NJ Long Term Monitoring and Assessment Strategy

2022-2032

Cover Photo- Great Gorge Lake, Vernon Twp., Sussex County

New Jersey Department of Environmental Protection

Water Resource Management

Division of Water Monitoring and Standards

February 2022

INTRODUCTION

In 2004, New Jersey (NJ) prepared its initial Long Term Monitoring and Assessment Strategy, under the EPA Guidance for Long Term Monitoring and Assessment Strategy development (see below) and as a requirement for continued receipt of Clean Water Act Section 106 funds. That 10-year document, which articulated both the current monitoring and assessment capabilities of the NJ Department of Environmental Protection's (DEP) water monitoring programs as well as monitoring and assessment gaps, expired in December 2014. Much progress was made in filling gaps and enhancing the monitoring and assessment programs between 2004-2014; however, due to shifting priorities and shrinking resources, many gaps remain or continue to emerge.

This update describes how the DEP Division of Water Monitoring & Standards (DWMS) plans to implement its mission and achieve its goals under the Federal Clean Water Act for the period 2021-2031. All of the implementation plans are dependent upon availability of resources and needed technical support, as articulated in this document. The multiple purposes of this update include:

1. Continue to 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.
2. Provide a framework for the State to articulate its programmatic and resource needs to implement the elements above.
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).
4. Allow the State to describe the who, what, when, where and why of water monitoring in NJ.
5. Allow the DEP DWMS to present its goals, objectives and approaches for the protection and management of NJ's water resources.
6. Provide a forum for dialogue with monitoring partners to allow for opportunities for collaboration and/or information dissemination through leveraging of resources.

EPA GUIDANCE FOR LONG TERM MONITORING AND ASSESSMENT STRATEGY DEVELOPMENT

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 had relied on

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[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

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.

This document has been prepared using the national guidance issued by EPA in its *Elements of a State Water Monitoring and Assessment Program* to ensure compliance with federal Clean Water Act requirements. The Guidance recommends the key elements for a state water monitoring and assessment program that meets the prerequisites of CWA Section 106(e)(1). The Guidance also details that a State must have a monitoring and assessment program strategy that addresses all waters of the State. Development and implementation of this strategy also allows for continued receipt, by the State, of federal funds under CWA Section 106.

REGULATORY JUSTIFICATION FOR THE WORK OF THE DIVISION OF WATER MONITORING AND STANDARDS (DWMS)

One of the priorities of the DWMS is to ensure that clean and plentiful water is provided for public health, the environment, and ecosystems of the State, while following the mandates set forth by Federal and State Law. DWMS operates under the following federal and state statutory authority: the federal Clean Water Act, Sections 106(e), 303(d), 305(b), 314, 319(h), and 604(b); the federal Beaches Environmental Assessment and Coastal Health Act of 2000 (BEACH Act); the New Jersey Water Quality Planning Act; the New Jersey Water Pollution Control Act; and the Watershed Protection and Management Act (C.58:29-1); as well as the following federal and state rules and regulations: Title 40, Code of Federal Regulations (Title 40 CFR) and the U.S. Food and Drug Administration's National Shellfish Sanitation Program (NSSP); as well as the New Jersey Administrative Code (N.J.A.C. Title 7. Environmental Protection), which includes the New Jersey Water Planning rule.

DWMS' goals and associated objectives are carried out by the Bureau of Freshwater and Biological Monitoring (BFBM), the Bureau of Environmental Analysis, Restoration and Standards (BEARS), the Bureau of Marine Water Monitoring (BMWM) as well as the DWMS Director's Office staff.

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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]..."

As described above, the document has been prepared using the national guidance issued by EPA in its *Elements of a State Water Monitoring and Assessment Program* to ensure compliance with federal Clean Water Act requirements. 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 is to include discussions of the following 9 elements:

1. Monitoring Objectives
2. Monitoring Design[2]
3. Core & Supplemental Indicators[2]
4. Quality Assurance
5. Data Management
6. Data Analysis/Assessment
7. Reporting
8. Programmatic Evaluation
9. General Support & Infrastructure Planning

Several of the elements are covered within the individual waterbody/network descriptions or as part of the document appendices, while others are covered universally within separate, individual sections of the Strategy document.

The Strategy is to be long-term, encompassing a 10-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 this 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 DEP to conduct or coordinate with its partners. This monitoring includes water testing associated with aquatic living resources, including shellfish. Unlike some state environmental agencies, DEP includes both the environmental regulation, as well as the natural resource programs, within the same agency. Also, unlike many other state environmental agencies, DEP has responsibility for implementation of the water monitoring portion of the National Shellfish Sanitation Program for the State. For non-tidal rivers and streams, DEP 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 DEP is done by DWMS, there are other programs in the DEP that also perform ambient water monitoring and several of these are included in this Strategy as well, including wetlands and ground water. The Strategy also contains several other NJ water monitoring programs conducted in partnership with agencies outside of DEP including

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[2] Contained within waterbody/network information in Appendix A

EPA's National Aquatic Resource Surveys (National Coastal Condition Assessment, National Rivers and Streams Assessment, National Lakes Assessment and National Wetlands Condition Assessment), EPA's National Regional Monitoring Network, USDA's National Water Quality Initiative, the Cooperative Coastal Monitoring Program, and the Barnegat Bay Long Term Ambient Monitoring Program.

PARTNERSHIPS/STAKEHOLDER INPUT

DWMS recognizes the important role that partners play in assisting the State in achieving various aspects of an adequate monitoring program. One way the DEP communicates and collaborates with partners is through the NJ Water Monitoring Council. The Council serves as a statewide body to promote and facilitate coordination, collaboration and communication of scientifically sound ambient water quality and quantity information to support effective environmental management. It is comprised of 40+ members representing 27 different organizations including state/federal/county government, interstate organizations and commissions, environmental commissions and authorities, academia, watershed associations, a utilities authority, and a dischargers group.

In addition to the Council, there are other divisions within DEP that either provide or use monitoring and assessment data and/or information. As such, meetings were held in order to solicit their feedback and draft pieces of the document were provided for their review.

Comments from partners and stakeholder groups have been incorporated into the Strategy document where appropriate.

GOALS AND OBJECTIVES

DWMS strives to achieve its mission by operating under the following goals and objectives:

Goal 1: Monitor and assess all waters of the State - Collect, interpret and assess physical, chemical, and biological monitoring data to determine the quality of New Jersey's waters and develop measures needed to protect, maintain, enhance, or restore their quality to ensure the protection of ecological and public health.

> Objectives:
> - o Determine water quality status and trends using multiple monitoring designs, including fixed site, targeted and statistical survey (probabilistic), as well as assessment tools to obtain an overall understanding of statewide water conditions
> - o Determine if all waters of the State are meeting applicable water quality standards and supporting applicable designated uses; identify healthy waters as well as those that are stressed, threatened or impaired
> - o Provide and assess data to confirm, evaluate and support development of surface water quality criteria and surface water classifications, including antidegradation designations

Goal 2: Identify and evaluate effectiveness of actions needed - Identify the actions needed to protect, maintain, enhance, or restore water quality, and evaluate the effectiveness of actions that are implemented, to ensure the protection of ecological and public health.

> Objectives:
> - o Identify stressors/causes and sources of water quality impairment
> - o Identify (and fill) data gaps
> - o Identify emerging water quality conditions and adapt monitoring efforts and assessment methods accordingly
> - o Conduct monitoring in response to emergencies (e.g., sewage releases/spills, harmful algal blooms, flooding, etc.)
> - o Integrate monitoring and assessment with management actions
> - o Evaluate effectiveness of water quality protection, maintenance, enhancement, total maximum daily loads (TMDLs), and restoration strategies and programs
> - o Collaborate with other internal and external programs, agencies and entities as appropriate

Goal 3: Share all available data and information - Communicate and disseminate monitoring and assessment results and information for use by the Department, other organizations/agencies, partners as well as the interested public to better inform environmental and public health decisions affecting New Jersey's waters.

> Objectives:
> - o Develop effective communication and dissemination strategies and tools for appropriate audiences (implementing programs, government officials, interested public)

- Expand accessibility and use of NJ's water quality monitoring data and assessment information for use both within DEP as well as by the Department's various external data users
- Develop clear and consistent messaging explaining water quality results and what they mean (Is it safe to swim here? Are the fish and shellfish safe to eat? Is the aquatic life healthy?)
- Communicate and coordinate routinely with other state and national agencies, organizations, councils and partners that perform ambient water quality monitoring and assessment, to assure that data, information and resources are leveraged as efficiently as possible.

MONITORING NETWORK TIERS

NJ has developed a 3-tiered approach for its monitoring programs: Tier 1- Statewide Status and Trends Monitoring, Tier 2 – Targeted Monitoring, and Tier 3 – Effectiveness Monitoring. Descriptions of each tier are as follows.

Tier 1: Statewide Status and Trends Monitoring
Ambient water quality information, problem identification & trends evaluation

Tier 1 monitoring focuses on collecting statewide water quality data and information to comply with federal and state mandates. These efforts feature both fixed stations and probabilistically selected monitoring locations which provide long-term data and information that support water quality assessment, status and trends evaluation, and other water quality management needs. Monitoring includes physical/chemical, biological and/or habitat-related parameters in NJ's fresh, marine and ground waters. Tier 1 monitoring provides data that is assessed to determine the quality of NJ's waters and develop measures needed to protect, maintain, enhance, or restore their quality as well as identify areas of interest which can often be addressed under Tier 2. U.S. EPA National Aquatic Resource Surveys are also included in this category and will be used to track trends nationwide.

Tier 2: Targeted Monitoring
Monitoring of Targeted Areas or Specific Issues

Tier 2 provides a more comprehensive evaluation of areas of interest often requiring cross-program collaboration. Targeted monitoring includes monitoring in a specific or priority stream, watershed or region. It also includes monitoring conducted to confirm or add to previous data for more robust assessments and may investigate specific parameters, pollutant sources, natural conditions or to support emergency or priority activities which are not necessarily specific to a stream, watershed or region. It can also provide the baseline data for comparison to Tier 3 monitoring or verify causes, or suspected causes, of impairments. This type of monitoring typically has a set timeframe to obtain data.

Tier 3: Effectiveness Monitoring
Determining effectiveness of management measures

Tier 3 monitoring provides follow-up analysis of various management measures that have been implemented for areas of interest and evaluates their effectiveness. Effectiveness of waterbody-specific management actions is determined using indicators of improvement which are evaluated before and after management actions are implemented.
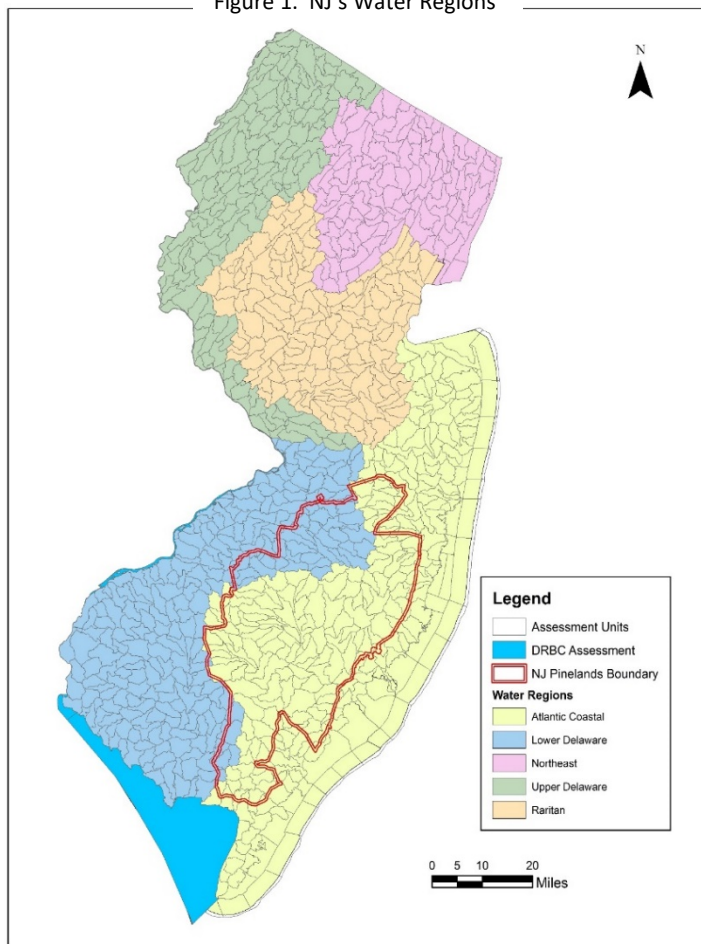
MONITORING NETWORKS

The following section of the Strategy describes DWMS' monitoring networks by waterbody type and monitoring area. Also included, but not administered by DWMS, are ground water and wetland networks. For each Network, the objectives, design and detailed descriptions are outlined below. Appendix A provides a comprehensive overview of all Division Networks, both freshwater and marine water, and includes the following information: Resource Category, Legislative/Regulatory Mandates and other Requirements, Funding Sources, Watershed Monitoring Area, Media Assessed, Designated Use Support, Water Quality Indicators, Data Availability & Data Sources, Users & Uses of the Data, and partners that assist in sample collection.

NJ employs integrated monitoring designs to efficiently address key water quality data needs to effectively manage its water resources. These designs address the physical, chemical and biological conditions of the State's rivers, streams, lakes, coastal, ocean, estuarine waters, ground water and wetlands. In addition to meeting NJ's water quality information objectives as discussed previously, the designs are intended to meet the state water monitoring requirements of Section 106 of the federal Clean Water Act, as well as the basic elements of a state water monitoring program, as articulated in EPA's *Elements of a State Water Monitoring and Assessment Program* document. The design also includes an EPA-mandated, probability-based network for making statistically valid inferences regarding the condition of all State water types.

DWMS' Bureau of Freshwater and Biological Monitoring (BFBM) and

Figure 1. NJ's Water Regions

Legend
- Assessment Units
- DRBC Assessment
- NJ Pinelands Boundary

Water Regions
- Atlantic Coastal
- Lower Delaware
- Northeast
- Upper Delaware
- Raritan

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Miles

Bureau of Marine Water Monitoring (BMWM) have several networks that integrate a number of monitoring designs (e.g., fixed station, targeted, intensive monitoring, rotating water regions [Figure 1], and probability) to meet the range of ambient water quality decision needs such as: assessment of aquatic life, recreational use, water supply and fish and shellfish consumption; determining water quality status and trends; identifying impaired waters and waters needing protection; identifying causes and sources of impairment; and supporting water quality criteria development, including nutrient criteria.

Long-term ambient monitoring strategies employed are comprised of multiple water quality assessment techniques including: biological surveys, habitat assessments, biological monitoring, pathogen monitoring, and collection of physical/chemical data. Media sampled include water column, sediment, and fish and shellfish tissue.

Exact site coordinates, sampling frequency, analytical and field methods, data assessment and management, and other project details, including each network's current Quality Assurance Project Plan (QAPP), can be found on the appropriate bureau webpages. Sampling locations are updated routinely and are available at NJ-GEOWEB:
http://www.nj.gov/dep/gis/geowebsplash.htm.

Table 1: New Jersey Water Monitoring Networks by Waterbody Type

I.   FRESHWATER RIVERS AND STREAMS
    A. Physical/Chemical & Bacteriological Networks
       1. Ambient Surface Water Quality Monitoring Network (ASWQMN)
       2. Regional Targeted Water Quality Network (RTWQN)
       3. Water Monitoring Gap and Enhancement Project
       4. Rivers, Streams, and Lakes Continuous Monitoring
       5. Stream Monitoring for Effects on Water Quality by Road Salt Application
       6. Ambient Summer Bacterial Monitoring Network

    B. Biological Networks
       1. Ambient Macroinvertebrate Network (AMNET)
       2. Fish Index of Biotic Integrity Network (FIBI)
       3. Headwaters Index of Biotic Integrity (HIBI)

    C. National Networks
       1. USEPA National Rivers and Streams Assessment (NRSA) - NJ component
       2. National Water Quality Initiative (NWQI)

II.   FRESHWATER LAKES
    A. Ambient Lakes Monitoring Network
    B. Cyanobacterial Harmful Algal Blooms
    C. NJ Participation in National Network – National Lakes Assessment (NLA)
    D. NJ's Participation in USEPA's Mid-Atlantic Regional Monitoring Network (RMN)

Freshwater Networks

Rivers and Streams: Ambient Surface Water Quality Monitoring Network (ASWQMN)

Purpose and Objectives:
The purpose of the Ambient Surface Water Quality Monitoring Network is to address the federal Clean Water Act and the 106 Water Grant requirements that mandate states to monitor the quality of their ambient waters. The monitoring is necessary for the determination of water quality status and trends to manage, protect, and restore New Jersey's water bodies, and to provide publicly accessible water quality data on the condition of these resources.

