not developed the monitoring protocols to be implemented by states, New Jersey anticipates that continued research and development into appropriate protocols will be necessary and the highest priority in order to develop an effective wetlands monitoring program. The Department will need to develop these protocols through two coordinated approaches: dedicated in-house staff to guide program development and assist in methods evaluation, and continued research to further develop and test methods for New Jersey.

Funding estimates are based on in-house staff NJDEP would need at a minimum to continue to work with its academic partners in methods development, geospatial analyses of current NJDEP data and pilot testing of protocols. Resource estimates include funds for 2 wetlands scientists (lead scientist and research scientist), a GIS specialist and two environmental specialists.

A small in-house staff devoted to wetlands monitoring methods development is needed. This team would synthesize and coordinate with all relevant programs within New Jersey so that any assessment program will be developed in light of various program mandates as well as utilize key data sets available through such programs. Program needs over the next five years include having a minimum number of staff and funding to conduct in-house assessments, evaluate appropriate standards developments, report on core indicators, provide peer review in metric development and monitoring protocol design. The Department estimates an annual budget of $540,000 to provide for the five full-time positions noted.

NJDEP, in collaboration with Rutgers University, is expanding upon various State-initiated projects to develop and test wetlands assessment methods for New Jersey. The research underway is now being adapted to capture EPA's mandate that states develop wetlands monitoring programs as part of their statewide water monitoring strategies. Therefore, New Jersey is exploring quantitative testing of biological and vegetative community data as they pertain to ambient water quality data and rare wetland community data. The methods development will be an iterative process that will examine the ability to assess different wetland functions and whether development of additional standards or designated uses is indicated for New Jersey. Another key component will be to determine what the appropriate classification system for New Jersey wetlands may be in order to develop methods most fitting to wetland type.

The research funding estimate is based on current research that the Department is undertaking with Rutgers University that represents the initial stages of development of an IBI for one wetland type (floodplain forests) for one ecoregion (Highlands). Completion of methods development for floodplain forests in the Highlands would include expanding the field set from 10 sites to another 15-20, reanalysis of data and calibration of the method at an estimated cost of $75,000.

Based upon the work currently underway and assuming some costs will remain constant (field data collection, data analysis, testing and implementation) we estimate it would cost a minimum of $675,000 to complete the development of an IBI for this one ecoregion for all wetlands classes (using the HGM classification system just to estimate the minimum number of wetland classes as 7). We estimate to expand this research to other ecoregions (there are a total of 8 New Jersey ecoregions) for all wetland types would cost $100,000 for each wetland type in each remaining ecoregion (approximately $700,000 per ecoregion). This estimate uses assumes working with State university scientists as opposed to private consultants.

B. Future Resource Needs

Future needs cannot yet be determined without research and development of monitoring protocols. It is anticipated that once the Department has selected the appropriate classification system, protocols and metrics, wetlands can be assessed through both targeted monitoring by the regulated community pre and post impacts, as well as an eco-region based assessment that would focus on the key wetlands functions of most value for the program to ascertain priorities for restoration and preservation as well as evaluate regulatory adaptation. We expect that a fully operating program could anticipate 120 potential days of monitoring in a field season that enables approximately 40-60 sites per season.

1. VOLUNTEER MONITORING

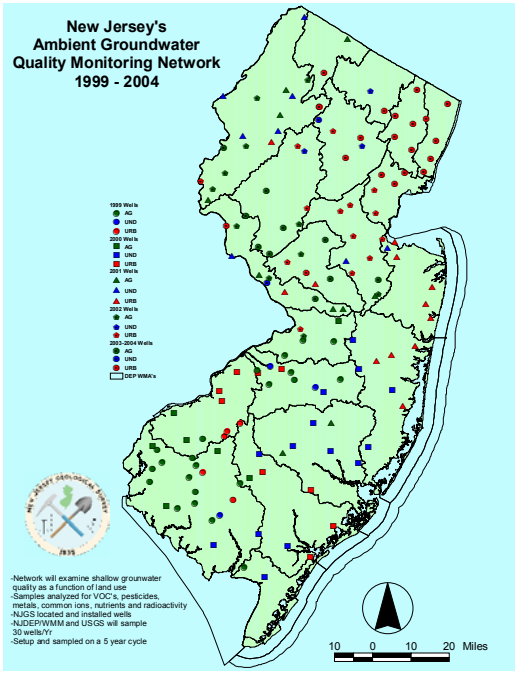
Wetlands monitoring is a long-term goal of the Watershed Watch Network. The volunteers will be able to monitor and assess the fresh water wetlands systems within the State through visually assessing the flora of the ecosystem. Currently there are many volunteers that have expressed an interest in these types of monitoring however; the program does not have the staff, equipment or financial resource to operate this type of program. To date this is a concept that needs to be expanded upon. Wetlands Monitoring Program will be created once a FTE is secured for this project. The program needs to hire one Wetlands Monitoring Coordinator, and one Quality Assurance Coordinator. The Quality Assurance Coordinator would be the same FTE for all programs within the WWN. The Watershed Watch Network will not be able to aid the NJDEP in meeting its water quality goals unless addition staff is hired.

F. GROUNDWATERS

1. AMBIENT GROUND WATER MONITORING NETWORK

Monitoring Objectives

The Ambient Groundwater Quality Monitoring Network (AGWQMN) is a cooperative project between the NJDEP and the United States Geological Survey (USGS), and provides information about land use related non-point source pollution impacts to shallow ground-water quality in the State of New Jersey. The original (pre-1999) network mainly focused on determining ground-water quality as a function of geology throughout New Jersey using private residential wells. The goals of the recently completed redesigned network are to determine the status and trends of shallow ground-water quality as a function of land use related non-point source pollution in New Jersey. This network consists of 150 wells screened at the water table that are sampled 30 per year on a 5-year cycle. The first cycle will be completed and the second started in 2004.



The first and most significantly impacted part of the ground-water system is the top of the water table. By monitoring younger ground water quality at the water table rather than the older water in the deeper system, we are better able to evaluate how current land use activities, regulations and BMPs are affecting ground water quality, and take more immediate corrective actions if necessary. By 2014, three sets of ground-water quality data from the 150 well network will be available to assess status and trends.

Data from other New Jersey monitoring programs such as the Private Well Testing Act (PWTA), which requires a raw water sample analyses that includes total coliform, lead, nitrate, VOCs, arsenic and mercury in vulnerable counties during real estate transactions, complement the AGWQMN. The PWTA data can be used to spatially assess the quality of the used ground-water resource for those parameters that are tested. Since domestic potable wells generally draw in deeper water with variable

ages and recharge area sources, the PWTA data cannot easily be used to achieve the monitoring objectives 2, 3 and 4 below. Additionally, monitoring wells are sampled at pollution sites throughout the State of New Jersey as part of the NJDEP/SRP operations. Unlike the AGWQMN, water quality from these wells is limited to target pollutants representing site specific point source impacts.

The objectives of the ambient network are: (1) To assess the water quality status, (2) To assess water quality trends, (3) To evaluate contaminant transfer relations (sources), and (4) To identify emerging water quality issues.

Monitoring Design

A total of 150 wells, screened at the top of the water table, were installed between 1999 and 2004. Of these wells 60 were installed in urban land use, 60 in agricultural, and 30 in undeveloped land use (see map). The wells installed in the undeveloped land use provide a baseline to evaluate impacts by urban and agricultural land uses. Wells were sampled the year they were installed and future sampling will be done on a 5-year cycle (30 per year), starting with the first 30 wells installed. A probabilistic design (stratified random site selection process developed by Scott, 1990) was used that involved separating the State into 60, 60 and 30 various sized cells, with each cell containing the same area of the target land. Within each cell, a well site was located in or down gradient of the target land use to ensure that the shallow ground-water quality would reflect that land use. Land use designations were determined by using 1986 and 1995 land use coverage's, 1995 aerial photographs, site visits and using site specific topographic relationships to estimate the groundwater flow directions. The 1986 and updated 1995 digital land use data categories were interpreted from 1986 and 1995 color infrared aerial photography (NJDEP, 2000).

Core and Supplemental Water Quality Indicators

The well water is analyzed for the following core chemical and physical parameters at each well site:

- Field Parameters (monitored constantly during pumping):
  - pH
  - Specific Conductivity
  - Dissolved Oxygen
  - Temperature
  - Alkalinity
  - Turbidity
- Lab Parameters:
- Major Ions
- Trace Elements (metals and metalloids)
- Gross-alpha particle activity (radioactivity)
- Volatile Organic Compounds (Schedule 1307, analyzed using USGS method O-4127-96 (Zaugg & others, 1995))
- Pesticides (Schedule 2001, analyzed using USGS method O-1126-95 (Rose & Schroeder, 1995))
- Nutrients

NJDEP's Water Monitoring and Standards program and the USGS collect the well-water samples, and the USGS laboratory in Denver, Colorado analyzes the samples.

Quality Assurance

A Work/Quality Assurance Project Plan has been developed, reviewed and approved by the NJDEP Office of Quality Assurance for this project. If changes are made to this plan, it will be resubmitted for approval.

Standardized sampling techniques and analytical methods are used for this project for data comparability.

Data reduction will occur in the field through field QC sheets, which will be kept in the USGS - Trenton office and the Water Monitoring and Standards Program files. Reduction of data in the lab will follow the Quality Control Manual - USGS - Open File Report 87-457, *Techniques of Water Resources Investigation of the United States Geological Survey, Quality Assurance Practices for the Chemical Analysis of Water and Fluvial Sediments*, Book #5, Chapter A6.

The USGS QA/QC officer will conduct data validation following the procedures in: USGS - NWIS QW VALID 90.1 Program with in house quality assurance products.

Data Management

Initially, the data are entered into the USGS NWIS database. Currently, data for the Ambient Groundwater Quality Monitoring Network is available from the following sources: (1) USGS NWIS (http://nj.usgs.gov) computerized data system, and (2) USGS Annual reports *Water Resources Data - New Jersey*. Future data will be available from the current sources, but will also be available from the following sources: (1) NJGS and NJDEP websites in I-Map format (Fall 2004), (2) Reports in 305(b) portion of the *New Jersey Integrated Water Quality Monitoring and Assessment Report*, (3) NJDEP/USGS informational circulars, and (4) EPA's computerized data system, STORET.

Data Analysis / Assessment

Data will be compared with current New Jersey ground-water and drinking-water quality standards. Select parameters will be compiled and compared as a function of land use.

Reporting

Reporting of data, and findings will be done in the following publications: (1) USGS Annual Reports *Water Resource Data - New Jersey*, (2) NJDEP/USGS Information Circulars, (3) The groundwater portion of the *New Jersey Integrated Water Quality Monitoring and Assessment Report*, (4) NJGS and NJDEP websites in I-Map format (Fall 2004).

Programmatic Evaluation

Audits of the network and procedures will be done periodically. Meetings are held yearly with the USGS and the Water Monitoring and Standards Program to review sampling protocols and get feedback on the monitoring program. The USGS laboratory is audited annually by its own quality assurance branch whom employ USGS, EPA, and DOE auditors. EPA Region 8, Office of Drinking Water, and the USGS Laboratory every 3 years for certification to analyze drinking water constituents.

Ground-water quality changes related to seasonal and climatic variability have not been defined for these wells. This type of characterization is required so that the evaluation of status and trends of water quality from these wells is statistically valid. For example, it will be difficult to determine if changes in water quality are related to loadings or seasonal and climatic variations that result in cyclic contaminant concentrations. It is proposed that at least 10 to 20 of the wells in each land use be

sampled quarterly (4 times a year) until short term water quality variations are defined. It must be noted that while the spatial and temporal distribution of the AGWQMN sampling is adequate to provide a general land use impact assessment on shallow ground-water quality, it is not sufficient to assess point sources of pollution.

In the future, NJDEP will explore the integration of appropriate ground water data, from the Private Well Testing Act and other relevant ground water data sources, in the Ground Water portion of the biennial *New Jersey Integrated Water Quality Monitoring and Assessment Report.*

- Monitoring Timeline:
  Monitoring for the AGWQMN program, over the next five years is expected to occur on the following timeline:
  - April to November, 2004 - Finish 1st round of sampling, 1st 30 wells prepared for sampling (Second Round)
  - April to November, 2005 - 2nd group of 30 prepared for sampling (Second Round)
  - April to November, 2006 - 3rd group of 30 prepared for sampling (Second Round)
  - April to November, 2007 - 4th group of 30 prepared for sampling (Second Round)
  - April to November, 2008 - 5th group of 30 prepared for sampling (Second Round)
  - April to November, 2009 - 1st group of 30 prepared for sampling (Third Round)
  - April to November, 2010 - 2nd group of 30 prepared for sampling (Third Round)

- Implementation Plans:
  - 2005 - 2009 Plan:
    - Continue the ongoing monitoring activity
    - Reassign wells located in Agricultural or Undeveloped land use that have been transformed into Urban land use as transitional wells
    - Locate and install wells to maintain 60 wells in Agricultural and Urban land use, and 30 wells in Undeveloped land use

  - 2010 - 1014
    - Continue the ongoing monitoring activity

General Support and Infrastructure Planning

A. Current Resource Needs

(1)	Total Funding -	$117,400 per fiscal year
(2)	Staffing -	1.5 FTE per fiscal year
(3)	Total Operating Cost –	$202,400 per fiscal year
(4)	Laboratory Resources-	$30,000 per fiscal year

B. Future Resource Needs (SFY 2014)

(1)	Total Funding -	$140,729 per fiscal year
(2)	Staffing -	2.0 FTE per fiscal year
(3)	Total Operating Cost -	$306,422 per fiscal year
(4)	Laboratory Resources -	$33,139 per fiscal year
(5)	Research -	$5,500 per fiscal year
(6)	Training -	$1,650 per fiscal year
(7)	Program Improvements -	$33,000 per fiscal year

Resources estimated are current needs multiplied by 1% inflation over 10 years.

Funding is needed for general maintenance of network wells, replacement of wells when needed, sampling and analysis of samples, for new parameters that are added, and training for personnel on new water quality/monitoring technology.

2. PRIVATE WELL TESTING

Monitoring Objectives

New Jersey is the only state in the nation that requires mandatory statewide private well testing upon the sale of a house. The Private Well Testing Act (as set forth by N.J.S.A. 58:12A-26 et seq.) was signed into law in March 2001 and became effective in September 2002. Under this Act, when property with any private well is sold or leased, the well water must be tested for contaminants. This testing provides important information about the property's drinking water quality. Additional information may be found on the NJDEP Private Well Testing webpage (http://www.state.nj.us/dep/pwta/).

Monitoring Design

The well sample, which must be raw water, before treatment, must be collected by either an employee of a certified drinking water laboratory certified to collect PWTA samples; or by an authorized representative of such a laboratory. The laboratory provides the results to both the requestor as well as the NJDEP; the lab must also provide locational information to the state including street address, municipality, county, lot and block numbers, as well as GPS coordinates of the well.

Core and Supplemental Water Quality Indicators

All wells must be tested for the following contaminants: total coliform bacteria, fecal coliform/E.coli, iron, manganese, pH, 26 volatile organic compounds (VOCs) with established Maximum Contaminant Levels in NJ, nitrate, and lead. Private wells located in certain counties also have to test for arsenic, mercury and 48-hour rapid gross alpha particle activity.

QA/QC

Testing/sample collection must be performed by a Certified Laboratory. "Certified laboratory" or a "certified environmental laboratory", means any laboratory, facility, consulting firm, government or private agency, business entity or other person that the Department has authorized pursuant to the Regulations Governing The Certification of Laboratories and Environmental Measurements, N.J.A.C. 7:18, to perform analysis in accordance with the procedures of a given analytical method using a particular technique as set forth in a certain methods reference document, and to report the results from the analysis of environmental samples in compliance with a Department regulatory program.

Data Management

This is the first program in NJ that utilizes complete electronic transfer of data. The laboratory reports the water test results to the NJDEP electronically, where it is stored in an in-house database (EQUIS). Through a recently-received EPA Challenge Grant, NJDEP has begun developing a revised data management system which will use E2 (InfoTech) technology to check incoming data and will store the data in COMPASS.

Data Analysis/Assessment

The data collected by this sampling are analyzed by the certified laboratory. The laboratory is required to report the test results to both the NJDEP as well as the person who requested the test, on a New Jersey Private Well Testing Form provided by NJDEP. The reporting form will show how the well water results compare with State and Federal drinking water standards. The Private Well Testing Act also requires NJDEP to report all test failures to county health officials or (in some cases) municipal health officials with in five days.

The information from this program will be used to develop a better understanding of the well water quality supplied to homeowners with private wells. Some results have already confirmed expectations about ground water quality (e.g., arsenic detections in the Piedmont Region of the state) while others are leading to a better understanding of ground water quality (e.g., wells in bedrock aquifers have higher potential for fecal coliform contamination than wells in the Coastal Plain).

Reporting

NJDEP prepared a report of well test results from the first 6 months of the program. The report is available electronically (http://www.state.nj.us/dep/pwta/). A report on the first 2 full years of the program is currently under development.

Program Evaluation

Recommended program improvements include:

- Need for improved electronic data transfer and management - already begun with receipt of EPA Challenge grant
- Inaccurate GPS information - the submission of poor quality GPS data on the reporting forms has hampered the department's ability to map all of the contaminant information. Although there is no certification program for those who collect GPS data. The Department has organized an inter-program workgroup to evaluate the situation and to make recommendations for establishing a program to ensure accurate reporting of point locations.
- Need to change sampling protocol for lead – previous studies have shown that lead in well water samples collected from homes served by private wells is most likely coming from the plumbing. The sampling location, for this contaminant, may need to be changed to the kitchen tap in future regulations.
- Need legislative and regulatory changes to allow for sample collection before and/or after the treatment unit (if one is present) – currently, the law only allows for single sample collection and the regulations specify the analysis of a raw water sample.
- Inability to assess the effectiveness of the PWTA program in ensuring that properties are being tested, and those with well test failures are providing treatment
- Need educational materials for private well owners, including better treatment recommendations for owners with well test failures
- Need to develop information on post-treatment well water quality to assess if treatment is successful in reducing contaminant levels

General Support and Infrastructure Planning

Not applicable.

G. AMBIENT MONITORING FOR NJPDES PERMITS

The Division of Water Quality, in carrying out its responsibility under the NJPDES Program, may require permittees to conduct some ambient monitoring. This monitoring is specific for permit development and as such is not designed to serve the purposes of on-going routine ambient water monitoring.

Monitoring Objective

The Federal Clean Water Act requires States to develop water quality based effluent limits (WQBELs) where necessary to ensure that the Surface Water Quality Standards (SWQS) are met. In accordance with our regulations, it is the responsibility of the permittees to provide the information necessary to develop WQBELs. As part of the WQBEL development process, the permittees (Municipal and Industrial Facilities) may conduct one or more of the following studies, as necessary:

- Water Quality Studies (a limited ambient study of pollutants of concern upstream and downstream of the discharge to determine assimilative capacity and to develop site specific wasteload allocations.)
- Ammonia Toxicity Studies
- Dilution Studies
- 316 (thermal discharge and intake) Studies
- phosphorus (limiting nutrient and diurnal DO studies)
- Biological Assessment Studies
- Site Specific Hardness Studies
- Water Effect Ratio Studies

Overall, approximately 10-15 ambient studies are being conducted per year.

The Division of Water Quality utilizes the 303d portion of *the New Jersey Integrated Water Quality Monitoring and Assessment Report* to identify the pollutants of concern, water quality data provided by permittees through the aforementioned studies, data generated through the TMDL process, and the existing water quality data in STORET to establish the appropriate effluent limits in the permits.

Monitoring Design

The monitoring program design and rationale for selection of monitoring sites, such as the plant outfall for effluent sampling or receiving stream for existing background quality of the receiving stream, and the number of samples required vary depending on the purpose of the study as required in the permit and as agreed in a workplan.

Core and Supplemental Water Quality Indicators

Not applicable

Quality Assurance

A work plan must be submitted to the Department for approval prior to commencement of any sampling. The work plan must conform to EPA's *Guidance for Preparation of Combined Work/Quality Assurance Project Plans for Environmental Monitoring* and NJDEP's *Field Sampling Procedures Manual.* Any work done without an approved work plan places the permittee at risk of obtaining unusable data and potential rejection of all data collected. The permittee and the Department agree upon the QA work plan required for any given project prior to implementation. Within the Department, the QA work plan is reviewed by the Permitting Program and the Office of Quality Assurance.