The objectives of the Ambient Surface Water Quality Monitoring Network are to:
1. Assist in determining statewide water quality status for designated uses, and attainment of human health and aquatic life surface water quality standards
2. Evaluate water quality trends over time
3. Evaluate effects of land use and management practice on water quality
4. Determine background water quality
5. Complement biological, atmospheric and ground water networks
6. Better define non-point source contributions
7. Identify emerging and watershed-specific issues/contaminants

Program Description and Design:
This network began in 1976, is a long-standing, cooperative effort (design and sampling) between DWMS' Bureau of Freshwater and Biological Monitoring and USGS. The network consists of approximately 123 sites (73 permanent and 50 sites for statewide probabilistic/ statistical survey purposes). Permanent sites include background/reference sites, land use indicator sites, and watershed integrator sites.
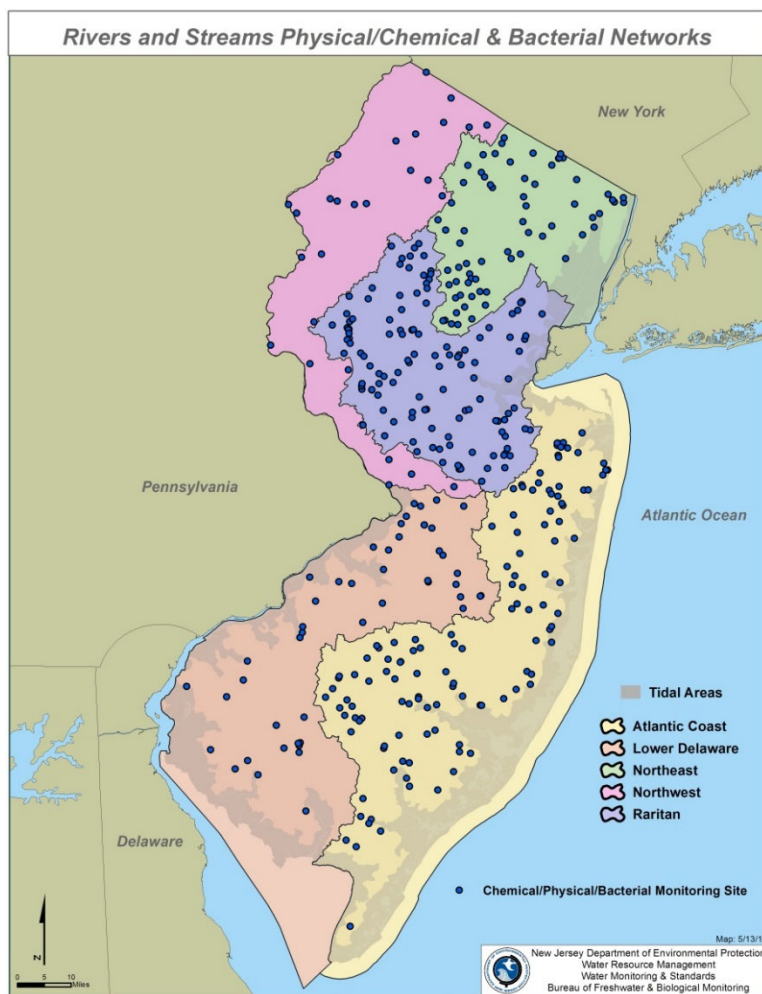
Type of Samples Collected:
Water Column (DO, pH, temperature, specific conductance, turbidity, discharge, total phosphorus, total nitrogen, nitrate-nitrite), basic cations and anions, sediment, metals, pesticides, toxics, radionuclides, PFAS

Data Availability:
USGS National Water Information System (NWIS), National Water Quality Portal

Data Users:
NJDEP (DWMS, DWQ, SRP, DWSG), NJ Water Supply Authority, DRBC, EPA, USGS, academia, watershed associations, the public

Legislative/Regulatory Mandates:
Federal Clean Water Act, NJ Watershed Protection and Management Act, NJ Water Quality Planning Act

Program Website:
http://www.nj.gov/dep/wms/bfbm/surfacewater.html

Rivers and Streams: Regional Targeted Water Quality Network (RTWQN)

Purpose and Objectives:
This network builds on concepts used to assess the ecological health of the Barnegat Bay watershed. The Department's work in Barnegat Bay uses a model approach for water quality assessment and restoration on a regional basis. Under this paradigm, the Department has organized its water program operations to consider water resource issues on a regional, integrated and holistic basis. This approach encourages development of measures to restore, maintain and enhance water quality uses that maximize effectiveness and efficiency in achieving positive environmental outcomes that are tailored to the unique circumstances of each region.

Under the regional assessment approach, the Department focuses on one of New Jersey's five water regions (Atlantic Coastal, Lower Delaware, Northwest, Raritan, and Northeast) during each Integrated Water Quality Assessment Report (Integrated Report) cycle. Together with the other freshwater monitoring networks, the rotating water regional approach results in a comprehensive assessment of the entire state every 10 years. The DEP initiated the Regional Comprehensive Assessment process in the Atlantic Coastal Region for the 2014 Integrated Report cycle that was followed by 2014-2015 monitoring in the Raritan Region for the 2016 Integrated Report cycle. The 2018 and 2020 reporting cycles focused on the Lower and Upper Delaware Regions, respectively. For 2020-2022, monitoring efforts will focus on the Northeast Water Region.
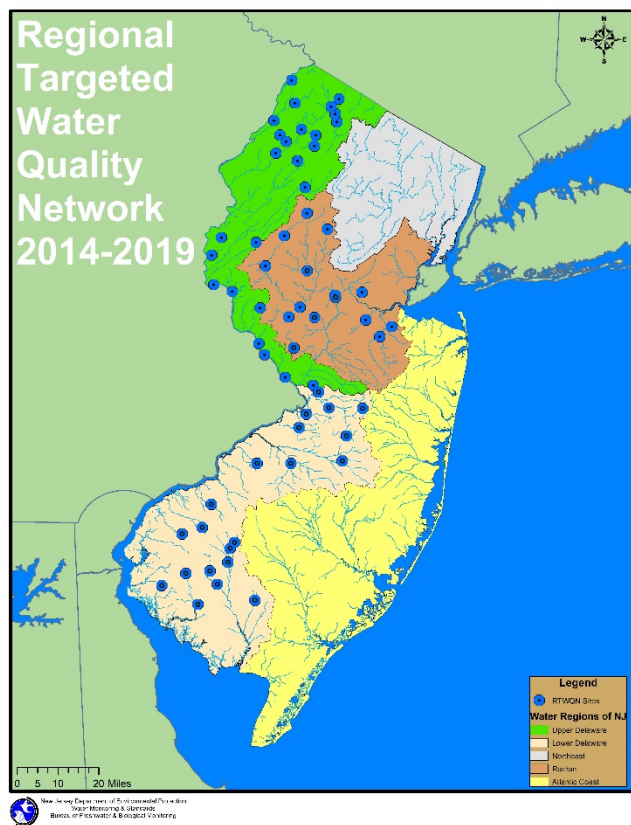
Sites are selected to:
- Address data gaps or lack of water quality data;
- Be representative of water body being monitored;
- Support 303(d) List de-listings/listings;
- Focus on nutrient-related 303(d) parameters and their sub-watersheds;
- Provide chemical data to supplement biological AMNET benthic macroinvertebrate data;
- Support future TMDL development, implementation and effectiveness monitoring; and
- Monitor effectiveness of 319(h)-funded or other water quality restoration projects.

Program Description and Design:
The program uses a Rotating Region design. In each region, 25 stations are sampled 20 times every two years for conventional/nutrient parameters and 8 times every two years for metals

parameters. Discharge (stream flow) measurements are made at each station during each sampling event. Continuous monitoring (diurnal dissolved oxygen and seasonal temperature monitoring) is conducted at a subset of the selected stations, as well as additional stations within the region.

Type of Samples Collected:

Water column (DO, Temperature, Specific Conductance, pH, Turbidity, Discharge), Nutrients (Total phosphorus, TKN, Nitrate-Nitrite), basic cations and anions, metals

Data Availability:

National Water Quality Portal, Water Quality Data Exchange System

Data Users:

NJDEP (DWMS, DWQ, NJGWS), USGS, academia and the Public

Legislative/Regulatory Mandates:

Federal Clean Water Act, NJ Watershed Protection and Management Act

Program Website:

http://www.nj.gov/dep/wms/bfbm/saswmn.html

Rivers and Streams: Water Monitoring Gap and Enhancement Project

Purpose and Objectives:
The Water Quality Monitoring Gap and Enhancement Project was established in 2016 as a monitoring effort which focuses on streams or watersheds that are not currently included in other existing networks. These monitoring locations could be where no previous water quality information was collected or at which previous information is minimal or dated. Other project objectives include:

- Locating sites that can be used to assess background/reference water quality conditions;
- Investigating water bodies with suspected water quality issues;
- Monitoring the effectiveness of implemented best management practices;
- Assessing new or updated technologies and methods for future incorporation into routine monitoring work; and
- Investigating parameters which have not been sampled previously or in some time.

Program Description and Design:
Sites are selected based on current needs and are sampled (frequency and parameters) based onsite-specific gaps in knowledge or needs in terms of follow-up monitoring.

Type of Samples Collected:
Parameters vary from site to site based on needs, but at a minimum include: water column (dissolved oxygen, pH, temperature, specific conductance, turbidity, discharge, total phosphorus, total nitrogen, nitrate-nitrite), basic cations & anions, and metals. Other parameters may include pesticides, continuous monitoring parameters, or others determined on a site-specific basis.

Data Availability:
NJ Water Quality Data Exchange System, National Water Quality Portal

Data Users:
NJDEP (DWMS, SRP, DWSG), DRBC, EPA, USGS, academia, the public

Legislative/Regulatory Mandates:
Federal Clean Water Act, NJ Watershed Protection & Management Act, NJ Water Quality Planning Act

Program Website:
https://www.nj.gov/dep/wms//bfbm/sw_specialprojects.html

Rivers, Streams, and Lakes: Continuous Monitoring

Purpose and Objectives:

Most of DEP's water quality monitoring networks are part of discrete monitoring efforts, in which individual distinct samples are collected and analyzed. In contrast, continuous monitoring involves using data loggers and sondes with sensors and probes to collect water quality data at pre-determined intervals (often at 15 or 30 minutes) for a specified period. Continuous monitoring plays an important role in freshwater monitoring. In addition to characterizing baseline stream conditions more completely than discrete monitoring, continuous monitoring provides insights into daily and seasonal fluctuations that may not be seen with monthly or quarterly discrete sampling. Sites selected for continuous monitoring are targeted for a specific parameter of concern, such as diurnal fluctuations in dissolved oxygen or harmful algal bloom susceptibility.

During the days of warm summer months, dissolved oxygen may become dangerously low and produce anoxic conditions; such conditions may not be captured by discrete sampling.

Specifically, to support HAB response, DEP has 11 telemetry buoys and 1 land based unit equipped with continuous monitoring meters. Data can be viewed in real time for HAB screening and status monitoring. In addition, water quality data may be used to assess factors that may contribute to, or characterize, HAB production.

Program Description and Design:

Sites are selected to assess water quality standards for certain parameters at specific streams. Other sites may have historical discrete data that suggest an exceedance of current surface water quality standards in one or more parameters. Using single or multi-parameter data loggers and sondes, measurements are recorded at a specific time interval, such as every 15 minutes or 30 minutes, for a designated period, depending on project goals. For example, for diurnal dissolved oxygen monitoring, devices are deployed during the growing season (when photosynthetic activity will likely affect parameters such as dissolved oxygen) for anywhere from a few days to several months.

Type of Samples Collected:

Dissolved oxygen (concentration and percent saturation), pH, specific conductance, water temperature, turbidity, phycocyanin/chlorophyll a

Data Availability:
Data prior to 2010 are available through NJ Water Quality Data Exchange System and the National Water Quality Portal. Data collected from 2010 to date are available through this website: http://njdep.rutgers.edu/continuous/

Data Users:
NJDEP (DWMS, SRP, DWSG), DRBC, EPA, USGS, academia, the public

Legislative/Regulatory Mandates:
Federal Clean Water Act, NJ Watershed Protection & Management Act, NJ Water Quality Planning Act

Program Website:
https://www.nj.gov/dep/wms//bfbm/sw_monitoring.html

Rivers and Streams: Stream Monitoring for Effects on Water Quality by Road Salt Application

Purpose and Objectives:

- Develop a specific conductance database that examines critical, elevated winter specific conductance levels, the duration of elevated levels, and comparisons to baseline levels and normal fluctuations throughout the year in a variety of New Jersey's non-tidal, freshwater streams;
- Obtain insight into the deployment of targeted discrete sampling of total dissolved solids and chloride during periods of snowmelt;
- Determine how different road deicing operations may be impacting total dissolved solids and chloride levels in water bodies to support potential guidelines on best management procedures;
- Develop relationship curves between continuous specific conductance, total dissolved solids, and chloride, which may be used for more complete water quality assessments.

Program Description and Design:

- Sites are chosen that exhibit elevated concentrations in water quality parameters associated with road deicing, but which need additional data for assessment purposes.
- Data loggers are deployed at each of the sites which collect conductivity and temperature readings every thirty minutes. Six times a year, field parameters, flow measurements, and chloride and total dissolved solids samples are collected as well.
- Field parameters are analyzed immediately on-site and include dissolved oxygen, temperature, pH, conductivity, and turbidity.

Type of Samples Collected:
Discrete parameters include total dissolved solids chloride and field/analyze immediately parameters (dissolved oxygen, water temperature, specific conductance, pH and turbidity), and discharge measurements. Continuous monitoring parameters include water temperature and specific conductance.

Data Availability:
Discrete data are available through the NJ Water Quality Data Exchange System and the National Water Quality Portal. Continuous data available through the website http://njdep.rutgers.edu/continuous/

Data Users:
NJDEP (DWMS, SRP, DWSG), DRBC, EPA, USGS, academia, the public

Legislative/Regulatory Mandates:
Federal Clean Water Act, NJ Watershed Protection & Management Act, NJ Water Quality Planning Act

Program Website:
https://www.nj.gov/dep/wms//bfbm/sw_specialprojects.html

Rivers and Streams: Ambient Summer Bacterial Monitoring Network

Purpose and Objectives:
An important goal of the federal Clean Water Act is to protect and restore waters for swimming, and "primary contact recreation." Therefore, a prime objective is to assess whether primary contact recreation criteria are being met, as defined in New Jersey's Surface Water Quality Standards (N.J.A.C. 7:9B), using *Escherichia coli* (*E. coli*) concentrations.

Program Description and Design:
This program collects ambient bacterial water quality data at freshwater rivers and streams. To adequately assess the recreational criteria, five samples are collected within a 30-day period, typically between the months of May and September. Primary Contact Recreation Use support is assessed by comparing the geometric mean (geomean) of the *E. coli* data with the criteria. Monitoring is focused regionally, with one Water Region (Atlantic Coastal, Raritan, Lower Delaware, Upper Delaware, and Northeast) covered each sampling year. Sites are annually selected in either previously unmonitored HUC14s or at locations where fecal coliform or *E. coli* data has been previously collected (often for bacterial TMDLs), with a sufficient number of sites to provide thorough coverage of the Water Region. In addition, water temperature readings are made concurrent with each sample collection, and observations on recent precipitation are made to inform the assessment of the data.

Type of Samples Collected:
Water Column, (*E. coli*)

Data Availability:
EPA's Water Quality Exchange (WQX), Water Quality Portal (waterqualitydata.us)

Data Users:
NJDEP (DWMS, DWQ), DRBC, USGS, academia, the public, watershed associations

Legislative/Regulatory Mandates:
Federal Clean Water Act

Program Website:
http://www.nj.gov/dep/wms/bfbm/index.html

Rivers and Streams: Ambient Macroinvertebrate Network (AMNET)

Purpose and Objectives:

The major goal of the AMNET program is to provide a cost-efficient means of gauging the ecological health of watersheds throughout the state. This objective is accomplished through sampling and analysis of benthic macroinvertebrate communities from a network, representative of New Jersey's five (5) major Water Regions (Northwest, Lower Delaware, Northeast, Raritan, and Atlantic). In addition to adequately assessing major Water Regions, sites are also selected to represent and assess Aquatic Life Use attainment at the HUC14 scale, which is the assessment unit for the Integrated Report listings.

Program Description and Design:

This program monitors the in-stream benthic macroinvertebrate community as an indicator of the ecological health of non-tidal,

Rivers and Streams Ambient Macroinvertebrate Network (AMNET)

Sampled over 5 years

freshwater rivers and streams. Samples are analyzed in the BFBM's laboratory, and the taxonomic and count data is assessed using a multi-metric index. Three regionally-specific indices have been developed and calibrated for New Jersey rivers and streams. Based on the index score, a rating of Excellent, Good, Fair, or Poor is assigned to the site. Sites rated as Fair or Poor are considered as non-attaining for Aquatic Life support. Metrics used are measurable characteristics of the benthic macroinvertebrate community that respond in a predictable way to various water quality and habitat stressors, such sedimentation and eutrophication.