Data Management

Data submitted becomes part of the administrative file of NJPDES permit. The data contained in the NJPDES file are available for public review.

Data Analysis

Data generated by the permittee are analyzed statistically and used to calculate the appropriate effluent limitations for the project.

Reporting

Not applicable

Program Evaluation

Not applicable

General Support and Infrastructure Planning

Not Applicable

H. SITE REMEDIATION AMBIENT MONITORING

Monitoring Objectives

The NJDEP's Site Remediation and Waste Management Program (SRWMP) is responsible for the remediation of contaminated sites. SRWMP requires the sampling of various media, such as soil, ground water and, where warranted, potable well, surface water and even tissue sampling. However, SRWMP has a slightly different perspective on the sampling it conducts. Rather than an ambient approach, the sampling conducted by SRWMP is more on a site-by-site basis. It should be noted, that the minimum sampling requirements are outlined in detail in the Technical Regulations for Site Remediation (N.J.A.C 7:26E).

The objective of the monitoring is to evaluate discharges that occurred at the site in question. This includes determining what the contaminants of concern which are assessing potential sources of that contamination, delineation of the contamination both on and off site, and, if necessary, to see if any receptors (i.e. surface water or potable wells) have been impacted. Monitoring also takes place during and after the remedial activity at the site to determine the effectiveness of the remediation.

Monitoring Design

Typically soil and ground water samples are collected first. If the potential exists for surface water or potable well to be impacted, sampling of those media is required. The number of samples taken varies greatly, based on the number of areas of concern found at the site.

Core and Supplemental Water Quality Indicators

Sampling parameters include those parameters associated with the site. If the history of a site is unclear, additional sampling parameters are required for analysis to determine which contaminants are of concern. Once the sampling results are received, they are compared to the applicable standard for the media, such as the Ground Water Quality Standards, Surface Water Quality Standards, Safe Drinking Water Maximum Contaminant Levels (MCL's) or the Soil Remediation Criteria.

Quality Assurance

The samples are all analyzed using the appropriate EPA certified methods at New Jersey certified labs. All QA/QC data packages are looked at in some detail. Depending on the specific remedial program involved, the number of sampling results undergoing full data validation varies. At a minimum, ten percent of the results are looked at in detail.

Data Management

To date, the SRWMP has collected thousands of sampling results. Currently, the SRWMP requires that all data be submitted in an electronic format and is currently stored in the HAZSITE database. SRWMP is also working on making this information more accessible for general use. While a large majority of this information may not be useful for monitoring ambient quality, there may be some specific pieces of data that may be helpful in meeting this monitoring objective. Unfortunately, in the existing database there is no distinction between "background" data vs. the site data.

Data Analysis/Assessment

The data collected during the remedial activities at the sites are used to determine the type of remediation that needs to be conducted. The data are also used to evaluate the effectiveness of the remediation and to determine when the remediation is complete.

Reporting

The data generated by the SRWMP are submitted on a schedule based on the site specifics of the case.

Program Evaluation

Over the course of the next two years, an evaluation of what information may represent ambient quality data and how to make those specific pieces of data more readily available will be under taken. After that task is completed, SRWMP and Water Monitoring and Standards will need to discuss ways to share the data effectively.

General Support and Infrastructure Planning

Additional FTEs may be needed for HAZSITE data loading and system design for IMAP application and programming changes to indicate background samples to make SRP data more available for the *New Jersey Integrated Water Quality Monitoring and Assessment Report.*

I. TOXICS IN FISH AND SHELLFISH

Monitoring Objectives

Fish and shellfish consumption advisories due to toxic chemical contamination were announced in New Jersey in the 1980s and 1990s. Data from Division of Science, Research and Technology (DSRT) studies revealed that unacceptable risks existed for eating certain species of fish and shellfish from certain waters in the State. These advisories particularly apply to pregnant women, nursing mothers and young children because polychlorinated biphenyls (PCBs), dioxin and mercury are known to cause birth defects, developmental problems, neurological problems and/or cancer. New Jersey's *Year 2000 Water Quality Inventory Report* notes that 100% of assessed public lakes only partially support fish consumption designated use due to advisories to limit consumption and that 76% of assessed stream miles only partially support fish consumption designated uses. Both of these determinations were made on data

between five and ten years old. Data are needed to assess the levels of toxics in fish & shellfish within NJ waters on a routine basis.

In 1994, research on freshwater fish found mercury concentrations exceeding the risk-based health criteria established by the state. The NJDEP/Department of Health and Senior Services (DHSS) issued statewide, regional and lake specific, fish consumption advisories for two species, largemouth bass and chain pickerel. These data are also used to develop water quality assessments for specific waterways. Currently there are 41 freshwater lakes, rivers and reservoir in the state that are listed as impaired in the 303d list portion of the *Integrated Water Quality Monitoring and Assessment Report*. The 303d list drives the development of Total Maximum Daily Limits (TMDL) and other contaminant control strategies. By developing better monitoring tools, we can ensure the accuracy in application of any water body that is currently placed on the 303d list.

NJDEP has established certain areas of concern to address surface water and fish consumption advisories. These areas include:

- **Establishing a routine statewide fish tissue monitoring network: contaminants, target species and target water bodies.**
- Examining effectiveness of current consumption advisory education and outreach effort, and expand or re-focus as necessary.
- Based on available monitoring results, evaluate appropriateness of current fish consumption advisories and need for modifications.

Therefore, new data are needed to evaluate and adjust advisories as appropriate. Without regular monitoring data, current advisories could be either under or overly protective of human health.

The primary objectives of the fish monitoring program are to:

- Provide current and more comprehensive data on concentrations of toxic contaminants in fish and shellfish in order to assess human health risks and thus update/recommend fish consumption advisories.
- Provide data to develop environmental indicators to assess the progress of environmental management actions.

An optional objective would be to fill in data gaps regarding the effects of toxics on the ecological health of New Jersey's aquatic ecosystems. Additional funding and effort beyond that detailed below would be required to address this objective and to support the overall goal of protecting natural resources.

As noted in the above focus area, there is a clear need for a continuous Routine Monitoring Program for Toxics in Fish to regularly assess the status and trends of fish contamination and related consumption advisories in New Jersey waters. Where possible, the Monitoring Program will be coordinated with existing NJDEP sampling networks focused on tracking water quality (National Shellfish Monitoring Program, the Ambient Biomonitoring Network, the Ambient Stream Monitoring Network and the Index of Biotic Integrity, i.e., fish community sampling). The results of this program will be used to amend existing advisories or, if necessary, develop new advisories and will assist the NJDEP in evaluating trends in contaminant concentrations of these selected species. The NJDEP workplan established the foundation of a routine monitoring network to ensure that data is generated and that advisories can be updated on a regular basis.

Monitoring Design

The monitoring program described here builds upon DSRT fish contamination research that identified widespread mercury contamination in the fresh waters of the state, chlordane, PCB and dioxin contamination in site specific locations and PCB contamination predominantly in several coastal estuarine and marine fish species. The program will focus on collection of those fish species currently under consumption advisories collected from waterways identified with a specified chemical contamination. These data will provide a tool to assess the status and trends of these contaminants in the state's aquatic systems.

Due to the large number of water bodies in the state, the sampling is divided into five broad water regions on a recurrent five-year cycle. These regions are generally adapted from the five watershed management regions, recognizing the need to consolidate all estuarine/marine areas and consolidation of two Delaware River Basin regions (primarily due to accessibility of sites in contiguous waters). The five regions are:

1. Passaic River Region
2. Marine/Estuarine Coastal Region.
3. Raritan River Region
4. Atlantic Coastal Inland Waterways Region, and
5. Upper and Lower Delaware River Region

A detailed annual workplan is developed for each region that includes the selection of target analytes, fish species, sampling locations and sampling frequency. The annual sequence of tasks include: workplan development, sample collection, sample analysis, data assessment, risk assessment, reporting, submission to the interagency Toxics In Biota Committee (TIBC) for review and advisory update and subsequent management approval.

Currently, several species of freshwater gamefish (e.g., largemouth bass, chain pickerel, and bullheads) are under statewide, regional and water body-specific fish consumption advisories for elevated mercury concentrations. Fish species from additional freshwater areas (e.g., Bound Brook Area) are under PCB contamination advisories. Seven species of estuarine-marine fish/shellfish (striped bass, bluefish, white perch, white catfish, American eel, blue crab and lobster) are under consumption advisories on a statewide, regional and waterway specific basis for PCB and/or dioxin contamination. These species and locations are the starting point for the design of the Fish Monitoring Program. In addition, due to recent advisory updates other freshwater fish species to be sampled are listed in Table 1.

Table 1. Target Species for Freshwater and Marine/Estuarine Fish Tissue Monitoring

Freshwater Species		**Marine/Estuarine Species**
Largemouth Bass	Bullhead	Striped Bass
Smallmouth Bass	Catfish	Bluefish
Chain Pickerel	Carp	White Perch
Walleye		White Catfish
Lake Trout		Blue Crab
Sunfish		American Eel

The monitoring program design consists of representative sampling of targeted fish from the majority of public assessable waterways throughout the state. Sampling site selection within both the freshwater and

estuarine/marine components of the monitoring plan includes those lakes, rivers, reservoirs and coastal waterways under the current fish consumption advisories. These sites, derived from previous DSRT/ANSP research were chosen from a listing of publicly owned or assessable waters provided by the NJDEP's Division of Fish and Wildlife. To ensure unbiased coverage, the sample site selection was made by using a random-stratified method and modified to include specific recreationally important waterways. The statewide coverage of the Fish Monitoring Program incorporates all of these sites, and when possible may be adjusted to include a limited number of specific water bodies not previously sampled.

Collections of targeted species from each region included in the monitoring plan will be analyzed for those chemical analytes identified in Table 2.