There are approximately 750 active sites statewide in the AMNET network with about 150 sites sampled annually. These sites were initially selected using a stratified approach to ensure complete and representative coverage of each Water Region. Working in cooperation with DWMS' Bureau of Environmental Analysis, Restoration & Standards (BEARS), enhancements to the network have been implemented to ensure that sites are located to best assess the sub-watersheds of the state at a HUC14 scale. Sites in the network are sampled once every five years, using a rotational basin approach. Sampling at each Water Region's complement of sites is completed in roughly a year,
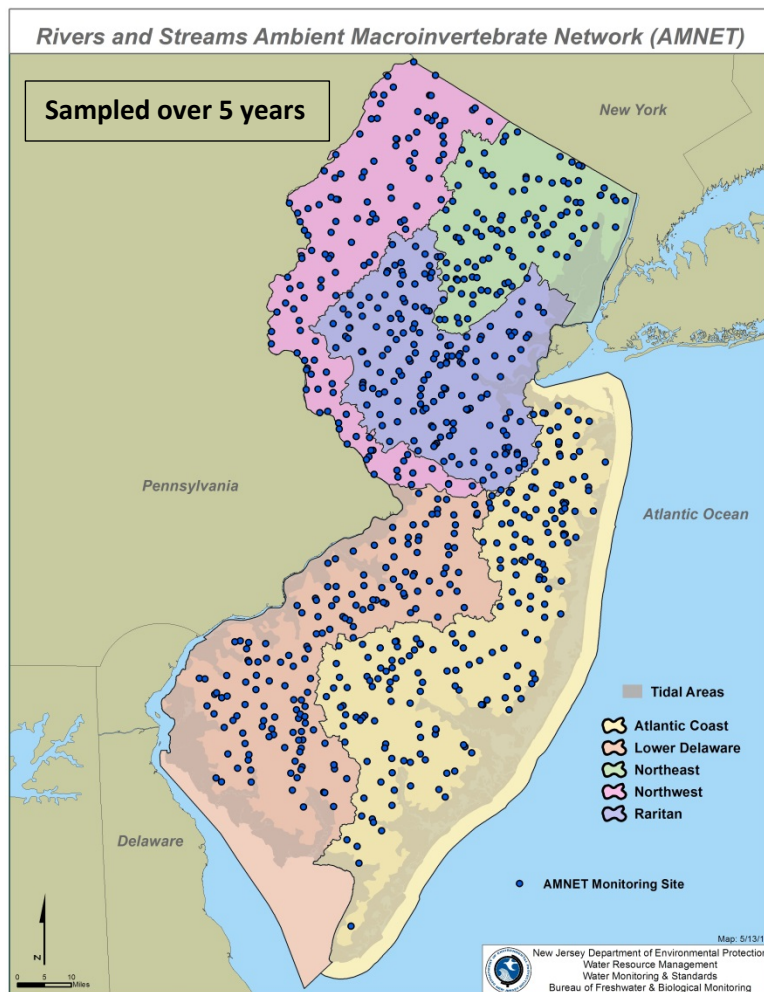
using an April through November index period. Concurrent with benthic macroinvertebrate sampling, a visual-based habitat assessment is conducted, field chemistries are collected, pictures are taken, observations are recorded, and nutrient samples are collected.

Probabilistic sites are selected using Generalized Random Tessellation Stratified (GRTS) Spatially Balanced Survey Design. Where target criteria are met, these sites are co-located with a subset of ASWQMN sites. Design consists of 5 panels of 50 sites, with each panel to be completed every two years. Macroinvertebrates are sampled once at each of the 50 panel sites during the two-year period. Macroinvertebrate collection follows the methods used in the Ambient Macroinvertebrate Network (AMNET). Upon completion of all five panels, a statewide statistical assessment can be performed.

Type of Samples Collected:
Biological (benthic macroinvertebrates), Water Column -dissolved oxygen (DO), pH, water temperature, specific conductance, turbidity, Total Phosphorus, Total Nitrogen, Nitrite-Nitrate (NO2-NO3), and visual-based habitat assessment.

Data Availability:
Program website, EPA's Water Quality Exchange (WQX), National Water Quality Portal

Data Users:
NJDEP (DMWS, DWQ, DSR), USGS, USEPA, academia, watershed associations, the public

Legislative/Regulatory Mandates:
Federal Clean Water Act

Program Website:
http://www.nj.gov/dep/wms/bfbm/amnet.html

Rivers and Streams: Fish Index of Biotic Integrity Network (FIBI) and Headwaters Index of Biotic Integrity (HIBI)

A. Fish Index of Biotic Integrity Network (FIBI)

Purpose and Objectives:

The primary purpose of this network is to provide a cost-efficient means of gauging the ecological quality of streams and watershed areas throughout the state. This objective is accomplished using the Fish Index of Biotic Integrity (IBI) for New Jersey fish assemblages, using the Northern Fish IBI and the Inner Coastal Plain Fish IBI (Southern IBI). A fish index has not been developed for the Pinelands region. The sampling objective is to obtain a representative sample of the fish assemblage in a 150-meter stream reach.

Rivers and Streams Fish Index of Biotic Integrity (FIBI) and Headwaters Index of Biotic Integrity (HIBI) Networks

Overall objectives include, but are not limited to:

- Determining water quality status and trends;
- Identifying impaired waters and waters needing protection;
- Identifying potential causes and sources of impairment;
- Implementing water quality management programs;
- Evaluating program effectiveness;
- Providing background data to assess environmental spills; and
- Informing the public about the condition of New Jersey's waters.

Program Description and Design:

There are approximately 226 active sites in the FIBI network consisting of fixed, probabilistic, and sentinel (least disturbed) sites. The data from fixed sites is used to assess long term trends, while probabilistic sites are important for assessing aquatic life use overall in the waters of the state. Probabilistic sites were selected using EPA probabilistic site selection methodology[3].

Candidate streams included all rivers and streams on NJDEP GIS coverage north of the fall line, non-tidal, and greater than 4.0 square miles in drainage, while candidate sites south of the fall line

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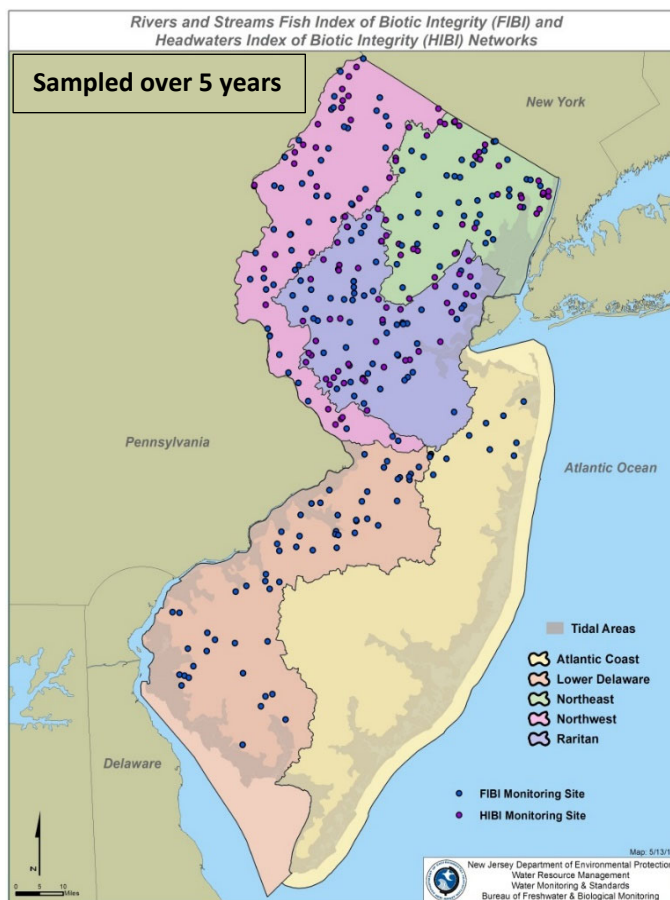
[3] Generalized Random Tessellation Stratified (GRTS) survey design

were non-tidal, greater than 2.0 square miles in drainage, and are located in the Inner Coastal Plain. Sentinel sites are considered high quality waterbodies located in fully or partially protected watersheds which are sampled on a routine basis to assess environmental changes such as global warming. These sites are part of the new Fish IBI targeted monitoring network in which all fixed site sampling will occur in one of four specific DEP Water Regions (Upper Delaware, Lower Delaware, Raritan, and Northeast). Random and sentinel sites are split between the region north of the fall line and the inner coastal plain. Fixed and random sites are sampled on a five-year basis, while sentinel sites are sampled every other year.

Enhancements to the network were instituted to include sites that best evaluate the sub-watersheds (HUC 14 scale) of the Water Region for Aquatic Life Use attainment in the Integrated Water Quality Assessment Report.

Type of Samples Collected:
Biological (fish), Water Column (DO, pH, temperature, specific conductance, discharge, total phosphorus, total nitrogen, nitrate-nitrite), visual and measured habitat parameters, discharge.

Data Availability:
Program website, NJ Water Quality Data Exchange System, EPA's STORET Data Warehouse, National Water Quality Portal

Data Users:
DEP (DWMS, DSR, DFW), DRBC, USGS, USEPA, academia, anglers, the public

Legislative/Regulatory Mandates:
Federal Clean Water Act

Program Website:
http://www.nj.gov/dep/wms/bfbm/ibipagemain.htm

B. Headwaters Index of Biotic Integrity (HIBI)

Purpose and Objectives:
The objective of the Headwaters IBI (HIBI) monitoring program is to assess stream condition and water quality in headwater streams of the State. In northern New Jersey, north of the fall line, 81% of the non-tidal stream miles are less than five square miles in drainage area, of which 35% are listed as anti-degradation waters. The HIBI monitoring program is designed to provide a rapid, cost-effective assessment of the water quality and condition of New Jersey's high gradient headwater streams with drainage areas less than four square miles. The HIBI complements the established northern Fish IBI program (FIBI) in that HIBI samples wadeable streams less than 4 square miles and FIBI samples wadeable streams larger than 4 square miles. The need for a headwaters biological assessment tool is due to the differences in aquatic faunal assemblages and fish species richness with stream size; therefore, FIBI metrics and methods are invalid for use on small headwater streams. The HIBI is an additional biological assessment tool for small streams

to be used in conjunction with the AMNET results to determine aquatic life use attainment for headwater streams.

Program Description and Design:
The HIBI assesses aquatic life use in headwaters streams less than 4 square miles in watershed area. A pilot project was led by the Academy of Natural Sciences at Drexel University in 2003 to study methods and metrics for the development of a headwater index of biotic integrity. BFBM continued the project and began a validation study in 2013 to develop the final metrics. Metric validation was finalized in 2016 and incorporated into the Integrated Water Quality Assessment Methods Document to be used in future New Jersey Integrated Water Quality Assessment Reports. A fixed network totaling 50 sites has been proportionally allocated to the three water regions (Northwest, Northeast, and Raritan) in northern New Jersey where the HIBI is applied.

Probabilistic sites, selected using a Generalized Random Tessellation Stratified (GRTS) survey design, which are intended to provide a statistical survey of the condition of the State's waters, are also sampled. In addition, sentinel sites are sampled to monitor reference conditions, variability through time, the effects of climate change, and evaluate trends in NJ headwater streams. Sentinel sites are selected based on the following criteria: 1) previous sampling must indicate at least three sensitive taxa; 2) designated by NJ's Surface Water Quality Standards as FW1-TP waters (nondegradation waters) or category one (C1) waters with trout production status; and 3) the percent Urban Land Cover within the stream's drainage area must not exceed 10%. Three of the selected HIBI sentinel sites are also part of EPA's Regional Monitoring Network to detect climate change effects in stream ecosystems.

Type of Samples Collected:
Biological (fish, salamanders, frogs, crayfish), Water Column (DO, pH, temperature, specific conductance, total phosphorus, total nitrogen, nitrate-nitrite)

Data Availability:
Program website, NJ Water Quality Data Exchange System, EPA's STORET Data Warehouse, National Water Quality Portal

Data Users:
DEP (DWMS, DSR, DFW), DRBC, USGS, USEPA, academia, anglers, the public

Legislative/Regulatory Mandates:
Federal Clean Water Act

Program Website:
http://www.nj.gov/dep/wms/bfbm/ibihibipage.htm

Rivers and Streams: NJ Participation in EPA Freshwater National Aquatic Resources Surveys (NARS) - National Rivers and Streams Assessment (NRSA)

Purpose and Objectives:
The National Rivers and Streams Assessment (NRSA) is a comprehensive, statistically valid survey of the Nation's flowing water resources. It is one in a series of surveys designed to assess the condition of all waters (rivers/streams, lakes, wetlands and coastal waters). Data from this monitoring serves as an overall assessment of the condition of the Nation's rivers.
The sampling design for the NRSA is a probability-based network that provides statistically-valid estimates of condition for all of the nation's rivers and streams with a known confidence. The survey measures a wide variety of variables intended to characterize the chemical, physical, and biological condition of the nation's flowing waters both on a national and ecoregional scale.

New Jersey is split into two major eco-regions and three minor eco-regions for the NRSA. The northern part of the state, above the fall line, is included in the Eastern Highlands eco-region and the southern part of the state, below the fall line, is included in the Plains and Lowlands eco-region. The Plains and Lowlands eco-region includes all states from the eastern and southeastern Coastal Plain, the Upper Midwest, the Temperate Plains, and the Northern and Southern Plains.
The Eastern Highlands includes all of the states from the Northern and Southern Appalachians.

Program Description and Design:
The National Rivers and Streams Assessment is a two-year sampling event which takes place every four years and will occur again in 2023-24. Approximately 20 sites are randomly selected in NJ from a pool of all freshwater rivers and streams in the State, including tidal waters. The sampling design is divided into wadeable and non-wadeable sampling protocols. Due to monitoring personnel limitations, DEP generally collects data at 8-10 sites and earns the Monitoring Initiative funds for this work. The remainder of the work is completed by EPA contractors.

Type of Samples Collected:
Water column (DO, Temperature, Specific Conductance, pH, Turbidity, Discharge), Biological (fish communities, fish tissue, benthic macroinvertebrates, periphyton), Chlorophyll (microcystin, chl-a), Nutrients (total phosphorus, TKN, Nitrate-Nitrite), pathogens, basic cations and anions, alkalinity, DOC, TSS

Data Availability:
EPA STORET Data Warehouse, National Water Quality Portal

Data Users:
NJDEP (DWMS), DRBC, USEPA, USGS, academia and the public

Legislative/Regulatory Mandates:
Clean Water Act

Rivers & Streams: NJ's Participation in the USDA/USEPA National Water Quality Initiative (NWQI)

Purpose and Objectives:
The National Water Quality Initiative (NWQI) is a joint project of the USEPA and the United State Department of Agriculture (USDA). The USDA, through the National Resources Conservation Service (NRCS), provides funding to farmers throughout the Nation to implement conservation practices to address water quality impairments (nutrients, total suspended solids, biological, pathogens) related to agriculture. The goal of the long-term monitoring is to determine the effectiveness of these conservation practices in improving water quality and/or biological conditions.

Program Description and Design:
Three watersheds in New Jersey were initially selected to receive this funding through NRCS- the Upper Salem River, the Upper Alloway Creek, and the Upper Cohansey River watersheds in Salem and Cumberland Counties. DEP, with USEPA support, is tasked with monitoring the effectiveness of these efforts to improve water quality at one of the watersheds - the Upper Salem River. Monitoring began in 2015, designed to detect improvement in biological conditions, as measured using the benthic macroinvertebrate community, and reductions in nutrient, sediment, and pathogen concentrations. Because of the lag time between implementation of practices and measurable changes in water quality attributable to these practices, monitoring is expected to last 7-10 years. To enable detection of potentially subtle changes, frequent sampling of water column parameters is necessary, as well as annual benthic macroinvertebrate sampling, targeting multiple sites in the watershed.

Type of Samples Collected:
Water column (dissolved oxygen (DO), water temperature, specific conductance, pH, Turbidity, Total Phosphorus, Nitrite-Nitrate (NO2-NO3), Total Kjeldahl Nitrogen (TKN), E. coli, Total Suspended Solids (TSS)), Biological (benthic macroinvertebrate)

Data Availability:
EPA STORET Data Warehouse, National Water Quality Portal, Water Quality Data Exchange System

Data Users:
NJDEP (DWMS), USEPA

Program Website:
https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/water/?cid=stelprdb1047761

Legislative/Regulatory Mandates:
Clean Water Act

Freshwater Lakes: Ambient Lakes Monitoring Network

Purpose and Objectives:

The purpose of the Ambient Lakes Monitoring program is to assess the ecological health of New Jersey's lakes.

Overall objectives of the program include:
- Determining water quality status and trends;
- Identifying impaired waters and waters needing protection;
- Identifying potential causes and sources of impairment;
- Implementing Water Quality Management Programs;
- Evaluating program effectiveness; and
- Informing the public about the condition of New Jersey's lakes

Data is collected to evaluate the trophic state and water quality of selected lakes and assess the ecological health of the State's lentic water resources. The network has three components: statewide statistical survey lakes, regional targeted lakes, and reference lakes. 250 lakes are monitored for the statewide statistical survey. Fifty of these lakes (designated as a Panel) are monitored over a two-year period (or 25 lakes per year) in order to develop baseline and statewide status and trend information. Regional targeted lakes and reference lakes are also sampled over a two-year period, but with greater monitoring frequency to characterize lake specific information.

In addition to evaluating the ecological health of lakes statewide, information from this monitoring network is used to assess the conditions of individual lakes in the New Jersey Integrated Water Quality Assessment Report.
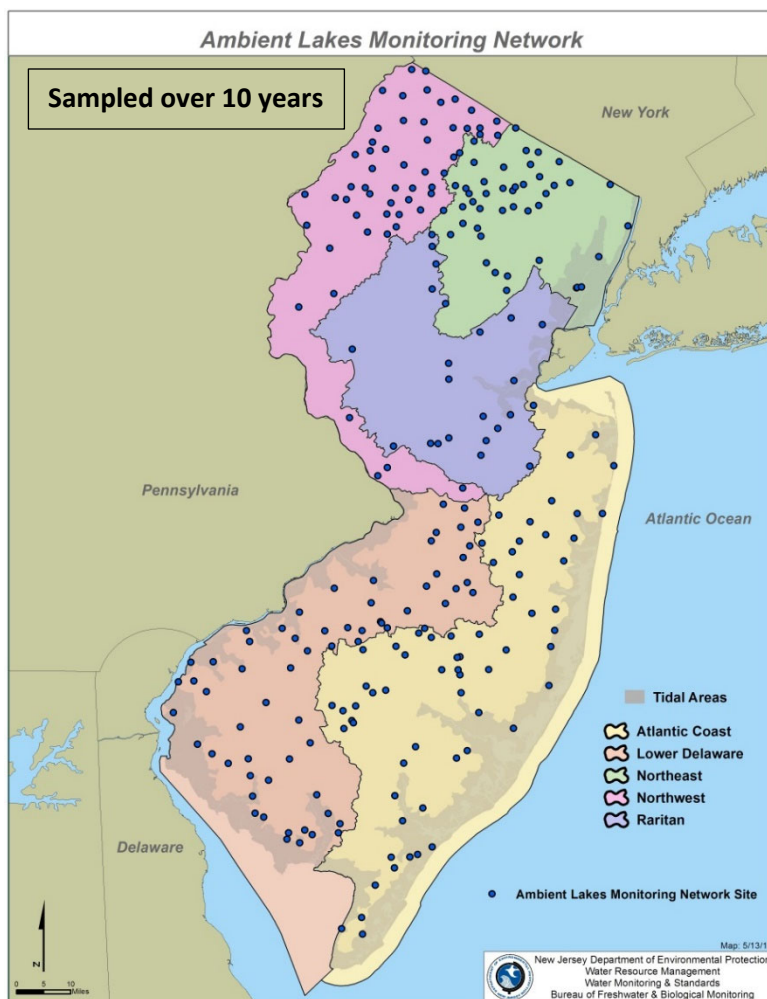
Program Description and Design:

For the Statewide Statistical Survey, 50 lakes, referred to as a Panel, are sampled over 2 years, or 25 lakes per year. A total of 250 lakes were selected for sampling over a 10-year period. Individual Panels of 50 lakes will have sufficient statistical confidence to assess statewide status every two years. It is anticipated that statewide trends will be assessed after all 250 lakes are sampled. Lakes were selected using USEPA probabilistic site selection methodology, Generalized Random Tessellation Stratified (GRTS) survey design for a point resource with reverse hierarchical ordering (RHO). See (Olsen, 2004)[4].

Potential sites included all lakes (public and private) on DEP Geographic Information System (GIS) Coverage "NJ National Hydrography Dataset," greater than or equal to 5 acres, minimum one meter deep, including potable water supply reservoirs and unnamed lakes.

In addition to the statistical survey sites, statewide reference and targeted regional lakes are selected. Eight (8) statewide reference lakes representing each Omernik Level III ecoregion are sampled annually to establish reference conditions. Ten (10) targeted regional are sampled four times annually. These lakes are chosen by the Bureau of Environmental Analysis, Restoration, and Standards (BEARS) from the Water Region of interest Integrated Water Quality Monitoring and Assessment Report cycle.

Type of Samples Collected:
Water Column (DO, pH, temperature, specific conductance, turbidity, discharge), ammonia, nitrogen, Chl-a, Secchi depth, Algal Blooms, Microcystin, alkalinity, hardness

Data Availability:
EPA STORET Data Warehouse, National Water Quality Portal, Water Quality Data Exchange system, Program Website

Data Users:
DEP DWMS, USEPA (and consultants), USGS, fishers and anglers, academia and the public, watershed associations

Legislative/Regulatory Monitoring:
Federal Clean Water Act

Program Website:
http://www.nj.gov/dep/wms/bfbm/lakes.html

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[3] Olsen, Tony. 2004. "New Jersey Lake Design Survey". United States Environmental Protection Agency

Freshwater Lakes: Cyanobacterial Harmful Algal Blooms (HABs) Freshwater Recreational Response Strategy and Monitoring

Purpose and Objectives:

Cyanobacteria are a type of bacteria capable of photosynthesis. Although they are not true algae, they are often referred to as "blue-green algae". Cyanobacteria frequently impart off- tastes and odors to the water in which they grow, and some species are able to produce toxins (known as cyanotoxins) that can be harmful to the health of humans and other animals. Although problems related to cyanobacteria most often occur in freshwaters (lakes and streams), cyanobacteria can also be found in marine waters.

New Jersey's Cyanobacterial Harmful Algal Bloom (HAB) Response Strategy was created to provide a unified statewide approach to responding to cyanobacterial HABs in freshwater recreational waters and sources of drinking water, and to protect the public from risks associated with exposure to these toxins. Although the primary focus is on the protection of human health, this strategy also provides information and advice regarding prevention of exposure to domestic animals and livestock. The Response Strategy identifies:

- Entities responsible for response and actions
- Recreational risk thresholds
- Acceptable parameters and methods for assessing risk
- Appropriate monitoring and analysis for microcystins, cylindrospermin, anatoxin-a, and saxitoxin
- Recommended Advisories and other appropriate communication mechanisms

The Bureau of Freshwater and Biological Monitoring is responsible for annual updates to the Strategy, as well as coordinating the State's responses per the Strategy and conducting monitoring and laboratory analysis for freshwater HABs.

Program Description and Design:

The scope of the Response Strategy is for lakes, rivers, and streams with potential public access, recreational use, bathing beaches (including licensed beaches), and sources of drinking water. These waterbodies may be owned or operated by state, county, municipal, federal or private entities. As such, coordination of the investigation and response activities will vary depending on ownership.

Direct drinking water concerns are addressed in DEP's Division of Water Supply and Geoscience (DWSG) Emergency Response Plan, which focuses on prevention and treatment of drinking water contamination, and applies to cyanobacterial HABs and toxins. DWSG will coordinate action with appropriate water supply authorities in the event of a drinking water contamination.

Specifically, to support HAB response, DEP has 11 telemetry buoys and 1 land-based unit equipped with continuous monitoring meters. Data can be viewed in real time for HAB screening and status monitoring. In addition, water quality data may be used to assess factors that may contribute to, or characterize, HAB production.

Type of Samples Collected:
Water Column (cyanobacteria identification, cell count, toxins, pigments). BFBM's laboratory has the capability to perform these analyses. Results are used to determine if HAB levels are above NJ recreational exposure guidance thresholds and if advisories are warranted.

Data Availability:
Response data: Program website. Routine data: EPA STORET Data Warehouse, National Water Quality Portal, Water Quality Data Exchange System

Data Users:
NJDEP (DWMS, NJGWS, Fish and Wildlife, Parks, DSR, DWSG), USGS, academia, the public, watershed associations, lake associations, State and local health departments

Legislative/Regulatory Mandates:
Federal Clean Water Act

Program Website:
https://www.state.nj.us/dep/hab/

Freshwater Lakes: NJ Participation in EPA Freshwater National Aquatic Resources Surveys (NARS) - National Lakes Assessment (NLA)

Purpose and Objectives:
The National Lakes Assessment (NLA) is a comprehensive, statistically valid survey of the Nation's lake resources. It is one in a series of surveys designed to assess the condition of all waters (rivers/streams, lakes, wetlands and coastal waters). Data from this monitoring serves as an overall assessment of the condition of the Nation's lakes. The sampling design for the NLA is a probability-based network that provides statistically-valid estimates of condition for all lakes with a known confidence. The survey measures a wide variety of variables intended to characterize the chemical, physical, and biological condition of the nation's lakes both on a national and ecoregional scale.

New Jersey is split into two major eco-regions and three minor eco-regions for the NLA.
The northern part of the State, above the fall line, is included in the Eastern Highlands eco-region and the southern part of the state, below the fall line, is included in the Plains and Lowlands eco-region. The Plains and Lowlands eco-region includes all states from the eastern and southeastern Coastal Plain, the Upper Midwest, the Temperate Plains, and the Northern and Southern Plains. The Eastern Highlands includes all of the states from the Northern and Southern Appalachians.

Program Description and Design:
The National Lake Assessment takes place every five years, most recently in 2017. Approximately 11 sites are randomly selected in NJ from a pool of lakes at least one meter deep and over 2.5 acres (1 hectare) in size. Lakes were selected randomly using a statistical survey design to represent the population of lakes in their ecological region.

Type of Samples Collected:
Water column (DO, temperature, Specific conductance, pH, Turbidity, Discharge), sediment, zooplankton, phytoplankton, microcystin, sediment cores/color, biological (sediment diatoms, aquatic macroinvertebrates), pathogens, visual habitat, pesticide screen

Data Availability:
EPA STORET Data Warehouse, National Water Quality Portal

Data Users:
NJDEP (DWMS), USEPA, academia and the public

Legislative/Regulatory Mandates:
Clean Water Act

Program Website:
https://www.epa.gov/national-aquatic-resource-surveys/nla

Freshwater Lakes: NJ's Participation in USEPA's Mid-Atlantic Regional Monitoring Network (RMN)

Purpose and Objectives:
The objective of the Regional Monitoring Network is to establish a long-term, regional network of freshwater lakes at which thermal and hydrologic data are collected. Data collected will allow for a better understanding of the relationship between biological, thermal, and hydrologic conditions at minimally-disturbed freshwater streams of the Mid-Atlantic region.

Program Description and Design:
The RMN is a broad project of the EPA's Office of Research and Development (ORD), for which BFBM is providing monitoring and sampling assistance at lakes in New Jersey. To augment similar efforts underway in other regions of the United States, temperature, dissolved oxygen and water level probes have been deployed at 2 lakes in New Jersey – Deer Park Pond and Hands Mill Pond. – These units will continuously record air and water temperatures, water level and dissolved oxygen in the water column. Trail cameras were also installed on the lake's shoreline with a time lapse program to capture ice cover during the winter months. Sites were selected in these minimally disturbed watersheds to evaluate impacts of climate-related changes, in the absence of other types of stressors. The site selection process used several factors including the historic record of data collected, disturbance analysis, low level of anthropogenic disturbance, limited potential of future disturbance in the watershed, and analysis of vulnerability to thermal change. Water quality samples will be collected at least once annually and analyzed for a range of parameters. This monitoring, which began in 2019, is expected to last for at least 10 years and provide NJ with invaluable water quality information which it could not obtain alone as one state.

Type of Samples Collected:
Water column (Continuous Temperature and DO, Specific Conductance, pH, Turbidity), and secchi depth.

Data Availability:
EPA STORET Data Warehouse, National Water Quality Portal

Data Users:
USEPA

Legislative/Regulatory Mandates:
Federal Clean Water Act

Program Website:
https://cfpub.epa.gov/ncea/global/recordisplay.cfm?deid=307973

Rivers, Streams & Lakes: Fish Tissue Monitoring Network (FTM)

Purpose and Objectives:
The goal of the freshwater fish tissue monitoring program is to collect primarily total mercury and polychlorinated biphenyls (PCBs) data in fish tissue. These two priority contaminants are responsible for the majority of the State's fish consumption advisories and designated use impairments. Additional contaminants, such as organochlorine pesticides (OCPs) and polybrominated diphenyl ethers (PBDEs) may also be measured on a site-specific basis for selected fish species.

The fish tissue monitoring data is used to:
- Provide current and more comprehensive data on concentrations of toxic contaminants in fish in order to assess human health risks and update/revise fish consumption advisories.
- Provide data to assess the impairment of the designated uses of the waterbodies sampled.
- Provide data to assess the trends in levels of contaminants that contribute to use impairment and fish consumption advisories.

Program Description and Design:
The establishment in 2014 of a regular tissue monitoring program was a key gap identified in NJ's 2005-2014 Long-term Monitoring and Assessment Strategy. Institutionalizing routine monitoring for mercury in fish tissue in NJ waters was recommended in the stakeholder –based NJ Mercury Task Force (*NJ Mercury Task Force Report, Volume I, 2001*). Work on sampling fish tissue for advisories, and for assessing the federal Clean Water Act fish consumption use, had been previously conducted by DEP's Division of Science and Research (DSR) on a research, project-specific basis with external research institutions. In 2014, NJ's fish tissue work transitioned from periodic research projects to annual, cost efficient, in-house monitoring to provide ongoing fish tissue data. Monitoring is conducted by BFBM with continued input on site selection and data analyses from the DEP's Division of Science and Research (DSR);
https://www.nj.gov/dep/dsr/njmainfish.htm.

Regional, targeted sampling is conducted using a rotating basin design, starting in the Raritan basin in 2014, the Atlantic (2015), Lower Delaware (2016), Northwest (2017), and the Northeast (2018). The fish sampled are those species commonly targeted and consumed by anglers. Starting in 2016, this targeted sampling was complemented by probabilistic sampling of mercury only in fish tissue in 10 lakes per year over 5 years to provide statistically valid statewide results.

Type of Samples Collected:
Tissue (primarily Mercury and PCBs, additional contaminants [e.g., PBDEs, OCPs, perfluoroalkyl substances -PFAS] may be measured on a site-specific basis for selected species as agreed upon with DSR.

Data Availability:
EPA STORET Data Warehouse, National Water Quality Portal, Water Quality Data Exchange system

Data Users:
NJDEP (DWMS, DSR, and DFW), DRBC, anglers, watershed associations

Legislative/Regulatory Mandates: Clean Water Act

Program Website: http://www.nj.gov/dep/wms/bfbm/ftmmainpage.html

Freshwater and Marine Cooperative Monitoring: Barnegat Bay Long Term Ambient Monitoring (BBLTAM)

Purpose and Objectives:

The Barnegat Bay Long Term Ambient Monitoring (BBLTAM) network is a targeted program focusing solely on the watershed of Barnegat Bay and its tributaries. BBLTAM is an extension of the Barnegat Bay Ambient Monitoring program. The purpose of this long-term monitoring network is to monitor the on-going quality of the bay and its tributaries. Emphasis is placed on the tributaries that are believed to have the most significant impacts/loading to the bay, as well as diverse land use types. The goal of this program is to evaluate changes in water quality in the Barnegat Bay watershed over time.

Program Description and Design:

BBLTAM samples are collected twice a month during the summer months, once a month during the spring and fall, and once every other month during the winter from 28 sites within the Barnegat Bay watershed (14 freshwater streams sites and 14 bay sites). These sampling sites are strategically selected to measure nutrient loading and water flow movement within the Barnegat Bay estuary. The utilization of data loggers within buoys to collect continuous data are deployed at 4 sites in the Barnegat Bay estuary. These real-time Telemetry Buoys measure physical and biological water quality data (pH, salinity, temperature, dissolved oxygen, turbidity, specific conductance, and chlorophyll a) once every 15 minutes.