Table 2. Fish Tissue Monitoring Analyte List

ORGANOCHLORINE PESTICIDES	Polychlorinated biphenyls					
HC (ALPHA, BETA, GAMMA DELT	1	31,28	74	134,144	185	207
Heptachlor	3	33,21,53	70,76	107	174	194
Heptachlor epoxide	4,10	22	66,95	149	177	205
Chlordanes (gamma and alpha)	6	45	91	118	201,171	206
Nonachlors (cis and trans)	7	46	56,60	134	172,197	209
Dieldrin	8,5	52	101	131	180	
DDDs (o,p and p,p)	14	49	99	146	193	
DDEs (o,p and p,p)	19	48,47	83	132,153,105	191	
DDTs (o,p and p,p)	12,13	44	97	141	199	
Aldrin	18	37,42	81,87	137,176	170,190	
Endosulfan I and II	17	41,71	85	158	198	
Endrin	24,27	64	136	129,178	201	
Oxychlordane	29	40	77,110	187,182	203,196	
Total Mercury	26	100	82	183	189	
TCDD dioxin/furan	25	63	151	128	208,195	

Total mercury will be analyzed for all freshwater fish collected. A limited number of PCB (congener specific and calculated total Aroclor) and pesticide analysis (e.g., chlordane, DDX, etc.) will be included where appropriate. All coastal estuarine and marine species, unless specified will be analyzed for both PCB and total mercury. Monitoring for dioxins/furans at specific stations (e.g., Newark Bay and Raritan River) is also included. Emerging contaminants of concern (e.g., PBDE's) may be added to the list when appropriate.

Core and Supplemental Water Quality Indicators

Fish/shellfish consumption core indicators include chemical/toxicological endpoints for the marine, estuarine and freshwaters of the state. The core set of indicators for freshwaters is the presence and levels of mercury in upper trophic level fish (e.g., bass and pickerel). For marine and estuarine waters the core indicators are levels of PCBs and pesticides in popular recreational species (e.g., striped bass and bluefish). Supplemental indicators are the levels of these contaminants in other species in the waters of

the state (e.g., mercury in sunfish, PCBs in blue crab). In addition, other supplemental indicators include measurements of specific contaminants in specific water bodies (e.g., dioxins/furans in fish and crabs from the Newark Bay Complex).

QA/QC

DSRT has modified a EPA QA Project Plan outline for use in DSRT-funded projects. Quality Assurance Project Plans are completed for monitoring this project. The Principal Investigator is responsible for providing a QA Project Plan to the DSRT Project Manager for review and approval. The twelve points of the QA/OC outline are followed when preparing the QA Project Plan. The objective of the QA Project Plan is to outline the procedures that will be developed or used to generate data of acceptable quality. References to standard procedures and/or the literature are included where appropriate. The PM will interact with the PI during the preparation of the Quality Assurance Project Plan and approve the plan. Both the PI and PM will agree upon the level of QA/QC required for this particular project prior to implementation.

Laboratories certified by the State of New Jersey (NJDEP Office of Quality Assurance) will be used for contaminant analysis where applicable. All data submitted to NJDEP will be rigorously documented and undergo quality assurance by the laboratory's and/or NJDEP's QA staff.

Data Management

DSRT personnel will be responsible for the overall project management activities involving the various program components including sample management and laboratory analysis, data management, data coordination and evaluation, and reporting.

All field and analytical data will be generated or entered in digital format (e.g., Excel files). Data from the laboratory will be sent in digital format to NJDEP as part of the reporting procedure. All data generated will be placed in the NJDEP's STORET database, which will then be posted to EPA's national STORET database. This will ensure that the information is readily accessible to other state and Federal agencies. Data will also be posted on NJDEP's website so that it is accessible to the general public.

Data Analysis and Assessment

Data generated through this monitoring program will be utilized to identify the status and trends of selected contaminant levels in fish currently under fish consumption advisories. Data are statistically analyzed to determine trends and average concentrations of contaminants in fish tissue on a statewide, regional and/or waterbody-specific basis. Tissue contaminant concentrations are compared to benchmark values to determine applicable fish consumption advisories. Using EPA guidance, the state is currently using risk-based values for mercury and PCBs for setting fish consumption advisories. The state expects to use risk-based values for other contaminants in the future (e.g., chlordane, DDT). Data generated will be used for the fish consumption designated use assessment for *the New Jersey Integrated Water Quality Monitoring and Assessment Report*. This assessment will follow the *Integrated Water Quality Monitoring and Assessment Methods* document.

Reporting

The laboratory will prepare a technical report containing analytical and quality assurance/quality control procedures along with all of the sample data. The data generated through this project will be reported to the TIBC for updating and revising state fish consumption advisories and the development of outreach programs and materials. All revisions to the state fish consumption advisories and the technical reports will be posted on DSRT's Web Site along with ArcView-based GIS maps with links to other relevant federal and state programs associated with contaminated food fish. Other DSRT activities will include

data development to support watershed characterization and assessment, water quality analysis (CWA: 305(b) and 303(d)), and recommendations for further research that may be identified.
Public health outreach and risk information will be developed with fish consumption advisory messages matched to specific populations within the advisory areas (e.g., Spanish signage and small group presentations). These risk reduction strategies will take into account ethnic differences in information sources, perceptions about safety and health risks, and consumption patterns. Information will be developed about risk reduction from eating certain kinds of fish, eating smaller fish and cooking to eliminate rather than retain all contaminants as a part of the educational /outreach program. This additional information will help people to understand that they can reduce risk while not necessarily decreasing the amount of fish eaten.

Programmatic Evaluation

Program evaluation is conducted on an annual basis through review of the workplan developed for each year of the five-year program. NJDEP water quality resource managers and other programs (e.g., Fish & Wildlife, Office of Natural Resource Restoration) review the workplan and provide feedback on data needs and utility of the data to be generated. In addition, NJDEP works cooperatively with adjacent states to coordinate data collection and data sharing for interstate waters.

Current gaps in the program involve resources and data. Resource gaps include the need for additional staff (2 FTEs) and identified dedicated funding for future monitoring. Data gaps include the need for initial or more spatially comprehensive contaminant data (e.g., PCBs, mercury) on popular recreational species such as fluke (summer flounder), porgy, sea bass, tautog and winter flounder. There is also limited or no data for some classes of contaminants (e.g., PBDEs, dioxins/furans) for these popular recreational species, as well as for species currently under advisory for other contaminants. A substantial data gap is that there is currently no statewide molluscan shellfish monitoring for contaminants.

General Support and Infrastructure Planning

A. Current Resource Needs

1. Funding, Staff, Training and Laboratory Resources.

Approximately $250,000 ($500,000 for marine waters) in funding is needed on an annual basis for the fish monitoring program. This includes labor for sample collection, analytical costs, and other expenses. All analyses are conducted by outside laboratories due to the lack of departmental facilities. In addition, a total of 2.5 FTEs (effort beyond the annual funding levels) are needed for project coordination, statistical analysis, data analysis, outreach and report writing by DSRT staff.

2. Program Improvements

If supplemental funding becomes available, additional sampling sites, fish species or non-routine contaminants can be included in the monitoring program. For example, there are several popular recreational species for which there is limited or no contaminant data. In addition, there are emerging contaminants of concern (e.g., PBDEs – flame retardants) that could be added to the routine monitoring program for assessment. Additional sampling locations would assist in assessing waterbodies that have not been sampled.

B. Future Resources Needs

1. Funding, Staff, Training and Laboratory Resources

The department has not identified a dedicated source of funding for routine fish monitoring. Past monitoring has relied on research funds and other funds on a short-term basis. Additional funds are needed to continue monitoring in future years. Assuming funds are identified, the DFW and/or a contractor will conduct the field-sampling portion of the monitoring program for Years 3-5 (2005-2007) and subsequent monitoring cycles. However, there is a need for additional DFW personnel (2 FTE) and equipment purchase ($50,000) to conduct the monitoring program in future years. These constraints are unlikely to be resolved in time to conduct the Year 3 program, so Year 3 fish collection and chemical analysis may again be the responsibility of ANSP/DSRT.

Estimated costs per year range from $250,000 to $500,000 and include labor, equipment, expendables and analytical services. A total of approximately $1,500,000.00 is needed over each five-year monitoring period. Subsequent years would repeat the five-year cycle starting in 2008. Funding for these years would be higher based on expected cost increases (e.g., salaries, inflation, etc).

DSRT will support sampling coordination with either the contractor and/or DFW for throughout the program. As reported, DSRT will also provide in-kind services for project management, reporting, evaluation and assessment.

2. Program Improvements

If supplemental funding becomes available, additional sampling sites, fish species or non-routine contaminants can be included in the monitoring program. For example, there are several popular recreational species for which there is limited or no contaminant data (e.g., fluke (summer flounder), porgy, sea bass, tautog and winter flounder). In addition, there are emerging contaminants of concern (e.g., PBDEs – flame retardants) that could be added to the routine monitoring program for assessment. Additional sampling locations would assist in assessing waterbodies that have not been sampled. Additional data are needed on the amounts and types of fish that recreational anglers are consuming across the state so that the monitoring program can be designed to sample the most popularly consumed species. Finally, contaminant data on forage species of fish (e.g., prey species) are needed in order to assess the ecological risks and potential impacts to upper trophic level consumers (e.g., piscivorous species such as bald eagle).

J. IMPAIRED WATERBODY/TMDL MONITORING

Monitoring Objectives

New Jersey is committed to addressing the cause of impairment in waters listed on the 303(d) list of water quality limited segments at a pace that is reasonable and according to the prioritization included in the 303(d) list. Currently, the NJDEP has prioritized pathogen and phosphorus impairments. Pathogen impairments, as indicated by elevated levels of fecal coliform, are important because of the implications to human health. Phosphorus impairments are responsible for eutrophication in lakes and secondary responses such as dissolved oxygen impairment. These two impairments constitute the majority of the impairments in New Jersey waters. The list, prioritization and 2-year schedule are available on the Department's web page at: www.state.nj.us/dep/wmm/publications.html.

In evaluating each listed impairment, the Department determines if an impairment currently exists and, if so, the most appropriate means to address the impairment, a TMDL or an alternative enforceable management response. A technical approach is developed for each impairment. This approach may

establish that additional data are needed to confirm the impairment; inform the approach; determine critical locations or seasonal effects; identify sources; or develop, calibrate or validate a model. Monitoring may also be identified as part of an implementation plan or follow up for the selected management response in order to evaluate effectiveness and/or refine the management response. Thus, targeted monitoring projects are conducted as needed in order to develop, implement, evaluate or refine management responses to address impairments.