Type of Samples Collected:

Water column (DO, Temperature, Specific Conductance, pH, Turbidity, discharge, total phosphorus, TKN, Nitrate-Nitrite, chlorophyll, basic cations & anions).
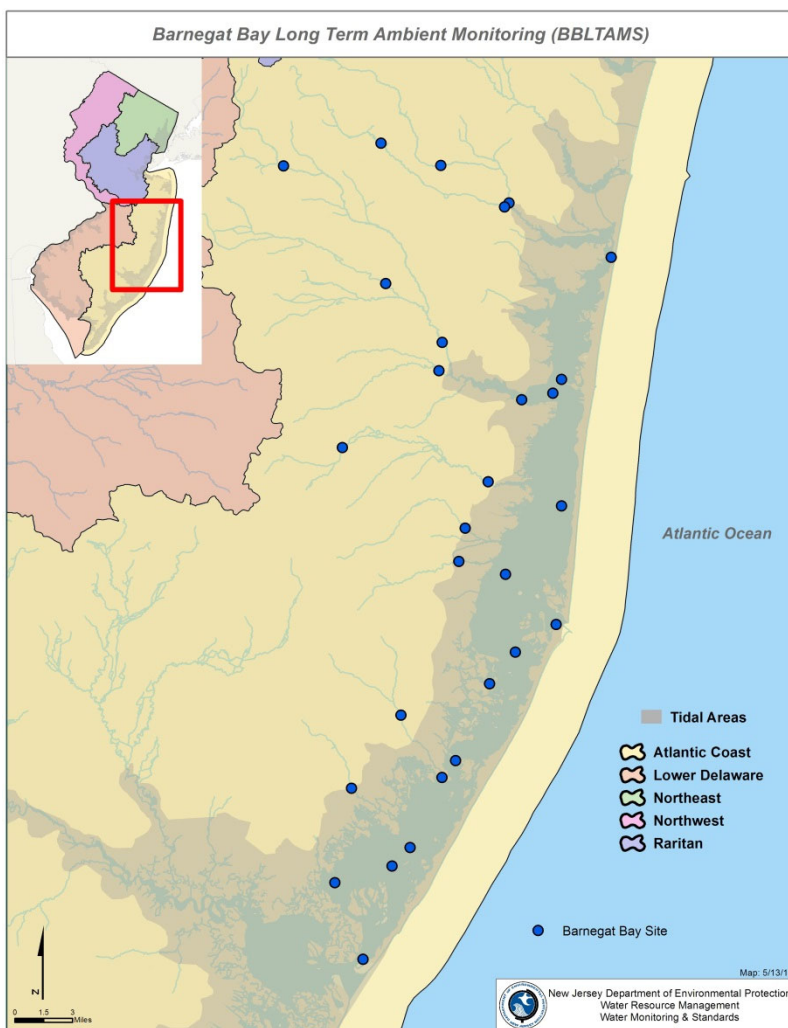
Data Availability:
EPA STORET Data Warehouse, National Water Quality Portal, NWIS, Water Quality Data Exchange System

Data Users:
NJDEP (DWMS, DSR), USEPA, USGS, academia, and the public

Legislative/Regulatory Mandates:
Federal Clean Water Act

Program Website:
http://www.nj.gov/dep/barnegatbay/plan-wqstandards.htm

Marine: Estuary and Ocean Networks

Estuary & Ocean: New Jersey Shellfish Sanitation Program

Purpose and Objectives:
The U.S. Food and Drug Administration (FDA) oversees shellfish-producing states' compliance with the guidelines and regulations set in the National Shellfish Sanitation Program's "Guide for the Control of Molluscan Shellfish" (NSSP Guide). The NSSP Guide summarizes the minimum requirements necessary for the State to regulate the interstate commerce of molluscan shellfish (oyster, clams, mussels, and scallops) and establishes methods to protect public health by assuring the sale or distribution of shellfish from safe sources and by assuring shellfish have not been adulterated during cultivating, harvesting, processing, shipping, or handling.

The NJ Shellfish Sanitation Program addresses the annual classification of shellfish growing waters, based on current bacteriological water quality conditions to determine where molluscan shellfish can (and cannot) be safely harvested for human consumption.

Program Description and Design:
The shellfish monitoring program is implemented pursuant to statutory law (N.J.S.A. 13:1D-9, 58:24-1, 23:2B-1, 2C:64-1, 4:27-1, and 50:1-5) and state regulations (N.J.A.C 7:12). The shellfish monitoring program also adheres to the requirements of the U.S. Food and Drug Administration (FDA) National Shellfish Sanitation Program's "Guide for the Control of Molluscan Shellfish" (NSSP Guide). The Bureau of Marine Water Monitoring conducts scientific investigatory work and research and revises the state regulation as needed. The shellfish monitoring program consists of sample collection and fecal coliform analysis of 12,000 water samples annually and molluscan shellfish, the inventory of actual and potential sources of pollution, and hydrographic studies of flow patterns which distribute pollution.

Sampling sites are chosen to provide representative data for all the State's major bodies of saline waters, including the New Jersey state waters of the Atlantic Ocean (within 3 nautical miles of the coastline). There are approximately 1,800 statewide NSSP monitoring sites, of which approximately 45 sites are also being used for routine biotoxin monitoring and phytoplankton identification. Depending on the results from the Aircraft Remote Sensing program, any NSSP monitoring site can be activated for biotoxin analysis.

Type of Samples Collected:
Water column (Temperature, fecal coliform)

Data Availability:
EPA STORET Data Warehouse, National Water Quality Portal, Water Quality Data Exchange System, Program website

Data Users:
NJDEP (DWMS, DWQ, DSR) USEPA, academia, the public, and fishers and anglers

Legislative/Regulatory Mandates:
Food and Drug Administration (FDA)

Program Website:
www.nj.gov/dep/wms/bmw/nssphome.html

Estuary: *Vibrio* Monitoring Program

Purpose and Objectives:
The *Vibrio* Monitoring Program fulfills the risk assessment and management sections defined in the Food and Drug Administration (FDA) National Shellfish Sanitation Program's "Guide for the Control of Molluscan Shellfish Model Ordinance" (NSSP Guide). The NSSP Guide requires member states to annually assess *vibrio* illnesses associated with the consumption of shellfish and develop a contingency plan to address outbreaks of *vibrio* related illnesses from shellfish consumption.

Since shellfish are filter feeders, they can readily accumulate, bacteria, viruses, toxigenic algae, and other substance from the water column. *Vibrio*'s, including *Vibrio parahaemolyticus (Vp)* and *Vibrio vulnificus (Vv)*, are bacteria that naturally appear in coastal waters and are not related to pollution. According to the Centers for Disease Control and Prevention (CDC), vibriosis causes an estimated 80,000 illnesses and 100 deaths in the US every year. People with *vibriosis* become infected by consuming raw or undercooked seafood or exposing a wound to marine water. Currently in New Jersey waters, *vibrios* are found during the summer months and more often found in oyster tissue than clam tissue. High levels of *Vp* may result in gastrointestinal illness in humans, however, people with a *Vv* infection can get seriously ill and need intensive care.

Since *vibrios* are not related to pollution levels, traditional controls for shellfish sanitation are not effective. Therefore, monitoring is crucial. The data accumulated also provides valuable insight into understanding *vibrios*. The objective of the *Vibrio* Monitoring Program is to collect data related to *vibrio* dependent variables (*e.g.* salinity), then evaluate those variables and the conditions (*e.g.* water temperature) in which *vibrios* are most robust. The resulting analysis of this information is used to establish a risk assessment model and written into New Jersey's *Vibrio* Control Plan (VCP), updated annually, to minimize the risk of *vibrio* illness from shellfish harvested from State waters. New Jersey's VCP addresses program coordination (with Department of Health and DEP Bureau of Shellfisheries and Bureau of Law Enforcement – Marine Region), response to potential outbreak, post-harvest time and temperature controls, hours of harvest for tidal and intertidal waters, and Hazard Analysis and Critical Control Points (HACCP) plan requirements. In addition, the VCP recommends additional best management practices to be implemented to further minimize risk from *vibrios*.

Program Description and Design:
Samples are collected weekly during the June thru August in areas where commercial oyster harvesting typically occurs.

The Bureau of Marine Water Monitoring (BMWM) annually monitors oyster and/or clam tissue for total *Vibrio parahaemolyticus (Vp)*, *Vibrio vulnificus (Vv)*, and virulent genes of *Vp* (tdh and trh). Samples are analyzed for *Vp* and *Vv* using Multiplex Real-Time PCR Assay with an Internal Amplification Control for the Detection of Total and Pathogenic *Vibrio parahaemolyticus*. In addition, BMWM is looking for specific virulent strains of *Vp* using Pulse Field Gel Electrophoresis (PFGE). BMWM's laboratory in Leeds Point is Pulse Net certified to perform PFGE to identify strains of *Vp* that may be virulent.

Parameters Analyzed:
Water column (Dissolved Oxygen, Temperature, Specific Conductance, pH Turbidity), shellfish (oysters/clams) for *Vibrio parahaemolyticus* and *Vibrio vulnificus.*

Data Availability:
Upon request.

Data Users:
NJDEP Division of Water Monitoring & Standards (DWMS) and US Food Drug Administration (FDA)

Legislative/Regulatory Mandates:
US Food Drug Administration (FDA)

Program Website:
 https://www.state.nj.us/dep/bmw/nssphome.html

Estuary and Ocean: Coastal Phytoplankton Monitoring Network and Aircraft Remote Sensing

Purpose and Objectives:
The purpose of both the Coastal Phytoplankton Monitoring and Aircraft Remote Sensing Networks is to monitor for algal blooms and identify any Harmful Algal Bloom (HAB) biotoxin producing species that may pose a public health risk through shellfish consumption and/or primary contact. HABs represent a small subset of phytoplankton species that negatively affect human, animal, and ecosystem health, by production of biotoxins. Other algal blooms may impact ecosystem health, by secondary factors, such as reducing dissolved oxygen concentrations or altering the pH of the water. As part of the State's compliance with the National Shellfish Sanitation Program's "Guide for the Control of Molluscan Shellfish Model Ordinance" (NSSP Guide) and N.J.A.C. 7:12, New Jersey is required to develop a Biotoxin Contingency Plan that includes control measures for marine biotoxins to address outbreaks of shellfish related illnesses.
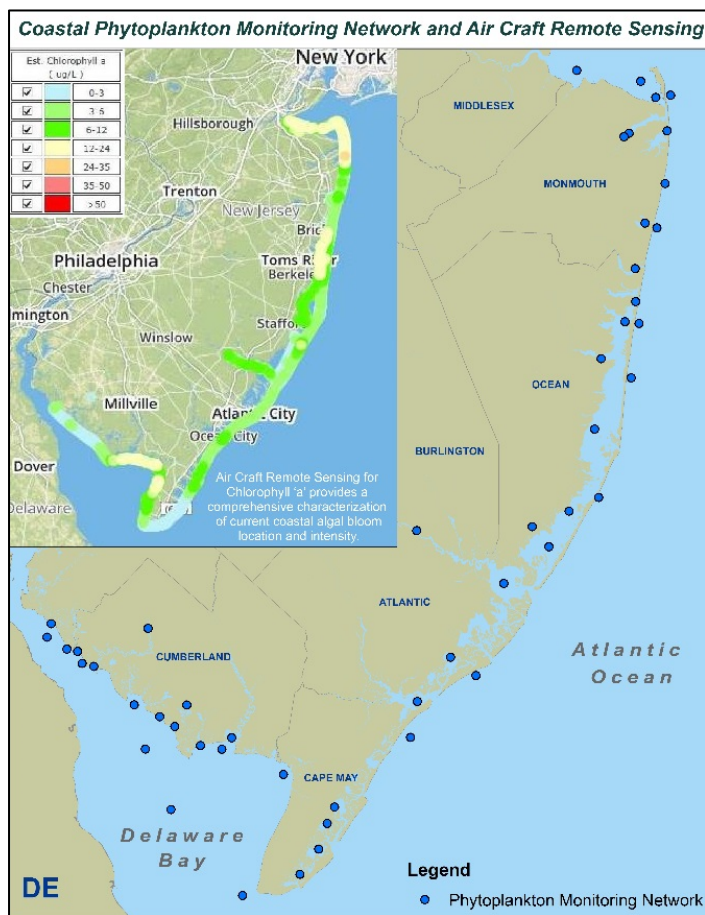
Program Description and Design:
Routine water samples are collected year-round at approximately 45 stations in coastal waters (see adjacent map). Remote sensing flights occur 6 days per week during the summer from Memorial Day through September, and once a week in April, May, September, and October, and November (weather permitting). Since chlorophyll is a plant pigment, high levels of chlorophyll in the water are typically associated with an algal bloom. To detect potential blooms, an airplane equipped with a remote sensor produces estimated chlorophyll-*a* concentrations that are made available for viewing through an interactive map (see an example on the map insert). Developing algal blooms are monitored through this tool and BMWM will strategically deploy field staff to locations of concern. In these situations, water samples are collected and brought back to the laboratory for

 HAB analysis. If any biotoxins are found in bloom conditions, then BMWM follows the protocols in the Biotoxin Contingency Plan.

Aircraft remote sensing flight plans were adapted in 2019 to include surveys of several inland lakes to help target the location of potential

HABs and understand the spatial extent of identified blooms. At the time of writing, lakes surveyed are Round Valley and Spruce Run Reservoirs, Budd Lake, Lake Musconetcong, Lake Hopatcong, Lake Mohawk, Greenwood Lake, and Swartswood Lake.

Parameters Analyzed:
Water column chlorophyll-*a* and phytoplankton species identification and quantification.

Data Availability:
National Water Monitoring Council's Water Quality Portal and BMWM's website.

Data Users:
NJDEP: Division of Water Monitoring & Standards (DWMS), Division of Water Quality (DWQ), Division of Science and Research (DSR), Division of Parks and Forestry

United States Environmental Protection Agency (USEPA), county health departments, academia, and the public

Legislative/Regulatory Mandates:
FDA and Federal Beach Act

Program Website:
Coastal Phytoplankton Monitoring: www.nj.gov/dep/bmw/phytoplankton.htm
Aircraft Remote Sensing: http://njdep.rutgers.edu/aircraft/

Estuary & Ocean: Cooperative Coastal Monitoring Program (CCMP)

Purpose and Objectives:
The Cooperative Coastal Monitoring Program (CCMP), also known as New Jersey's Beach Water Quality Monitoring and Notification Program, assesses nearshore coastal water quality, investigates sources of water pollution, and enables the New Jersey Department of Environmental Protection (DEP) and local health agencies to respond and alert the public to immediate health concerns arising from pollution in coastal recreational areas.

Program Description and Design:
Water quality monitoring at New Jersey's beaches has been performed through the Cooperative Coastal Monitoring Program (CCMP) since 1974. In October of 2000, the Beaches Environmental Assessment and Coastal Health Act (BEACH Act) was signed into law, amending the Clean Water Act. The BEACH Act required EPA to develop performance criteria for testing, monitoring, and notifying public users of possible coastal recreation water problems. EPA awards BEACH Act grants to fund the implementation of beach monitoring and notification programs to protect beachgoers from poor water quality at coastal beaches. The program is administered by the DEP with the participation of the New Jersey Department of Health and local environmental health agencies. All water quality analysis is conducted by DEP certified laboratories, and results are available within 24 hours of sampling.

Cooperative Coastal Monitoring Program (CCMP)
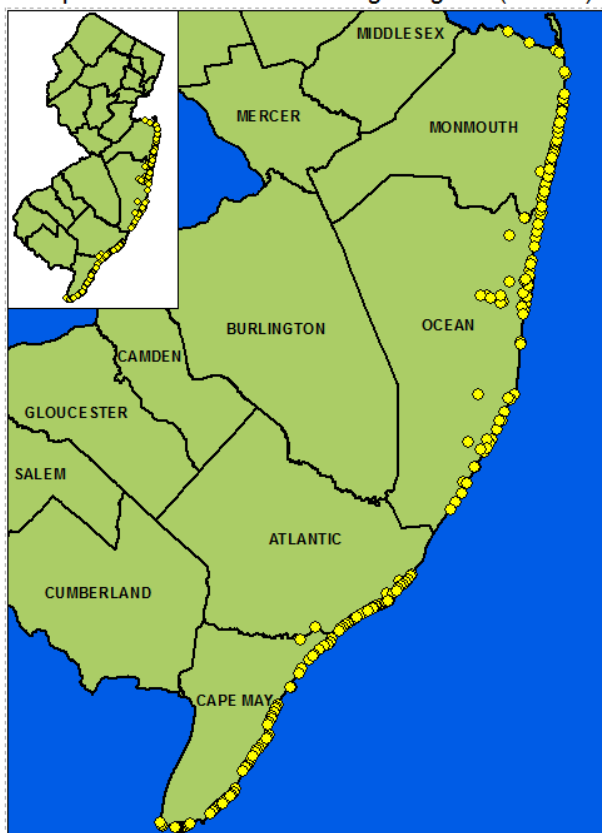
As one component of New Jersey's CCMP, bathing beaches are sampled for fecal indicator bacteria weekly starting two weeks prior to a beach opening for swimming (generally mid-May for ocean beaches) and continues until the beach closes for the season. Fecal waste from humans and animals may contain microorganisms that can cause illness if accidentally ingested during bathing or water sport activities. The primary recreation standard found in the New Jersey State Sanitary Code requires that the concentration of the fecal indicator bacteria, *Enterococci,* not exceed 104 colony forming units per 100 milliliters of sample. The presence of fecal indicator bacteria does not by itself indicate that disease-causing organisms are present; it does indicate that fecal waste has impacted water quality to some degree, and that disease-causing organisms could be present. Samples that are above this water quality standard indicate water that presents an increased risk of illness. Swimming in or contact with water containing elevated levels of fecal indicator bacteria may cause gastrointestinal symptoms such as nausea, vomiting, diarrhea, and abdominal pain, respiratory symptoms like sore throat, cough, runny nose, and sneezing, eye and ear symptoms including irritation, earache, and itchiness,

dermatological symptoms like skin rash and itching, and flu-like symptoms such as fever and chills. These symptoms are minor most of the time, but can occasionally be more serious, especially for individuals more susceptible to illness, such as children and the elderly.

New Jersey has more than 600 public recreational lifeguarded bathing beaches. The CCMP monitors about 188 primary ocean stations and 26 primary bay/river stations weekly during the recreational bathing season for water quality. Primary stations are bracketed with additional monitoring stations in the event a primary station exceeds the primary recreation standard. Generally, around 4,000 water quality samples are collected each beach season. Ocean sampling stations are selected in areas that are close to potential pollution sources, such as stormwater outfalls, inlets, and coastal lake discharges. By selecting monitoring locations at beaches with nearby potential sources of contamination, New Jersey is taking a conservative approach in selecting beaches most susceptible to degraded water quality. In areas where there are no potential pollution sources, monitoring stations are selected to represent water quality at several adjacent beaches. All recreational bay and river beaches are monitored due to their non-contiguous locations. The locations of monitoring stations are reviewed annually but remain relatively constant.

NJ Coast at Seaside Heights (photo by Steve Jacobus, NJDEP)

Advisories

Any initial sample that exceeds the primary recreation standard requires that the county or local health agency issue a swimming advisory at the bathing beach where the sample was collected. During beach advisories, the county or local health agency must post a "Swimming Advisory" sign at the beach to warn the public of potentially unhealthy water conditions due to elevated bacteria. The advisory is also posted on the Department's website: www.njbeaches.org. Following an initial exceedance, resamples of the primary station and a bracket station on both sides are conducted until water quality results are within the primary recreation standard. In addition, sanitary surveys are performed by certified health inspectors after every exceedance to identify possible pollution sources and observe water and shoreline conditions.

Bacteria Exceedance Closings

Beaches are closed to bathing if two consecutive samples collected at a bathing beach exceed the standard. The second consecutive exceedance may be from resamples at the primary station or bracket stations on either side of the primary station. Samples at bracket stations are also used to determine the spatial extent of the elevated bacterial concentration. During beach closings, the local health agency must post a "No Swimming" sign at the beach. Beach closings remain in effect until subsequent sampling of primary and bracket stations indicate bacteria levels are all within the primary recreation standard. Beach conditions, advisories, closings, and the reasons for beach closings are updated daily during the beach season on the Department's website at: www.njbeaches.org.

<u>Aerial Surveillance</u>
As part of the CCMP, the DEP also conducts coastal surveillance flights six days a week during the beach season, weather permitting, to get a visual assessment of coastal water and beach conditions. This aerial surveillance of the coast and bathing beaches allows the DEP to determine the extent of potential hazards such as floatable debris, sewer line breaks, or fish kills. In addition, the aircraft is equipped with chlorophyll-a sensors that provide the DEP with information on chlorophyll levels in coastal waters and allow the early detection of potential algal blooms. Coastal surveillance flights can be found at: https://njbeaches.org/daily_flights/.

Type of Samples Collected:
Water Column (enterococci)

Data Availability:
CCMP website, EPA's STORET Data Warehouse, National Water Quality Portal, Rutgers University.

Data Users:
NJDEP (DMWS, DWQ, DSR), USEPA, academia, and the public

Legislative/Regulatory Mandates:
Federal BEACH Act

Program Website:
 www.njbeaches.org

Estuary & Ocean: Nonpoint Source Tracking

Purpose and Objectives:
The Nonpoint Source (NPS) Tracking program targets degraded coastal areas due to nonpoint source pollution, specifically those areas in need of water quality remediation. Nonpoint source pollution is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, depositing them into lakes, rivers, wetlands, and coastal waters. NPS tracking is intricately tied to both shellfish growing waters through the U.S. Food and Drug Administration's National Shellfish Sanitation Program (NSSP) and beaches through the Cooperative Coastal Monitoring Program (CCMP). It is also used for obtaining data/information needed in the development of the Integrated Report and responding to reported incidents.

When routine NSSP monitoring indicates a decline in water quality, a NPS network may be developed to identify the pollutant source impacting the shellfish growing area in order to prevent downgrades in shellfish classification and to assure that molluscan shellfish harvested from New Jersey waters are safe for consumption.

When routine monitoring through the CCMP indicates a decline in water quality, a NPS network may be developed to identify the pollutant source impacting the recreational bathing beach to prevent closures due to bacteria or floatables and to assure public health is protected from exposure to potentially contaminated water at public bathing beaches.

A NPS network may also be developed in response to the Integrated Report when sufficient information is not available to assess the support of a designated use for a waterbody. Areas are placed on a list of impaired waterbodies when they do not support the applicable designated use (aquatic life, recreation, drinking water, fish consumption, or shellfish consumption). A NPS network may be developed to identify the pollutant source to help avoid the waterbody being placed on the impaired waterbodies list or in an effort to delist a waterbody.

Program Description and Design:
In general, the BMWM's NPS program identifies areas impacted by pollutant sources from: 1) routine monitoring data generated by the NSSP and CCMP monitoring networks; 2) the Integrated Water Quality Assessment Report; and 3) reported incidents (*e.g.* emergency hotline calls). Once an impaired area is identified, existing data and information is researched, reviewed, and analyzed to identify gaps and develop targeted monitoring studies and sanitary surveys. Internal and external partnerships are formed to improve communication, create ownership, and ensure all stakeholders are working toward the same goal of improving water quality while leveraging services and funding sources. The Department works with stakeholders to identify optimal solutions. Projects are prioritized, implemented, and constructed to improve water quality. Follow-up monitoring is performed to confirm that the source was mitigated and to ensure the continuation of long-term operation and maintenance. The design of any specific source tracking effort will depend on the specifics of the project, such as extent and significance of impact, and type of impairment being addressed (*e.g.* stormwater, septic, or agriculture).

Type of Samples Collected:
Water Column (Dissolved Oxygen, Temperature, Specific Conductance, pH, Turbidity), Nutrients (Total Phosphorus, Total Nitrogen, Nitrate-Nitrite), Pathogens (Fecal coliform, *Enterococci*, and phage), Antibiotic Resistance Analysis (ARA), and Human Bacteroides.

Data Availability:
Upon Request

Data Users:
NJDEP (DWMS), academia, and the public

Legislative/Regulatory Mandates:
Federal Clean Water Act, USEPA Beach Act, US Food & Drug Administration (FDA)

Program Website:
https://www.nj.gov/dep/wms/bmw/pollutiontracking.html

Estuary & Ocean: Coastal Water Quality Network / National Coastal Condition Assessment

Purpose and Objectives:
The Coastal Water Quality Network (CWQN) was created to comply with a US Environmental Protection Agency (EPA) mandate to satisfy US Food and Drug Administration (FDA) requirements. The CWQN's goal is to assess nutrient and water quality conditions within New Jersey's marine waters to better understand the dynamics of anthropogenic and natural ecological impacts on water quality. Data generated from this network supplement practical policy decision making to address coastal water quality problems.

The National Coastal Condition Assessment (NCCA) is a federally-funded program managed by EPA to assess the ecological condition of the nation's estuarine resources. The Department collects samples for EPA to be analyzed for water chemistry, sediment chemistry/toxics, fish tissue contaminants, and benthic diversity. Data results are used by EPA for National Assessments, and by the Department to find impaired areas.
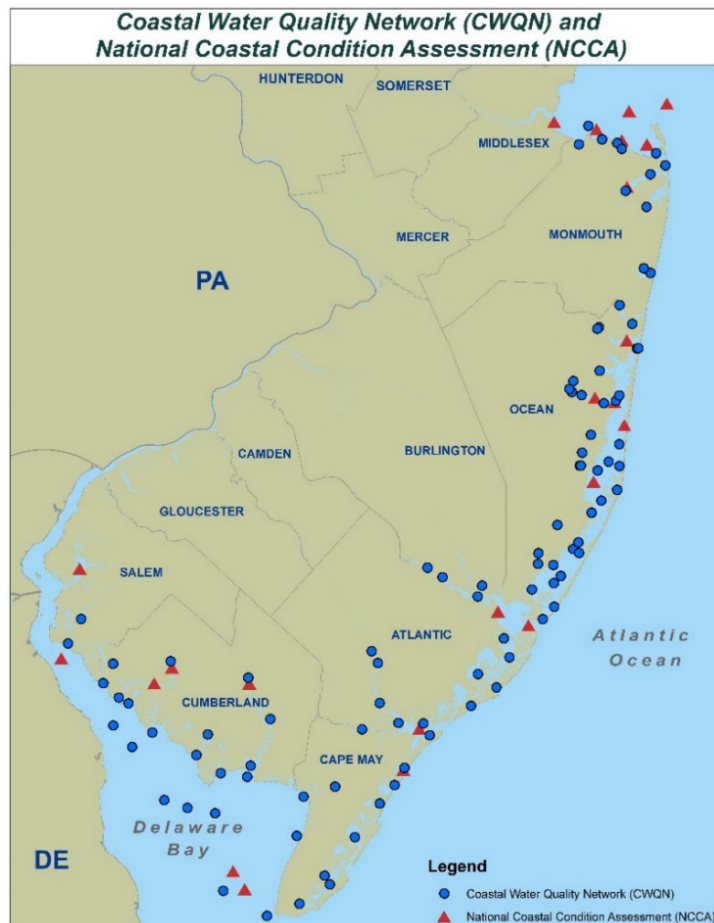
Program Description and Design:
CWQN and NCCA are both probabilistic sampling design approaches to ensure that as many marine waters as possible have representation within the state. Thirty-three (33) sites are visited monthly over a two-year period for CWQN. After the two-year period, 40 new sites are chosen.

NCCA has approximately 25 sites that are visited every 5 years. The NCCA sampling will occur again in 2025.

Parameters Analyzed:
Dissolved Oxygen, Temperature, Specific Conductance, Salinity, pH, Turbidity, Alkalinity Nutrients (Total Phosphorus, Total Nitrogen, Nitrate-Nitrite, Orthophosphate, ammonia, organic carbon), and Biological (Chlorophyll-*a*, Enterococcus, Biogenic Silica), Benthic Community, Sediment, and Fish Tissue chemical contaminants.

Data Availability:
EPA STORET Data Warehouse, National Water Quality Portal, NWIS, Water Quality Data Exchange System

Data Users:
NJDEP, EPA, academia, and the public

Legislative/Regulatory Mandates:
Federal Clean Water Act

Program Website: www.nj.gov/dep/wms/bmw/coastalwaterquality.htm

Estuary: Continuous Data Program (Buoys)

Purpose and Objectives:
The Continuous Data Program (Buoys) complies with the mandate established by the Federal Clean Water Act, to satisfy U.S. Food and Drug Administration (FDA) requirements, and to assist with Phase One and Phase Two of the Barnegat Bay Long-Term Monitoring Program. The primary goal of this program is to collect continuous water quality data to enhance the Department's ability to assess water quality and to deliver near real-time water quality information to the public. The water quality data provided by this program aids in explaining the changes in water quality through time and helps in model development. Data and their assessment results help lead to practical policy and decision making to address coastal water quality problems.

Program Description and Design:
Deployment of eight real-time water quality buoys from April through October, that collect water quality data in 15-minute intervals. Data logs are received each hour at the laboratory and are posted to the continuous monitoring website.

Type of Samples Collected:
Water Column: Dissolved Oxygen, Temperature, Specific Conductance, Salinity, pH, Turbidity, and Chlorophyll-*a*.

Data Availability: Program website, Rutgers University

Data Users:
NJDEP (DWMS, DSR) USEPA, USGS, academia, fishers and anglers, and the public

Legislative/Regulatory Mandates:
US Food Drug Administration (FDA), EPA Clean Water Act

Real-Time Continuous Data Program (Buoys)

Program Website: http://njdep.rutgers.edu/continuous/
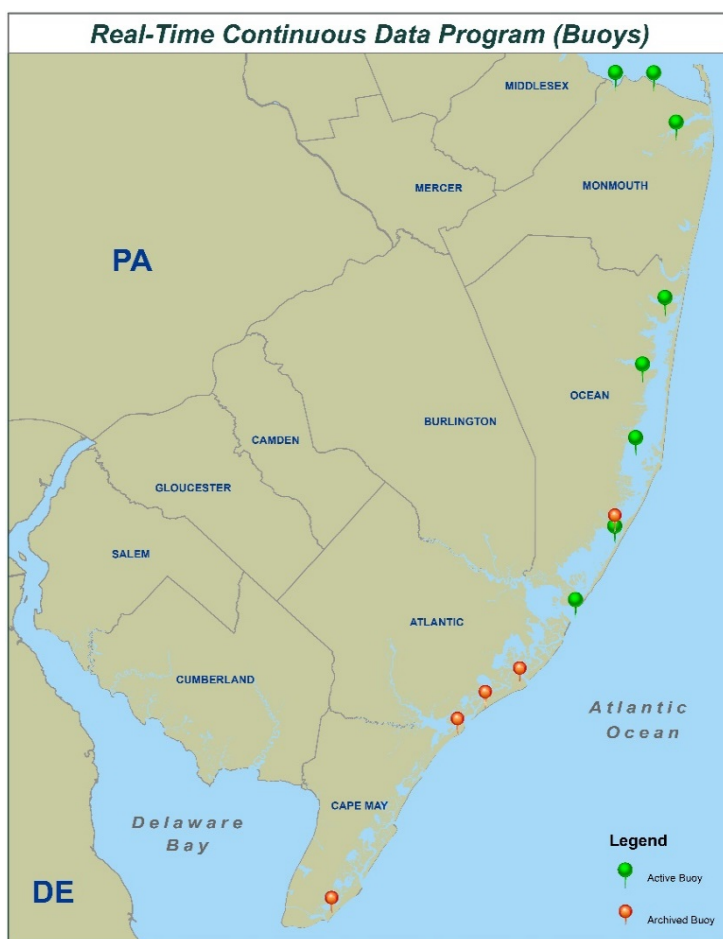
Ocean: Benthic Indicator & Slocum Glider Program

Purpose and Objectives:
Data from the Slocum Glider support development of new Dissolved Oxygen (DO) criteria based on duration and spatial extent of low DO. Data also inform NJDEP's Integrated Report. Currently, NJ ocean waters are listed as impaired for DO.

The data also help evaluate whether chemical and biological ocean impairments coincide by using an Ocean Benthic Index.

This program improves understanding of monthly stratification of ocean waters and its effect on DO. This temperature data is shared with Rutgers University and National Oceanic and Atmospheric Administration (NOAA) hurricane forecasters for tropical storm intensity forecasts.

Program Description and Design:
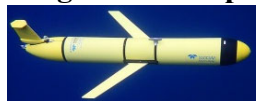
Slocum Gliders are autonomous underwater vehicles fitted with sensors for measurement of chlorophyll-*a*, DO, salinity, and temperature. NJDEP's glider is typically deployed for 2-3 weeks at a time for 3 separate missions between March and November. Data is collected at 0.25-meter depth increments which creates a three-dimensional profile of ocean conditions.

Ocean benthic sampling is performed at a total of 50 locations. Forty of these locations are selected based on a probabilistic sampling strategy, while the remaining 10 are sites that are fixed station revisits. This network is used to assess the biological health of New Jersey's Atlantic Ocean waters upon finalization of a benthic metric.

Parameters Analyzed: Water Column (DO, Temperature, Specific Conductance, pH, Turbidity), Sediment, and Macroinvertebrates.

Data Availability: Benthic data is available upon request from BMWM; glider data is available on the BMWM website (see below).

Data Users: NJDEP Division of Water Monitoring and Standards (DWMS), NOAA, academia and the public

Legislative/Regulatory Mandates: Federal Clean Water Act

Program Website: www.nj.gov/dep/wms/bmw/glider.html

Estuary Network

DWMS / Interstate Environmental Commission Harbor Estuary Monitoring Network

Purpose and Objectives:
DWMS and the Interstate Environmental Commission (IEC) partnered to develop Harbor Monitoring Network and implement that network annually beginning in spring 2021. In the first year, IEC will monitor the concentration of bacteria and nutrients in the NJ portion of the NY/NJ Harbor Estuary. In subsequent years the network may be expanded to include continuous monitoring and contaminants of emerging concern however, year 1 will remain the baseline.

The purpose of the Harbor Estuary Monitoring Network is to collect data to investigate current water quality conditions in waters which were downgraded by the NJDEP from the surface water classification SE1, to SE2 and SE3 in 1985 as part of a Use Attainability Analysis and determine if any classification upgrades are now warranted. Additionally, DWMS wants to obtain preliminary water quality data that will inform the design of future water

NJDEP/IEC Harbor Monitoring Network
Proposed Discrete Monitoring Locations

quality monitoring related to Harbor CSOs and NJDPES permitted discharges that DEP will use to:

- Revisit the calibration of the Harbor Eutrophication Model, and
- Validate the Pathogen Model developed for the Harbor.