Monitoring Design

Because monitoring to support TMDLs is issue-specific, the design of each monitoring project depends on the issue or question to be answered. Categories of targeted monitoring projects include:

Confirm impairment:

For some parameters and/or locations it may be necessary to confirm that an impairment does, in fact, exist. For example, data used initially to place a waterbody on the list of water quality limited segments may be quite dated and, because of changes in the monitoring network, some stations used to list a segment are no longer sampled. As a result, current data for some segments are not available. Given the efforts that have been and continue to be made to improve water quality, it may be appropriate to confirm that an impairment still exists. In this situation, the monitoring design typically will be similar to that which was used to list the impairment in the first place, with respect to location and parameter sampled.

An exception was impairment confirmation for metals listings. It was determined that the initial sampling methodology may have led to incorrect listings. The metal criteria are so minute that contamination in the field or the lab could deliver a hit. In response, a special monitoring program was conducted at locations listed as impaired for metals using "clean methods", in order to confirm which metals listings were actual and which were an artifact of the previous sampling methods.

In the case of phosphorus, supplemental monitoring may be needed to confirm impairment. A segment is listed as impaired whenever the numeric criterion is exceeded; but the water quality standard for phosphorus contains narrative components as well as numeric criteria that speak to whether phosphorus is the limiting nutrient in the system and is rendering the water body unsuitable for the intended uses. Routine ambient monitoring generally does not provide the data needed to determine if the numeric criterion does not apply per the narrative components of the standard. Thus, it is possible that a segment that exceeds the numeric criterion is not rendering the segment unsuitable for designated uses and is not the limiting nutrient, in which case the criterion would not apply and the segment would not be impaired. The Department has developed a protocol, which is available on the web (http://www.nj.gov/dep/dwq/techman.htm), for monitoring to determine if the numeric criterion applies in light of the narrative components of the standard. This protocol is triggered as NJPDES permit renewals are processed for dischargers into segments impaired for phosphorus, as an alternative to applying a WQBEL equal to the criterion to be met end-of-pipe, or where there is reasonable potential for a discharge to cause an exceedance of the numeric criterion in-stream. The protocol is also used in phosphorus TMDL development, in a modified form needed to address larger drainage areas, to determine applicability of the numeric criterion, the appropriate endpoint for a phosphorus TMDL, and the critical location(s) for achieving the endpoint.

Source Identification:

Monitoring to identify sources may focus on spatial extent, animate sources, or media sources. For example: the Department has established a methodology for determining the spatial extent for a given impairment based on a particular sampling location. In some cases, the length of the segment is considerable, perhaps many miles and inclusive of numerous tributaries. Implementation efforts can be better focused if the relative contribution of various tributaries can be determined or if a tributary can be

eliminated from the spatial extent of the impairment. This can be done through a targeted sampling project for the parameter of concern. In addition to spatial considerations, the nature of the source is important to inform implementation efforts for some parameters, such as fecal coliform. Therefore, a monitoring program to determine the source, i.e., human, domestic animal or wildlife, of the fecal coliform has been developed as a follow up to the 166 fecal coliform TMDLs that were developed in 2004.

The relative contribution of some pollutants, such as phosphorus, may be estimated based on land use and loading coefficients. This approach was used for the 35 lake TMDLs completed in 2004. However, in order to refine this source allocation, lake characterization projects are planned as a follow up to the TMDLs. These plans will provide a better relative contribution of load from the various sources and will include an estimate of internal load, septic tanks, and other sources for which data were lacking when the TMDLs were developed. These lake characterization reports may determine that revised loading contributions and reductions are in order; the reports will provide the basis for a more detailed lake restoration plan.

Arsenic impairments in the Wallkill basin may be a result of natural leaching of *in situ* geologic formations, an artifact of past mining activities or agricultural activities. A source identification project in this case will involve monitoring groundwater, surface water, sediment as well as speciation of the arsenic present.

Modeling:
In order to determine the relationship between the in-stream concentration of a pollutant of concern and the load of that pollutant, a model is needed. Models vary in the degree of complexity, and some require data collected under particular conditions in order to validate and verify the model for use in the intended application. Often this data is not available through the ambient monitoring network and a monitoring program must be designed and executed to provide the needed data. Sampling parameters, locations, conditions and frequency are based on the needs of the model and the type of impairment.

Evaluate Effectiveness:
Once TMDLs or other management responses are implemented, the effectiveness of the measures selected to resolve the impairment must be determined. This will inform the next step: shifting the segment to List 1 because the impairment has been successfully addressed or triggering adaptive management if it has not. For example, some of the lakes for which TMDLs were completed had restoration work underway. For these lakes, follow up monitoring is planned to determine if the measures taken were effective.

Core and Supplemental Water Quality Indicators

As described above, the parameters selected for a given monitoring project depend on the issue or question to be answered. The focus may be the parameter for which there is a listed impairment or related parameters, such as chlorophyll a or diurnal dissolved oxygen, with respect to phosphorus impairments.

Quality Assurance

Each targeted monitoring project is intended to answer a particular question. The project design is documented in a QAPP and evaluated in accordance with QA/QC procedures prior to initiating the project. Work is performed using Department resources to the extent they are available and supplemented through contractual arrangements with qualified professionals.

Data Management

Data gathered for targeted monitoring projects is reported in hard copy reports and in electronic format. Currently, where data collection is carried out using Department resources, the data are/will be entered into the STORET database. The Department intends to include a requirement for contracted monitoring services to include entering data into the STORET database (either directly or provided to the Department in a format that facilitates entry by the Department).

Reporting

Reports are prepared for each impairment addressed. TMDL documents are provided to EPA for review and approval before being adopted as amendments to the applicable Water Quality Management Plan. TMDLs that have been proposed, established, approved and adopted are available for review on the Department's web page at http://www.nj.gov/dep/watershedmgt/tmdl.htm.

When impaired segments have been successfully addressed, this outcome is reflected in the subsequent listing cycle for the Integrated List of Waterbodies. Once EPA approves a TMDL, the impairment is moved to Sublist 4A in the subsequent Integrated List. Where the management response is not a TMDL, a Technical Approach is prepared and subject to peer review prior to shifting the impairment to Sublist 4B.

Program Evaluation

The targeted monitoring used to evaluate the effectiveness of the TMDL implementation will be the key means to evaluate the overall program for monitoring to support TMDLs. The Department is currently focusing on implementing TMDLs and effectiveness evaluation will follow in turn.

General Support and Infrastructure Planning

Monitoring needed to support development, implementation and evaluation of TMDLs and other management responses is, to a large extent, determined as each group of impairments is evaluated. Therefore, the resources needed to support TMDL development over the 10-year timeframe can only be roughly estimated based on experience with the TMDLs developed to date. Monitoring is performed using Department resources, to the extent possible, with the remainder of the work performed by qualified consultants under contract to the Department, typically through the New Jersey Ecocomplex contract or contracts with watershed stakeholders working on priority segment restoration work. Funding is provided primarily through New Jersey Corporate Business Tax revenues. However, this source is variable and subject to numerous demands. Therefore, federal support for this federally mandated function is needed.

Pathogens: 166 fecal coliform impairments were completed in 2004. These required a source identification monitoring project which is estimated to cost $100,000 (~ $45,000 labor and ~$55,000 operating). Stakeholder data has resulted in numerous new listings of fecal coliform impairment; in addition, there are approximately 40 pathogen impairments in coastal waters. It is expected that source identification monitoring will be required as these impairments are addressed. Estimated cost: $100,000.

Phosphorus: 35 lake TMDLs were completed in 2004. 37 lakes were identified as needing detailed characterization monitoring. Estimated cost: $1.2 M. 7 lakes were identified as requiring follow up monitoring to determine effectiveness of restoration efforts. This work will be done using Department resources; estimated cost: $47,000 (~$20,300 labor and ~$26,700 analytical). At least 16 additional lakes require TMDL development and can be expected to require similar characterization efforts, estimated cost $0.5 M. Two major water basins have been undertaken to date, the Passaic and the Raritan basins. Monitoring to confirm impairment, determine critical locations, and to support modeling has incurred

costs of approximately $1.6 M. To address remaining riverine phosphorus impairments can be expected to entail an additional $1.6 M.

Other conventional impairments, metals, biological impairments, toxics in the water column and fish tissue have not been be evaluated sufficiently to allow an estimate of the cost of monitoring support, but it is reasonable to assume the cost will be multiple millions of dollars.

New Jersey also participates in TMDL efforts in two interstate waterbodies, the NY/NJ Harbor Estuary and the Delaware Estuary. Monitoring projects for impairments, including pathogens, nutrients (carbon and nitrogen) and toxics (PCBs and others), have cost multiple millions of dollars, contributed by the affected States, EPA and other partners.

1. SPECIAL BACTERIAL TMDL MONITORING PROJECT

Monitoring Objective

In accordance with Section 305(b) of the Federal Clean Water Act, the NJDEP developed the 2002 *Integrated Water Quality Monitoring and Assessment Report* addressing the overall water quality of the state's waters and identifying impaired waterbodies for which Total Daily Maximum Loads (TMDLs) may be necessary. The integrated list of waterbodies, contained within the *Integrated Water Quality Monitoring and Assessment Report*., identified certain waterbodies as being impaired by pathogens, as indicated by the presence of fecal coliform concentrations in excess of water quality standards. The objective of this monitoring project is to collect data to aid in the development of Implementation Plans that are part of the recently completed TMDLs. As part of this project new analytical indicators (i.e. male F+ coliphage and MAR (Multiple Antibiotic Resistance) will be employed in addition to fecal coliform.

Monitoring Design

A total of 149 sites in 15 Watershed Management Areas have been selected for sampling. Sample parameters at each site will vary by site, with fecal coliform only being collected at some sites and F+coliphage and/or MAR being collected at others. Sites are located in WMAs 1, 3, 6, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, and 20. Where fecal coliform is a requested parameter, a total of 10 fecal coliform samples will be collected at each site. Five of the 10 samples will be collected in a 30day period. The remaining 5 samples will be collected as follows: Two (2) samples will be collected monthly during the summer months not already sampled, and; the remaining 3 samples will be collected quarterly during the non-summer months. Where F+ coliphage or MAR is the requested parameter, a total of 4 samples will be collected -–two (2) of which will be collected in the summer time period (defined as May through September) and 2 samples will be collected at anytime of the year.