Program Description and Design:
This network is a cooperative effort (design and sampling) between DWMS Monitoring and the IEC. The network consists of 23 sites located in fresh and saline waters of the harbor estuary. DEP identified discrete monitoring locations at access points (bridges, piers, etc.) in Integrated Report Assessment Units (AUs, aka 14-digit Hydrologic Unit Codes or HUC14s) lacking monitoring results, at locations previously monitored by NJDEP, the US Geological Survey (USGS), the NJ Harbor Dischargers Group, locations used for modeling studies, and in areas with SE2 and SE3 waters.

Type of Samples Collected:
Field Measurements (DO, DO sat., pH, salinity, secchi disk, temperature, chlorophyll a), Bacteria (fecal coliform, enterococcus, and E. coli), Nutrients and Inorganics (chlorophyll a, Ammonia as N, Total Nitrogen as N, Nitrite + Nitrate, Total phosporus, Turbidity).

Data Availability:
National Water Quality Portal

Data Users:
NJDEP (DWMS, DWQ, SRP, DWSG), NJ Harbor Dischargers Group, EPA, USGS, IEC, NY/NJ HEP, academia, watershed associations, the public

Legislative/Regulatory Mandates:
Federal Clean Water Act, NJ Watershed Protection and Management Act, NJ Water Quality Planning Act

Program Website:
Pending

Ground Water

Ambient Ground Water Quality Monitoring Network (AGWQMN)

Purpose and Objectives:
The first Ambient Ground Water Monitoring Network was established by NJDEP and USGS in 1983. The original network was designed to determine the concentration range of chemical constituents as a function of rock type. Having addressed that goal, the network was redesigned in 1998 to address the federal Clean Water Act and the mandate set forth by the 106 Water Grant that States monitor the quality of their ambient waters. The Ambient Ground Water Quality Monitoring Network is part of the State of New Jersey's strategy to cover all waters of the State, with this particular network focusing on ground-water quality. The use of this network allows for the determination of ground water quality status and trends to aid in managing and protecting the States ground-water resources, and provides publicly accessible ground water quality data.
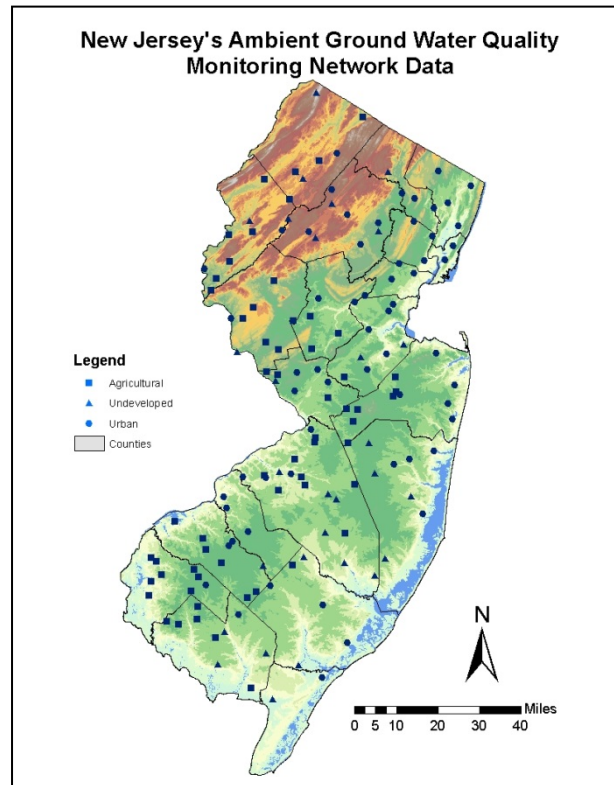
The goals/objectives of the Ambient Ground Water Quality Monitoring Network are to:
- Assess ground-water quality status
- Assess ground-water quality trends
- Evaluate contaminant sources (e.g. natural, anthropogenic)
- Identify emerging ground-water quality issues by land use
- Define ground-water quality by land use
- Determine potential ground-water impacts on surface water quality
- Assess emerging contaminants' impact on shallow ambient ground water

Program Description and Design:
The AGWQMN is a cooperative project between the NJDEP's New Jersey Geological & Water Survey, NJDEP's Bureau of Freshwater and Biological Monitoring and the United States Geological Survey and is comprised of 150 monitoring wells distributed Statewide that provides information about land-use-related non-point source contaminant effects on shallow-ground-water quality. Well sites were located using a stratified-random site selection with 60 wells in agricultural areas, 60 in urban/suburban areas and 30 in undeveloped areas (background wells). Network wells are screened, or open, just below the water table and the samples collected generally represent relatively young ground water. Monitoring wells were originally sampled on a 5-year cycle (30 wells per year). In 2014 the network design was modified to move from a 5-year cycle to a 3-year cycle (50 wells per year).

- Sampling Set 1 (1ˢᵗ year of the sampling cycle) sampling is in the Coastal Plain Physiographic Province (Southern NJ).
- Sampling Set 2 (2ⁿᵈ year of the sampling cycle) sampling is in the Coastal Plain and Piedmont Physiographic Provinces (South and Central NJ).
- Sampling Set 3 (3ʳᵈ year of the sampling cycle) sampling is in the Piedmont, Highlands, and Valley and Ridge Physiographic Provinces (Central and North NJ).

Parameters Analyzed:
Nutrients, DOC, trace elements, major ions, pesticides, volatile organic compounds, and radionuclides. In 2020 twenty-eight (28) PFAS compounds were included to the parameter analysis list. Included in the PFAS analysis is the collection of equipment blanks at 100% of the sampling sites. By the end of the year in 2022, all 150 network monitoring wells will have been sampled for PFAS. In addition, as part of a limited study, six (6) AGWQMN wells additional samples for mercury isotope analysis will be obtained.

Data Availability:
USGS website, NJDEP

Data Users:
NJDEP (DWMS, DSR, Site Remediation Program), USEPA, USGS, academia, and the public

Legislative/Regulatory Mandates:
Federal Clean Water Act, NJ Water Quality Planning Act, National Ground Water Monitoring Network

Program Website:
https://www.state.nj.us/dep/wms//bfbm/groundwater.html

Wetlands Networks

The New Jersey Department of Environmental Protection's wetland program is spread out across many Divisions within the Department, with the Divisions of Sciences and Research and Parks and Forestry acting as co-leads. New Jersey has taken a multi-faceted and comprehensive approach to monitoring, assessment, management, and protection of freshwater and coastal wetlands. The goals and activities of the wetland program are detailed in the NJ Wetland Program Plan (Plan) written by the Department and its partners for the USEPA. The current version of the Plan covers 2019 to 2022[5].   The steps outlined will serve to direct current and future wetland protection and management efforts along a coordinated path to the benefit of New Jersey's wetland resources and the quality of life for future generations. Goals and actions are grouped into six core elements:1) Monitoring and Assessment 2) Regulation 3) Voluntary Wetland Restoration, Creation, Enhancement and Protection and Improved Coastal Shoreline Resiliency 4) Wetlands Water Quality Standards 5) Adaptation, Resilience and Mitigation in a Changing Climate, and 6) Public Outreach and Education. The Monitoring and Assessment core element provides the critical underpinning of the other five core elements.

NJDEP wetland scientists and partners participate in four wetland monitoring and assessment networks:
1) National Wetland Condition Assessment (NWCA)
2) New Jersey Statewide Wetland Monitoring and Assessment Network (NJWETMAN)
3) New Jersey Tidal Wetlands Monitoring Network (NJTWMN)
4) The Mid Atlantic Coastal Wetland Assessment (MACWA)

Wetlands: NJ Participation in EPA National Aquatic Resources Surveys (NARS) - National Wetland Condition Assessment (NWCA)

Purpose and Objectives:
The USEPA National Aquatic Resources Surveys (NARS) National Wetland Condition Assessment (NWCA)[6] is a collaborative survey of our Nation's wetlands that examines the chemical, physical and biological integrity of wetlands through a set of commonly used and widely accepted indicators. The NWCA is a probabilistic statistical survey designed to answer basic questions about the extent to which our nation's wetlands support healthy ecological conditions and the prevalence of key stressors at the national and regional scale. It is intended to complement and build upon the achievements of the U.S. Fish and Wildlife Service Wetland Status and Trends Program, which characterizes changes in wetland acreage across the conterminous United States. Paired together, these two efforts provide government agencies, wetland scientists, and the public with comparable, scientifically defensible information documenting the current status and, ultimately, trends in both wetland quantity and quality (ecological condition).
The NWCA is a federally funded program managed by the USEPA. DEP conducts field surveys and collects data and samples from NJ sites for analysis by the USEPA. Results are used by the

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[5] https://www.epa.gov/sites/production/files/2019-05/documents/njdep_wpp_2019-2022_20mar2019.pdf

[6] https://www.epa.gov/national-aquatic-resource-surveys/nwca

USEPA for national status and trends reporting; DEP includes the NWCA data in its statewide wetland monitoring and assessment network.

Program Description and Design:
The National Wetland Condition Assessment (NWCA) started in 2011 and takes place every five years. The sampling design[7] for the NWCA is a probability-based network that provides statistically-valid estimates of ecological condition for a population of wetlands with known confidence. Sample points are selected at random to represent the condition of wetlands across the country by aggregated ecoregions and NWCA survey design groups by subregion. In NJ, the aggregated ecoregions included Coastal Plain (CP), Eastern Mountains and Upper Midwest (EM), and the survey design groups included Estuarine, Palustrine, Riverine and Lacustrine with herbaceous and woody wetland types within each group.

In New Jersey the 2011 NWCA included a total of 18 GRTS survey sites, including 14 coastal wetlands and 4 freshwater wetlands. In the 2016 NWCA a total of 14 sites were sampled in NJ, 5 in coastal wetlands and 9 in freshwater wetlands. Six additional hand-selected near-pristine EPA Reference Standard wetland sites were sampled (three each in 2011 and 2016) in one tidal marsh and five freshwater forested wetlands sites. The 2021 NWCA will include 12 GRTS survey sites in NJ and 5 reference standard tidal wetland sites chosen for the EPA. This represents a grand total of 44 GRTS survey sites plus 11 Reference Standard wetland sites for NWCA surveys in NJ. The national map of 2011 NWCA sites represents wetland condition along a disturbance gradient; the NJ map represents the 32 sites in NWCA 2011 and 2016 surveys plus 6 reference standard sites.

NWCA Aggregated Ecoregions
- Coastal Plains (CPL)
- Eastern Mountains and Upper Midwest (EMU)
- Interior Plains (IPL)
- West (W)

Disturbance Classes
- Least Disturbed (L)
- Intermediate Disturbed (I)
- Most Disturbed (M)

Map of New Jersey's 2011 and 2016 NWCA GRTS and Reference Survey Sites by Aggregated Ecoregions

NJDEP 2020
Parks & Forestry
Natural Heritage Program

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[7] https://www.epa.gov/national-aquatic-resource-surveys/national-wetland-condition-assessment-2011-technical-report

Type of Samples Collected:
The NWCA field teams collect data to characterize biological, chemical, and physical features of each site. Vegetation, soil, hydrology, water chemistry, algae, and buffer characteristics were chosen for evaluation based on their utility in reflecting ecological condition of wetlands or key indicators of stress that may influence condition across broad national and regional scales. Data for each of these indicator groups were obtained from field observations, field samples collected at wetland sites, and laboratory analyses of field samples. All sample metrics are detailed in the NWCA 2011 Technical Report[8] and in the NARS data portal.[9]

Data Availability:
EPA STORET Data Warehouse, National Water Quality Portal

Data Users:
NJDEP Divisions of Science and Research, Water Monitoring and Standards; NJ Tidal Wetland Monitoring Network, academia and the public

Legislative/Regulatory Mandates:
Federal Clean Water Act

Program Website:
https://www.epa.gov/national-aquatic-resource-surveys/nwca

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[8] https://www.epa.gov/sites/production/files/2016-09/documents/nwca_2011_technical_report_-_final_-_may_2016_ver2.pdf

[9] https://www.epa.gov/national-aquatic-resource-surveys/data-national-aquatic-resource-surveys

Wetlands*:* New Jersey Statewide Wetland Monitoring and Assessment Network (NJWETMAN)

Purpose and Objectives:

The purpose of the New Jersey Statewide Wetland Monitoring and Assessment Network (NJWETMAN) is to evaluate ecological condition of freshwater and tidal wetlands in order to preserve the important functions that wetlands provide including surface-water and ground-water quality, flood control, coastal storm surge detention, nutrient transformation, sediment and particulate retention, shoreline stabilization, and provision of plant and wildlife habitat (fish, shellfish, amphibian, waterfowl, shorebird and other wildlife). This goal is described in the Monitoring and Assessment section of the New Jersey Wetland Program Plan (WPP)[10], a guidance document developed by the NJDEP for the EPA.

NJ Statewide Wetland Monitoring and Assessment Network (NJWETMAN) Freshwater & Tidal Sites by HUC8 Watershed

NJDEP 2020
Parks & Forestry
Natural Heritage Program

The objectives of the NJWETMAN are to:

1. Develop a reference gradient network of wetland monitoring sites using a 3-tier approach and testing innovative new wetland condition assessment protocols.
2. Conduct sampling and data analysis utilizing a statistically valid population sampling method in order to develop status and trends reports on wetland condition by wetland type at statewide, ecoregion, and watershed scales.
3. Identify a set of reference standard (best condition) network of wetland monitoring sites by wetland type and by watersheds in NJ to guide wetland restoration.
4. Implement a sustainable monitoring program consistent with the wetlands monitoring strategy in the NJ Wetland Program Plan.
5. Incorporate wetland monitoring data into agency decision-making as needed, i.e. wetland water quality standards.

Program Description and Design:

The NJDEP has been engaged in wetland monitoring and assessment for more than four decades. Mapping of tidal wetlands was completed for the first time in the 1970's, and freshwater wetlands were first mapped in the 1980's. Since 1986 the State has classified land use/land cover and

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[10] https://www.epa.gov/sites/production/files/2019-05/documents/njdep_wpp_2019-2022_20mar2019.pdf

produced maps based on aerial photography; the most recent coverage is 2015. These map products are available as GIS downloads and interactive mapping online and have allowed the State to evaluate changes in land use and wetlands by acreage and class over time. Finer scale wetland mapping efforts by the NJDEP Regulatory Program began in 2014. Since 1996, EPA Wetland Program Development Grants have been utilized by the NJDEP to conduct inventory, classification, mapping, condition assessment, and baseline monitoring for rare freshwater and coastal wetland types throughout the State. Additional research has been conducted since 2000 to develop a wetlands mitigation rapid assessment tool, a wetland quality and function assessment tool, wetlands biological indicators for forested riparian wetlands in the Highlands and a statewide ecological integrity assessment protocol. A statistically valid (GRTS) baseline statewide wetland condition assessment was conducted at hundreds of sites in freshwater and coastal wetlands in all HUC8 watersheds between 2012-2016. This EPA Wetland Program Development Grant (WPDG) intensification study, testing NatureServe's Ecological Integrity Assessment protocol, was completed in 2018. While all wetlands are valued under State law regardless of value and function, these assessment tools will help evaluate condition of wetlands at various scales as well as set restoration targets.

The baseline reference gradient monitoring and assessment wetland sites in the NJWETMAN Network include 884 wetland plots in freshwater and tidally influenced sites statewide. The network includes data from 171 tidal and 713 freshwater wetlands. Of the 884 wetland plots approximately 100 are considered reference standard, or highest quality, wetlands. These data can be used to set restoration targets by wetland type.

Type of Samples Collected:
GIS Landscape Land Use Index and Buffer Condition, Wetland classification (NWI, USNVC, HGM), Human Stressor Index, Floristic Quality Index. Field metrics: vegetation (strata, species percent cover, floristic composition/diversity, native/non-native species, regeneration, unvegetated surface, woody debris), soils (profile, drainage, texture, chroma, hue, hydric indicators, pH), hydrology (water source, hydroperiod, hydrologic connectivity), size (patch type, comparative area), water quality (pH, conductivity, salinity).

In NJ, the NJWETCAM reference gradient network sites were used to test and modify the NatureServe Ecological Integrity Assessment Protocol[11] which including the following rank factors:
- Rank Factor: Landscape Context (GIS analysis and field assessment)
  - Major Ecological Factors: Landscape, Buffer
- Rank Factor: Condition (Field metrics)
  - Major Ecological Factors: Vegetation, Hydrology, Soils
- Rank Factor: Size (GIS and aerial photo imagery analysis, field mapping)
  - Major Ecological Factor: Relative Size
- Human Stressor Index (Field metrics)
- Floristic Quality Index (Field metrics)

Data Availability:

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[11] https://www.natureserve.org/conservation-tools/projects/ecological-integrity-assessment-wetlands

Wetland vegetation plot data is posted on VegBank, a national database of the Ecological Society of America's Panel on Vegetation Classification, and in EcoObs, a database developed by NatureServe and housed in the NJDEP's Division of Parks & Forestry, Natural Heritage Program. Tidal wetland data will be posted on the Riparia NJ tidal wetlands database in 2021.