Quality Assurance

A Quality Assurance / Project Plan (QAPP) is developed for the project and is reviewed annually or as needed to see if updates are required. The QAPP is reviewed and approved by the NJDEP's Office of Quality Assurance. Sample collection and preservation is in accordance with Standard Methods and /or the NJDEP's *Field Sampling Procedures Manual*.. In addition sterilized trip blanks and field blanks will accompany each set of field collected sample bottles.

Core and Supplemental Water Quality Indicators

- The following core parameters are monitored:

- Fecal coliform, male specific F+ coliphage and MAR

Data Management

Data from this project are stored on the Bureau of Freshwater and Biological Monitoring's local database and are uploaded into the EPA's STORET database.

Data Analysis and Assessment

The data collected by this project are assessed initially by the analyzing lab, who will make a preliminary determination as to the possible source(s) (i.e. human vs. animal) of the bacterial contamination. This will be done by either the serotyping or genotyping of the male specific F+ coliphage samples. Further evidence will be gathered from the reaction of the MAR samples to various antibiotics that will then be compared to a reference library of mammalian and avian antibiotic resistance.

Reporting

The data will be provided to the requesting NJDEP agency personnel in both electronic and hardcopy format.

Program Evaluation

Monitoring Timeline:
Sampling is scheduled to take place over a two (2) year time period.

Implementation Plans:
2005 – 2010
Project scheduled to terminate sometime in 2006
2011 – 2015
No further work projected

General Support and Infrastructure Planning

RESOURCE	Current FTE	Current Annual Cost ($)	FTE & Program Improvement (5 yr.)	Annual Cost & Planned Program Improvement Five (5) Year[29]	FTE & Program Improvements (10 yr.)	Annual Cost & Planned Program Improvements Ten (10) Year[30]
Staffing	0.73	68,470	0	71,894	0	0
Operating		2,500	0	2,625	0	0
Laboratory Operating		25,076	0	26,330	0	0
Research Costs		0	0	0	0	0
TOTAL COST		96,046		100,849		0

[29] Adjusted for inflation @ rate of 1.0% per year from current annual cost

[30] Adjusted for inflation @ rate of 1.0% per year from current annual cost

REPORTING

A. INTEGRATED WATER QUALITY MONITORING & ASSESSMENT REPORT

In 2000, EPA issued guidance (www.epa.gov/owow/tmdl/tmdl0103/2004rpt_guidance.pdf) encouraging states to integrate their Water Quality Inventory Report (Section 305(b) of the Clean Water Act) with their Impaired Waterbodies List (Section 303(d)) into a single product which would be termed an *Integrated Water Quality Monitoring and Assessment Report* (Integrated Report*)*. This guidance recommended, for the first time, that States integrate the two reporting requirements. The close association between the two reporting requirements is evident in that the 305(b) report presents the water quality status of all waters of the state while the 303(d) list represents a subset of these waters that statutorily require a TMDL. Both efforts utilize shared data sets. The Integrated Report describes attainment of designated uses, specified in New Jersey's Surface Water Quality Standards (SWQS), which includes: aquatic life, recreation, drinking water, fish and shellfish consumption, industrial and agricultural. In addition, ongoing and planned strategies to maintain and improve water quality are described, as well as recommendations and strategies to improve water quality statewide. The Integrated Report is intended to provide an effective tool for maintaining high quality waters and improving the quality of waters that do not attain water quality standards. The Integrated Report also provides water resource managers and citizens with detailed information regarding the following:

- Delineation of water quality assessment units providing geographic display of assessment results;
- Progress toward achieving comprehensive assessment of all waters;
- Water quality standards attainment status;
- Methods used to assess water quality standards attainment status;
- Additional monitoring needs and schedules;
- Pollutants and watersheds requiring Total Maximum Daily Loads (TMDLs);
- Management strategies (including TMDLs) under development to attain water quality standards;
- TMDL development schedules.

The Department elected to develop an Integrated Report for New Jersey since this approach offers several significant improvements over the traditionally separate Water Quality Inventory and Impaired Waterbodies List Reports. New Jersey submitted an Integrated Report in 2002 and 2004. Through the Integrated Report, the EPA and the Department can begin to implement recommendations regarding comprehensive monitoring strategies included in the National Research Council's Report "*Assessing the TMDL Approach to Water Quality Management"* (National Research Council, 2001). This report emphasizes the importance of science-based decision-making in both monitoring and assessment for developing an effective water quality management program.

The Integrated Report improves water quality reporting by providing detailed descriptions of data sources and assessment methods as a basis for sound, technical assessment decisions. Assessment results are represented in a spatial context, presenting a clearer picture of water quality. Monitoring needs and schedules are described, facilitating the articulation of monitoring priorities and identifying opportunities for cooperation with other agencies and watershed partners. TMDL needs and schedules are defined to convey plans for water quality improvements. Finally, the public participation aspects provide opportunities for data submittal and open discussion of water quality assessment methods and results. New Jersey's Integrated Reports, and associated information (including the methods document used to develop this report), may be

found on the Water Monitoring and Standards website at: www.state.nj.us/dep/wmm/sgwqt/wat/index.html.

B. OTHER REPORTING

In addition to use for the Integrated Water Quality Monitoring and Assessment Report, NJDEP's water monitoring data and information may be found in a variety of other reports/publications. These include network or project-specific reports, fact sheets, brochures, state of the environment reports, as well as other reports to EPA or FDA. Many of these are available electronically and, as such, may be found on the Water Monitoring and Standards website (http://www.state.nj.us/dep/wmm/publications.html), other NJDEP programs websites, or through the NJ Environmental Digital Library (http://njedl.rutgers.edu/njdlib/).

PROGRAM EVALUATION, TECHNICAL SUPPORT AND GUIDANCE NEEDS

As requested in the EPA Guidance Document, NJDEP has evaluated the water quality monitoring information available in the state, and compared this to what is needed over a 10-year period to meet the objectives and requirements in the Guidance. Each NJ ambient water monitoring program described in this strategy document contains a section that discusses the program evaluation for that particular monitoring effort. As appropriate, each section includes any current monitoring gaps, resource, technical support/guidance and training needs. As such, the reader is referred to each monitoring program description for specific information on program evaluation for that particular area. These strategic gaps and needs are summarized in Appendix III "NJ Current Monitoring Gaps and Needs Matrix".

Also, summarized below, are key technical support and training needs. Technical support and training from EPA, or other federal agencies, would greatly enhance NJ's water monitoring programs over the next decade.

Technical Support and Guidance Needs:

- STORET assistance
- Statistical input for evaluation of overall monitoring network design & redesign (especially important for statewide status sites and AMNET)
- Reservoir monitoring guidance
- Headwaters and Pinelands calibration for AMNET
- Assistance from EPA in development and application of protocols for estuarine and ocean benthic macroinvertebrate assessments
- Development of GIS-interfaced, user-friendly water quality models for tidal waters
- Assistance from EPA in transitioning NJ's Coastal Water Monitoring Network to a probabilistic design
- Evaluation of new sensor technologies for automated monitoring (e.g. chlorophyll) and their development as standard test methods
- Wetlands research protocols

Training Needs:

- Continuing need for taxonomic training for biological monitoring
- Assessing data based on a probabilistic network design
- Continued training on Tiered Aquatic Life Use (TALU) and its use for biological criteria

- Continued training on implementation of source identification
- Use of EPA's lakes biological monitoring protocols (once they are released)
- Use of tidal water quality models for spill response
- Genotypic methods for identifying coliphage groups (used to assess human/non-human coliform sources).
- Participation in regional training sessions/workshops on monitoring shellfish growing waters
- Use of satellite remote sensing data for coastal water quality

Resource Needs

Resource needs (staff and operating) are identified within each of the individual monitoring program writeups. Within many program descriptions, the resource needs are broken down into 5 and 10-year increments, which detail operating, staffing, research, and program improvements that are needed. For specific information on the resource needs for a particular monitoring program, the reader is referred to that individual section.

APPENDICES

1. NJ WATER MONITORING COUNCIL CHARTER AND MEMBERS

Establishment

The New Jersey Water Monitoring Coordinating Council was established on October 24, 2003 as part of New Jersey's celebration of World Water Monitoring Day.

Vision

To provide a water information foundation for enhanced management and protection of New Jersey's aquatic environment.

Mission

To serve as a statewide body to promote and facilitate the coordination, collaboration and communication of scientifically sound, ambient water quality and quantity data to support effective environmental management.

Scope

The Council will address the biological, chemical, physical and ecosystem aspects of water monitoring, including surface and ground waters, freshwater, estuarine, and marine environments in New Jersey.

Goals

- Enhance coordination, collaboration and communication in New Jersey's ambient water monitoring community
- Promote efficient use of monitoring resources by leveraging existing resources and developing new sources of support
- Enhance data exchange and compatibility.
- Promote dissemination of water resource status and trends to all users, including the public
- Facilitate water monitoring technology transfer
- Serve as a water monitoring information source
- Identify information/research needs and/or emerging problems
- Advocate state/interstate monitoring needs/concerns at the federal level
- Integrate with national monitoring organizations/councils

Operating Procedures/Structure

- Informal, consensus driven organization; votes taken, as needed, with one vote per organization (NJDEP – 1 vote/division)
- Open meetings
- Operating Structure - Co-chairs (NJDEP and USGS), Steering Committee, Council Coordinator, Members, Ad-hoc Members

Activities

Activities of the NJ Water Monitoring Coordination Council may include:

- Develop on-line inventory of NJ ambient water monitoring activities
- Review and comment on NJDEP's long-term water monitoring strategy for NJ
- Document and compare field and laboratory methods
- Enhance data management, exchange and compatibility
- Evaluate data assessment and information presentation
- Explore access to monitoring data from other organizations (e.g., water purveyors)
- Coordinate use of water environmental indicators
- Coordinate automated sensor monitoring
- Evaluate predictive tools for monitoring
- Integrate volunteer and local monitoring with state/regional programs
- Sponsor water monitoring technical seminars
- Coordinate responses on federal agency documents
- Advocate NJ monitoring needs at the federal level
- Leverage resources (e.g., joint projects)
- Develop funding opportunities for NJ monitoring efforts

Members

Leslie McGeorge*, NJDEP, Water Monitoring & Standards	Council Co-chair
Rick Kropp*, US Geological Survey	Council Co-chair
Alena Baldwin-Brown*, NJDEP, Water Monitoring & Standards	Council Coordinator

Bob Connell*, NJDEP, Water Monitoring & Standards
Al Korndoerfer*, NJDEP, Water Monitoring & Standards
Nancy Immesburger, NJDEP, Water Monitoring & Standards
Karl Muessig*, NJDEP, NJ Geological Survey
Mike Serfes, NJDEP, NJ Geological Survey
Lisa Barno, NJDEP, Division of Fish & Wildlife
MaryAnne Kuserk, NJDEP, Site Remediation and Waste Management
Danielle Donkersloot, NJDEP, Division of Watershed Management (Volunteer Monitoring)

Dave Stedfast*, US Geological Survey
Jack Gibs, US Geological Survey
Steve Nieswand, US Geological Survey
Bob Reiser, US Geological Survey

Bob Tudor*, Delaware River Basin Commission
Ed Santoro, Delaware River Basin Commission

Randy Braun, EPA Region 2, Monitoring and Assessment
Mike Glogower, EPA Region 2, Monitoring and Assessment
Paula Zevin, EPA Region 2, Monitoring and Assessment

Howard Golub, Interstate Environmental Commission

Mike Weinstein, NJ Marine Sciences Consortium

Nick Procopio, Pinelands Commission

Amy Shallcross, NJ Water Supply Authority

Jawed Hameedi, National Oceanic & Atmospheric Administration

Jeannine Der Bedrosian, NJ Water Resources Research Institute

Kirk Barrett, Rutgers University – Meadowlands Environmental Research Institute
Mike Kennish, Rutgers University – Institute for Marine & Coastal Sciences
Chris Obropta, Rutgers University – Cooperative Extension Service

Bill Simmons, Monmouth County Health Department

* - STEERING COMMITTEE MEMBER

2. EPA GUIDANCE LETTER TO NJ ON STRATEGY PREPARATION

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY -REGION II
290 BROADWAY
NEW YORK, NEW YORK 10007-1866

May 9, 2003

Bradley M. Campbell, Commissioner
New Jersey Department of Environmental Protection
7th Floor, East Wing
P.0. Box 402
401 E. State St.
Trenton, NJ 08625-0402

Dear Commissioner Campbell:

EPA's Office of Water (OW) recently has released the first comprehensive set of guidelines for developing or updating State water quality monitoring and assessment progran1s to ensure compliance with Clean Water Act requirements. The guidelines, *Elements of a State Water Monitoring and Assessment Program* (http://www.epa.gov/owow/monitoring/elements/ and enclosed), were developed to recommend the basic elements of a State water monitoring program. The EPA Regions and OW collaborated for several years to make these guidelines consistent, protective and useful without placing undue burdens on the States. States were involved in reviewing the guidelines.

The guidelines cover the entire process of developing a State water monitoring and assessment program, from developing a strategy and setting objectives, through design and selection of indicators, to reporting and program evaluation. New Jersey, as well as many other States, has made tremendous strides in these areas. EPA's Office of Inspector General made recommendations for enhancements to NJ's water quality monitoring program in their 1999 audit of NJ's program. These guidelines will assist with addressing those needs as well as ensure consistency throughout the country .The guidelines also serve as a tool to help EP A and the States determine whether a monitoring program meets the prerequisites of Clean Water Act Section 106(e)(1).

States should develop a monitoring program addressing the 10 elements summarized in the document. The first of these elements is a long-term state monitoring strategy. This strategy will be State specific, should build on the monitoring capabilities each State already has, and should include a timeline not to exceed 10 years to complete implementation. This monitoring strategy needs to describe how the State will address their water quality management needs and meet the requirements of the Clean Water Act (such as comprehensive assessment of all etc.). The monitoring strategy is critical because it also identifies resource needs and a timeline for implementation of the monitoring program.

For the Fiscal Year (FY) 2004 106 grant award, States should update their current monitoring program strategy or commit to complete development of such a strategy (according to 40CFR section 35.105, the 106 application is due 60 days prior to the start of the proposed funding period). States should begin

implementation of the strategies upon receipt of the subsequent award of a Section 106 grant or Performance Partnership Grant that includes Section 106 funds. Beginning with the FY2005 Section 106 grant cycle, activities from a State's strategy needed TO upgrade its monitoring program must be incorporated into Performance Partnership Grants
(PPG) that include Section 106 funds, consistent with the regulations governing the negotiation of work plans at 40 CFR 35.107. The State must also continue to submit reports under Section 305(b) and annual data updates to satisfy Section 106(e)(1).

EPA will work closely with New Jersey Department of Environmental Protection (DEP) in reviewing your monitoring program to determine whether progress has been adequate and reflects commitments negotiated in the Performance Partnership Grant (PPG) that include Section 106 funds. This evaluation will take into consideration the effects of funding shortfalls on a State's implementation of its monitoring program strategy. Emerging issues, such as wetlands monitoring, landscape or land use analysis and use of probabilistic designs, can also be addressed. EPA Headquarters will collaborate with the EPA Regional offices to assess overall State progress from a national perspective.

Thank you for your continued commitment to achievement of water quality goals and we look forward to jointly implementing these new guidelines. Should you have any questions, please contact Barbara A. Finazzo at 732-321-6754.

Sincerely,

ISI William J. Muszynski

Jane M. Kenny
Regional Administrator

Enclosure

cc: Ernest Hahn, Assistant Commissioner, Land Use Management/NJDEP

Leslie McGeorge, Administrator, Water Monitoring & Standards/NJDEP

3. NJ MONITORING GAPS AND NEEDS SUMMARY

Appendix 3

NJ's Water Monitoring & Assessment Strategy
Gaps and Needs[31]

Waterbody Type	Monitoring	Gaps/Enhancements	Resource and Technical Support Needs (including Research)
Non-Tidal Rivers & Streams	**Ambient Stream Monitoring** - chemical/physical cooperative network with USGS	2005-2009 ▪ Need for additional background sites ▪ Need to enhance number of random sites ▪ No periphytic chlorophyll 'a' monitoring for eutrophic status ▪ Need for lower reporting levels for selected parameters (e.g., Hg and As) ▪ Continuous water temperature monitoring	2005-2009 ▪ ~$90,000 additional operating per fiscal year ▪ 1.0 new FTE
		2010-2014 ▪ Evaluate need for bacteriological monitoring in cold-weather months ▪ Lack of resample procedures for unexpected results	2010-2014
	Supplemental Ambient Surface Water Monitoring (supplements above, provides more spatially complete assessment of waters)	2005-2009 ▪ Existing routine parameter list of limited scope ▪ No toxic compound (e.g., VOC, pesticides, metals) or bacteriological monitoring ▪ No periphytic chlorophyll 'a' monitoring for eutrophic status ▪ Lack of continuous water temperature monitoring	2005-2009 ▪ ~$330,000 additional operating per fiscal year ▪ 0.5 new FTE

[31] Resource and Technical Support needs are estimates to fill the gaps/enhancements noted for each monitoring network. Most gaps/enhancements cannot be addressed without additional or redirected resources (federal, state, or other).

Waterbody Type	Monitoring	Gaps/Enhancements	Resource and Technical Support Needs (including Research)
	303(d) Elevated Flow Metals Monitoring - to confirm or remove listed impairments	▪ Need for lower reporting levels for selected parameters (e.g., Hg & As)	2005-2009 ▪ Continuation of ~$55,000 operating per fiscal year ▪ ~$15,000 additional analytical funding to implement analytical methods with lower detection limits
	Ambient Biological Monitoring Network (AMNET) - benthic macroinvertebrates	2005-2009 ▪ Need for NJ Impairment Score (NJIS) calibrated for genus/species ▪ Pinelands and headwaters-specific NJIS ▪ Source ID & track-down surveys for impaired waters ▪ Evaluation of Probabilistic design component	2005-2009 ▪ $30,000 for consultant assistance in calibrating and developing modifications to NJIS ▪ ~$309,000 additional operating per fiscal year (*mostly lab costs associated with source ID & track-down surveys*) ▪ 1.5 new FTE
	Ecoregion Reference sites for AMNET	None	
	Fish Index of Biotic Integrity ▪ Northern NJ ▪ Southern NJ	2005-2009 ▪ No network sampling of headwater streams (*if efficacy confirmed by current research)* ▪ No network sampling of southern coastal plain	2005-2009 ▪ ~$6,000 additional operating/fiscal year ▪ 2.0 new FTE ▪ ~$21,000 additional operating/fiscal year ▪ 3.0 new FTE
	Periphyton Speciation Monitoring	▪ No monitoring network – may be needed for eutrophic status & phosphorus criteria	▪ ~$10,000 additional operating / fiscal year ▪ 1.0 new FTE (trained phycologist)
	Nonpoint Source Monitoring - Lower Delaware	None	Continuation of ~$227,000 operating per project year

Waterbody Type	Monitoring	Gaps/Enhancements	Resource and Technical Support Needs (including Research)
	Volunteer River and Stream Monitoring	▪ Need additional coordination for data management, training, & QA/QC efforts ▪ Only 1 full time staff member currently coordinating volunteer efforts	▪ 3 FTEs (Assistant Coordinator, Rivers & Streams Coordinator, & QA/QC Coordinator) ▪ $90,000 – operating ($30,000 initial startup + $6,000 annual operating for 10 years)
	DFW Fisheries & other Biological Monitoring	Integrated Biological Aquatic Assessment – ▪ Expand IBI development to Central portion of the State	▪ 2 FTEs, 2 seasonal ▪ $60,000/fiscal year (includes staff & operating cost)
Lakes & Reservoirs	Ambient **Lakes** Water Quality Monitoring	2005-2009 ▪ Need for short-term <u>trend</u> monitoring *(if not accomplished via volunteer monitoring approach below)*	2005-2009 ▪ If needed, ~$70,000 additional operating for first fiscal year, & ~$45,000 additional operating for fiscal years 2 and on. ▪ 2.0 new FTE
	Volunteer Lake Water Quality Trend Monitoring	▪ Need to ID resources for lakes monitoring project ▪ Need additional coordination for data management, training & QA/QC efforts ▪ Only 1 FTE currently coordinating volunteer efforts	▪ 1 FTE (Lakes Coordinator) ▪ $102,000 – operating ($32,000 initial startup + minimum of $7,000 annual operating for 10 years)
	Lake Beach Monitoring	▪ Information is currently submitted to DEP on annual basis & is not available for regular oversight of sampling ▪ Need recreational lake reporting system to evaluate adequacy of sampling & resampling to protect public health	▪ 1 FTE ▪ $100,000/yr, in part, to establish & maintain a web-based Recreational Lakes Reporting & Notification System.

Waterbody Type	Monitoring	Gaps/Enhancements	Resource and Technical Support Needs (including Research)
	Water Supply **Reservoir** Monitoring	▪ Monitoring of reservoirs (primary intakes) conducted by the purveyors for use of raw water for water supply purposes ▪ Need study of current & past reservoir monitoring conducted by purveyors (study could be done by EPA and AWWARF) ▪ Need coordination of any long term reservoir monitoring with existing surface water monitoring	
	DFW Fisheries & other Biological Monitoring	No monitoring gaps identified	
Tidal Rivers & Estuaries	NJ **Coastal Water** Monitoring	2005-2009 ▪ No toxics monitoring ▪ Need for benthic condition indices ▪ No monitoring in tidal tributaries to Delaware River ▪ Need better characterization of dissolved oxygen through use of automated monitoring.	2005-2009 ▪ $100,000 for research to develop benthic indices. ▪ Combine resources with EPA's NCA funding currently used for NJ waters. ▪ Delaware River tidal tributary monitoring gap is expected to be filled by DRBC in FY05 ▪ In FY05 submitted grant proposal to NOAA to significantly enhance DO monitoring in the ocean
		2010-2014 ▪ Need for better characterization of dissolved oxygen through use of automated monitoring.	2010-2014 ▪ Combine resources with EPA's NCA funding currently used for NJ waters. ▪ 1.5 FTEs

Waterbody Type	Monitoring	Gaps/Enhancements	Resource and Technical Support Needs (including Research)
	NJDEP's Application of **Nat'l Shellfish Sanitation Program**	2005-2009 ▪ Limited non-point source tracking ▪ No statewide molluscan shellfish tissue toxics monitoring ▪ Limited phytoplankton monitoring	2005-2009 ▪ Greater lab capability for alternate indicators expected in FY05 ▪ Routine funding for molluscan shellfish toxics (~$60K/yr of operating total) ▪ Greater use of remote sensing for targeting algal bloom evaluations. ▪ 1 FTE
		2010-2014	2010-2014 ▪ Routine funding for molluscan shellfish toxics (~$60K/yr of operating total) ▪ Greater use of remote sensing for targeting algal bloom evaluations.
	Nonpoint Source Tracking Monitoring	2005-2009 ▪ Routine use of alternate indicators is currently limited by laboratory capability to perform these tests.	2005-2009 ▪ Greater lab capability for alternate indicators – expected in FY05 ▪ 1 FTE, as well as more flexible use of overtime for storm event monitoring
		2010-2014	2010-2014 ▪ More flexible use of overtime for storm event monitoring
	EPA's **Nat'l Coastal Assessment** (NCA) Program (estuarine program)	2005-2009 ▪ Expansion of EPA's program to NJ ocean waters ▪ More extensive sampling for some parameters	2005-2009 ▪ Pooling resources with NCA in FY06 (currently $240,000/yr in NJ waters). ▪ ~$80,000/yr of research total to expand NCA monitoring to ocean waters.

Waterbody Type	Monitoring	Gaps/Enhancements	Resource and Technical Support Needs (including Research)
		2010-2014	2010-2014 ▪ ~$80,000/yr of operating total to expand NCA monitoring to ocean waters ▪ 1 FTE
	NY/NJ Harbor Ambient Monitoring	2005-2009 ▪ No coverage of most of these waters by state monitoring networks ▪ Conventional water column monitoring only ▪ Need to evaluate whether Discharger-based supplemental program will be long-term & whether it meets all state monitoring needs, including TMDL development ▪ Evaluate data accessibility by public & DEP	2005-2009 ▪ Evaluate data accessibility by public & DEP ▪ EPA assistance needed in evaluating Harbor Discharger data accessibility
	DFW Fisheries & other Biological Monitoring	No monitoring gaps identified	
Coastal Ocean Waters	Coastal Water Quality	2005-2009 ▪ Limited ocean DO monitoring ▪ No toxics monitoring ▪ Need for benthic condition measures	2005-2009 • Research to develop benthic indices. • Better characterization of dissolved oxygen through use of automated monitoring. • Combine resources with NCA funding currently used for NJ waters
		2010-2014	2010-2014 • Assess ocean waters using benthic impairment index • Better characterization of dissolved oxygen through use of automated monitoring

Waterbody Type	Monitoring	Gaps/Enhancements	Resource and Technical Support Needs (including Research)
	Nat'l Shellfish Sanitation	2005-2009 ▪ No statewide molluscan shellfish toxics monitoring ▪ Limited phytoplankton monitoring	2005-2009 • Greater lab capability for alternate indicators • Routine funding for molluscan shellfish toxics (~$60K/yr) • Greater use of remote sensing for targeting algal bloom evaluation
		2010-2014	2010-2014 • Routine funding for molluscan shellfish toxics (~$60K/yr) • Greater use of remote sensing for targeting algal bloom evaluations
	Beach Monitoring	▪ Need for monitoring of potential new northern urban beaches ▪ Ability to understand exceedance of standards with no identifiable source of contamination	1 FTE to expand monitoring to urban beaches, 2 FTEs for data management, laboratory resources for intensively monitored areas
	DFW Fisheries & other Biological Monitoring	No monitoring gaps identified	
Wetlands	Under development	▪ No currently existing national program that links to water quality program ▪ No scientifically accepted wetlands monitoring protocols developed yet by EPA ▪ National land use data sets provide lower resolution than NJ data	▪ 5 FTEs (~ $540,000 annual salary & operating) ▪ ~ $5.6 million total (estimate 5-7 years) research funds to develop IBI protocol and calibrate for 8 ecoregions and 7 wetland types (NJ has already contributed some state research underway to assess floodplain forest wetlands in one ecoregion using a vegetation and soil IBI approach)

Waterbody Type	Monitoring	Gaps/Enhancements	Resource and Technical Support Needs (including Research)
Ground Water	Ambient GW Monitoring – Chemical/Physical	2005-2009 ▪ Need to define seasonal or climactic variability vs. true land use trends ▪ Need complete statewide status picture – available in next 6 months	▪ 0.5 FTE to assist with well network operations & maintenance ▪ $100,000 operating for well maintenance & replacement, sampling/analysis of new parameters, new technology training
	Private Well Monitoring	Need to review findings of private well data gathered by NJDEP programs to help target areas of concern for groundwater assessment or inclusion in the GW network. Programs include NJ Spill Fund, SRP and the Private Well Testing program.	▪ 1 FTE ▪ $10,000 operating/year
Other – various waterbody types	Ambient Monitoring for NJDEP Permits	No monitoring gaps identified	
	Site Remediation Ambient Monitoring	Better data integration needed for Integrated Report of appropriate SRP ambient sampling results	▪ Additional FTEs may be needed for HAZSITE Data loading and system design for IMAP application and programming changes to indicate background samples in order to make SRP data more available for the Integrated Report
	Toxics in Fish & Shellfish	▪ No established continuous funding source for routine fish tissue monitoring ▪ Limited/no contaminant data for several popular recreational species (e.g., fluke, sea bass) ▪ Need to add emerging contaminants of concern (e.g., PBDEs – flame retardants) ▪ No routine program for molluscan shellfish (see Nat'l Shellfish Sanitation Program description under "Tidal Rivers & Estuaries")	▪ 4 FTEs & $300,000/year (covers fish & non-molluscan shellfish) ▪ $60,000/yr for molluscan shellfish (see Tidal Rivers & Estuaries)

Waterbody Type	Monitoring	Gaps/Enhancements	Resource and Technical Support Needs (including Research)
	Impaired Waterbody/TMDL Monitoring	▪ Impairment confirmation/refinement of spatial extent (phosphorus impairments statewide) ▪ Additional source ID (metals, biological) ▪ Lakes characterization monitoring ▪ Modeling support (metals, biological) ▪ Program effectiveness monitoring-Lakes with completed TMDLs to date ▪ Program effectiveness monitoring-Other	▪ Total Phosphorus: Budgeted $1.6 M contractual ▪ Add'l Source ID – Need: est. $1M ▪ Lakes - Budgeted: $500K Need: est. $1.2M ▪ Modeling - Need: est. $1M ▪ Effectiveness (Lakes) - Budgeted: $20K labor, $27K analytical ▪ Effectiveness (Other) - Need: resources needed - unknown at this time

Waterbody Type	Monitoring	Gaps/Enhancements	Resource and Technical Support Needs (including Research)
Other – Water Quality Assessment		▪ Develop site specific criteria to reflect natural conditions and incorporate into the Surface Water Quality Standards to ensure that appropriate assessment decisions are made ▪ Evaluate opportunities to utilize available sediment data collected during contaminated site investigations, dredging applications, and ambient monitoring programs to prioritize follow-up sampling and/or listing decisions ▪ Develop mechanisms (database/electronic transfers) to integrate and assess Departmental (i.e. NJPDES, SRP and NCA data) and non-department data into NJDEP's assessment database. ▪ Evaluate EPA's latest version of "Assessment Database" (ADB) to determine if appropriate for New Jersey's use for the Integrated List and Report and load with available data. ▪ Evaluate methods to improve the spatial extent of assessed water and minimum data requirements to assess designated uses with a goal of 100% assessed and to assign spatial extents to all available data sets. ▪ Develop an assessment methodology for interpreting benthic macro-invertebrate data for estuaries and open oceans and assess available data.	▪ 1 FTE ▪ .5 FTE first year to evaluate and develop method, .25 FTE yearly for assessment ▪ 3 FTE ▪ .25 FTE ▪ .5 FTE first year to evaluate and develop method, .25 FTE yearly for assessment ▪ .5 FTE first year to evaluate and develop method, .25 FTE yearly for assessment
Data Management		See Date Management section in document	See Data Management section in document