Data Users:
NJDEP Divisions of Science and Research, Watershed and Land Resource Protection, Water Monitoring Standards, Coastal Resiliency; External Stakeholders: Rutgers University, Drexel University, National Estuary Programs, Mid-Atlantic Coastal Wetland Assessment Workgroup, educators and the public.

Legislative/Regulatory Mandates:
While baseline studies have been supported by EPA Region 2 Wetland Program Development Grant funding, essential long-term monitoring work has not been funded by Clean Water Act Section 106 or EPA Region 2 WPDG funds to date.

Program Website:
Website is currently under development.

Wetlands: The New Jersey Tidal Wetlands Monitoring Network (NJTWMN)

Purpose and Objectives:
The mission of the NJTWMN is to identify current conditions and trends of tidal wetlands in New Jersey to improve resilience of coastal communities and ecosystems by providing data to prioritize restoration efforts and support informed management decisions.

The goals are to support the stated mission by conducting monitoring following the same protocols; sharing data across platforms that all parties can access; identifying research needs across the region; and engaging the public around the importance of tidal wetlands in New Jersey. Initial agreed upon shared monitoring metrics include: surface elevation tables, feldspar marker horizons, Real Time Kinematic Global Positioning Systems (RTK-GPS) surveys and other relevant data as agreed upon by the members of the Network.

Division of Science and Research staff have chaired the Network as well as subcommittees between 2018 and 2020. The work undertaken by the Network helps DEP to meet goals listed in Core Element 1: Monitoring and Assessment of the Wetland Program Plan.

<u>Objectives</u>:
To meet the goal, the NJTWMN will seek to:
- Communicate openly and honestly with network members.
- Provide leadership in establishing and maintaining the shared goal.
- Identify specific research questions and data needs.
- Collect data that meets agreed upon QA/QC standards.
- Develop standardized agreements to share data across NJTWMN member organizations.
- Identify and seek funding to support projects, data storage needs, and file sharing.
- Meet participant's needs by regularly reviewing short- and long-term goals of the NJTWMN.

Program Description and Design:
The State of New Jersey has over 300,000 acres of tidal wetlands located in three separate providences along the coastline. Because coastal wetlands play a critical role in the ecological and historical heritage of the State, a convening meeting of natural resource partners conducting wetlands monitoring was held in December 2018 to discuss statewide tidal wetland monitoring and data sharing. The participants agreed to establish a group and named it the New Jersey Tidal Wetland Monitoring Network (NJTWMN). Representatives of organizations who conduct long-term tidal wetland monitoring in the State of New Jersey may join the NJTWMN at any time.

The Network is comprised of more than 221 long term tidal wetland monitoring stations in the state. The current members of the network are as follows: NJ Department of Environmental Protection, Division of Science and Research; Barnegat Bay Partnership; Cape May National Wildlife Refuge; Academy of Natural Sciences- Drexel University; Edwin B. Forsythe National Wildlife Refuge; Jacque Cousteau National Estuarine Research Reserve; Meadowlands Environmental Research Institute; National Park Service; Natural Resources Conservation Services; New Jersey Sports and Exposition Authority/ Meadowlands Environmental Research

Institute; NJ Department of Environmental Protection, Division of Land Use and Natural Heritage Program; NY/NJ Baykeeper; Partnership for the Delaware Estuary; Rutgers University; The Nature Conservancy; and The Wetlands Institute.

Type of Samples Collected:
Elevation (Surface Elevation Tables and RTK-GPS surveys), accretion (Marker Horizons), plants, animals, soils, water chemistry, etc.

Data Availability:
Currently only by request from individual organizations. A data sharing agreement among the partners is to be executed by the end of 2020.

Data Users:
NJDEP (DSR) and listed Network members above

Legislative/Regulatory Mandates:
Work is not funded by Clean Water Act Section 106 funds.

Program Website:
Website is currently under development using EPA WPDG.

Wetlands: The Mid Atlantic Coastal Wetland Assessment (MACWA)

Purpose and Objectives:

The MACWA is a 4-tier monitoring and assessment program envisioned to provide rigorous, comparable data across all tidal wetlands of the Mid Atlantic, especially those in the Delaware Estuary within Delaware, New Jersey, and Pennsylvania, as well as Barnegat Bay in New Jersey. It has become a platform through which research and monitoring is conducted and data are mined for various purposes.

NJDEP helps to fund MACWA monitoring, reporting, trainings, and meetings. Participating in MACWA helps DEP to meet goals listed in Core Element 1: Monitoring and Assessment of the Wetland Program Plan.

Program Description and Design:

In 2006, the Partnership for the Delaware Estuary (PDE) identified coastal wetlands status and trends as a top priority for understanding the overall environmental health of the watershed. Until then, information about coastal wetland condition and acreage was limited and not consistent among the three estuary states.

In 2007, PDE worked with the Delaware Department of Natural Resources and Environmental Control (DNREC) to design and begin to implement a multi-level program to assess the health and extent of coastal wetlands in a consistent manner across the Delaware Estuary. Then, in 2008, PDE along with the Barnegat Bay Partnership (BBP) expanded this program to areas outside the Delaware Estuary, referring to it as the Mid Atlantic Coastal Wetland Assessment (MACWA). MACWA supports a comprehensive assessment of coastal wetland condition across the Mid-Atlantic region. PDE, BBP, and partners such as the Academy of Natural Science of Drexel University, NJDEP, and Rutgers University have since worked to implement MACWA as a regional strategy, which is continuously updated and strengthened.

The programmatic structure of MACWA generally follows EPA national guidance:

1. Remote Sensing: landscape census surveys of extent and condition.
2. Ground Truthing: probabilistic on-the-ground sampling across the study region to assess condition and to ground-truth Tier 1 surveys.
3. Intensive Studies: studies to examine specific relationships among condition, function, and stressor impacts.
4. Station Monitoring: intensive monitoring of condition and function at a networked array of fixed stations.

Type of Samples Collected:
Elevation (Surface Elevation Tables and RTK-GPS surveys), Accretion (Marker Horizons), plants, animals, soils, water chemistry, etc.

Data Availability:
Currently only by request from individual organizations. A data sharing agreement among the partners should be executed by the end of 2020.

Data Users:
NJDEP (DSR), federal agencies, academia, and the public

Legislative/Regulatory Mandates:

Work is not funded by Clean Water Act Section 106 funds. Each organization procures funding to continue monitoring each year.

Program Website:
https://www.delawareestuary.org/science-and-research/wetlands/macwa-homepage/

QUALITY ASSURANCE/QUALITY CONTROL

DEP maintains a strong commitment to the collection and use of high-quality data to support environmental decisions and regulatory programs. As such, DEP 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.

As such, all environmental data collection performed or used by DEP must comply with and be accompanied by a signed Quality Assurance Program Plan (QAPP) approved by USEPA, USGS, the Delaware River Basin Commission (DRBC) or the DEP. A QAPP documents the planning, implementation, and assessment procedures for a project, as well as any specific quality assurance and quality control activities. It spells out all the technical and quality aspects of the project necessary for obtaining the type and quality of environmental data and information needed for a specific decision or use. Entities responsible for generating data are responsible for compiling the data, completing a detailed quality assurance review, and addressing questions regarding the data set.

The DEP 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 about the DEP's QAPP process is available on the Office of Quality Assurance's website at: https://www.nj.gov/dep/enforcement/oqa.html.
USEPA's QAPP guidance document is available at:
http://www2.epa.gov/sites/production/files/2015-06/documents/air_h20_qapp04.pdf. Additional information on specific QA/QC procedures for each particular type of waterbody monitoring can be found in the Quality Assurance Project Plans (QAPPs), which are available on each program's bureau websites.

DATA MANAGEMENT

DEP is committed to sharing and making available electronic data to both government agencies and the public. As detailed in the previous section, data made available to the public undergoes strict QA/QC (Quality Assurance / Quality Control) protocol processes to ensure data is of the highest quality for accurate assessment and analysis of NJ waters.

Data QA/QC Process:
NJ implements several methods for handling the QA/QC of data that range from automated record flagging to manual/visual inspection of data. The combination of QA/QC protocol depends on the type of data (spatial, discreet laboratory samples, and continuous) being collected.   The QA/QC process for spatial data begins by ensuring that all relevant spatial information such as station coordinates accurately reflect data sampling points. NJ metadata geospatial standards are also followed to make users aware of the exact content and quality of the spatial datasets being generated.

Once data samples are collected and analyzed, they are QA/QC'ed at the NJ certified laboratory performing the analysis. All NJ certified labs follow strict analysis guidelines that adhere to both state and federal regulations. Once analyzed, lab results are then entered into various data management systems depending on the program and laboratory responsible for that data. These data management systems help enforce a number of strategies to verify that there are no data entry mistakes. This is achieved through setting up programming logic that alerts users that basic rules and thresholds may have been exceeded. In addition, when applicable, manual review of data is also performed. Manual review of data may occur for both discreet and continuous data to determine if higher or lower expected results are associated with external variables such as rainfall, tides, droughts, etc. Once satisfied with the data set, data is prepared to be loaded into its respective data management system.

Data Storage and Availability:
NJ employs numerous systems for storing, managing, and making publicly available the data collected by the programs outlined in prior sections of this report. Discreet data compatible with EPA's Water Quality Exchange (WQX) schema is submitted to EPA's WQX database. Data submissions to the WQX database occur via a web-based application called WQX-Web as soon as data QA is complete. Depending on the program, some data is also publicly available through USGS's National Water Information System (NWIS). Data residing in WQX and NWIS are automatically loaded to the Water Quality Portal (WQP) through scheduled uploads. The Water Quality Portal (WQP) is a cooperative service sponsored by both EPA and U.S. Geological Survey's (USGS). This service provides a tool to download both WQX and NWIS data in a standardized format. In addition to WQP, DEP also utilizes continuous water quality data through a DWMS/Rutgers University-hosted continuous monitoring website.

All information is used by the Water Quality Assessment Program to generate Integrated Water Quality Assessment reports. This assessment information is provided to EPA in a compatible electronic format on a schedule concurrent with EPA's assessment cycle. Where appropriate, any GIS information generated from the 305(b), 303(d), and individual programs are made publicly available via website, GIS service, and interactive maps. Additionally, final assessment results

and TMDL information are loaded into the EPA ATTAINs database. ATTAINS supports various web-based applications and tools hosted on the EPA website to view information about local waterbodies.

Websites for these data storage and retrieval systems are as follows:

- EPA WQX: http://www.epa.gov/waterdata/water-quality-data-wqx#weboverview
- WQX Web: https://www.epa.gov/waterdata/water-quality-data-upload-wqx#wqxoverview
- USGS NWIS: http://waterdata.usgs.gov/nwis
- National Water Quality Portal: http://www.waterqualitydata.us/
- Continuous Monitoring Data: http://njdep.rutgers.edu/continuous/
- DEP GIS Downloads: https://www.nj.gov/dep/gis/listall.html
- EPA ATTAINS: http://www.epa.gov/waterdata/attains

Additional information about the public availability of raw and assessed data from each of the DWMS monitoring programs can be found in Table 1 below.

DATA ANALYSIS/ASSESSMENT

The federal Clean Water Act (CWA) mandates that states submit biennial reports to USEPA describing the quality of their waters. Section 305(b) requires states to report on the status of principal waters in terms of overall water quality and support of designated uses, as well as strategies to maintain and improve water quality. Section 303(d) requires states to list waters that are not attaining designated uses because they do not meet surface water quality standards despite the implementation of technology-based effluent limits. States must prioritize waters on the 303(d) List of Water Quality Limited Waters (303(d) List) for total maximum daily load (TMDL) development and identify those high priority waters for which they anticipate establishing TMDLs in the next two years. NJ prepares an Integrated Water Quality Assessment Report (Integrated Report) that combines and satisfies the reporting and public participation requirements of CWA Sections 305(b), 303(d) and 314. NJ's Integrated Reports are intended to provide effective tools for maintaining and enhancing high quality waters and restoring impaired waters.

As explained in the previous section, DEP utilizes high quality data generated by its own monitoring networks as well as other monitoring organizations and partners, including federal and county government agencies, regional commissions (e.g., Pinelands Commission), watershed associations and other voluntary citizen monitoring, and regulated dischargers/consortiums. All readily available data that meets DEP's data quality requirements is assessed by BEARS using scientific methods developed specifically for the applicable type of parameter, designated use, and waterbody to determine compliance with NJ's surface water quality standards (SWQS). These methods are described in detail in the Integrated Water Quality Assessment Methods (Methods Document) and published for public review and comment prior to completion of the assessment process.

Parameters are assessed as attaining or not attaining the applicable surface water quality standard at each station for which sufficient data is available to assess compliance. Data from all stations located within each assessment unit (AU) is assessed collectively to determine if the applicable designated uses are fully supported, not supported, or if there is insufficient information to assess the use. AUs assessed as "not supporting" a designated use includes those that require a TMDL for pollutant cause(s) of use impairment as well as those covered by an approved TMDL that have not yet attained the applicable water quality standards necessary to fully support the use. Pollutants that require TMDL development are placed on the 303(d) List.

The Delaware River Basin Commission (DRBC) assesses water quality and use support for the Delaware River mainstem, Estuary, and Bay. Their assessment results are reported in NJ's 303(d) and Integrated Lists. DRBC's Water Quality Assessment Reports and corresponding methods are available on their website at https://www.state.nj.us/drbc/.

In 2012, the Department introduced more "comprehensive assessment" methods that consider multiple water resource concerns, using a wide array of watershed information and water chemistry, physical, and biological data to produce a robust assessment of environmental conditions affecting water quality water quality assessment. This comprehensive assessment method was adapted to a rotating basin approach for 2014. Under the comprehensive regional assessment approach, the Department combines a statewide water quality assessment for key

designated uses with a more comprehensive assessment in one of New Jersey's five water regions (Atlantic Coastal Region, Raritan, Lower Delaware, Upper Delaware and Northeast) each assessment cycle, resulting in a comprehensive assessment of the entire state every 10 years. This new approach is explained in more detail in the New Jersey Integrated Water Quality Assessment Methods document (https://www.nj.gov/dep/wms/bears/docs/2016_final_methods_doc_wRTC.pdf) and in the Department's current "New Jersey's Vision Approach for Assessment, Restoration and Protection of Water Resources under the Clean Water Act Section 303(d) Program" (https://www.state.nj.us/dep/wms/bears/docs/ir1820-NJVision2021.pdf), which is prepared in accordance with USEPA's "A Long-Term Vision for Assessment, Restoration, and Protection under the Clean Water Act Section 303(d) Program". BEARS has designed a new interface for sharing data and assessment results through an enhanced website and interactive mapping features that presents the 2018/2020 Integrated Report. The new 2018/2020 web-based report is user-friendly and much more meaningful format for the 2018/2020 report (please view - https://www.state.nj.us/dep/wms/bears/assessment-report20182020.html).

Reporting:

In accordance with CWA sections 106, 305(b), 303(d), and 319(h) and section 406 of the BEACH Act, the State is required to provide appropriate reports and/or data to EPA. All activities funded with CWA monies are required to be included, as commitments, in the DEP/EPA Performance Partnership Agreement (PPA). The PPA identifies all DEP commitments to be undertaken utilizing funding provided by USEPA to implement specific provisions of the federal CWA. Under the PPA, the DEP must submit annual progress reports to EPA Region 2 on the status of each commitment. The progress report must also include an explanation of why any specified deadlines have not been met along with an anticipated timeframe for completion.

DWMS also submits annual reports to EPA Region 2 on progress made towards specific Water Quality Measures identified in the PPA and/or EPA guidance, including SP10 and SP12, and WQ27 and 28. Annual Nonpoint Source Success Stories are submitted to EPA, which identify waters that were identified on the 303(d) List but have been restored due to implementation of CWA Section 319(h) Nonpoint Source Pollution Control grant-funded projects and now attain applicable water quality standards.

In addition to documents such as the NJ Integrated Report and Nonpoint Water Quality Restoration Success Stories, DWMS also makes its water monitoring data available in a variety of ways, as per the Data Management section. Beyond the Integrated Report, this data is also used for a variety of other purposes including updating six water-related chapters in the Department's Environmental Trends online reporting system (available at: http://www.nj.gov/dep/dsr/trends/index.htm), reporting Departmental Key Performance Indicators which were established as part of the Governor's Performance Center (http://www.yourmoney.nj.gov/transparency/performance/), recreational bathing beach closures, shellfish harvesting water classifications, water quality criteria development, stream classifications, as well as for Category One antidegradation designations for rivers and streams.

PROGRAMMATIC EVALUATION

Throughout the course of the year, DWMS meets with its EPA counterparts both as program-to-program meetings as well as during the 3 yearly NJ Water Monitoring Council meetings. In this way, EPA is kept apprised of the status of monitoring, assessment and standards activities within the State. This frequent interaction enables both agencies to raise issues in advance as well as seek assistance when questions occur, gaps or needs are identified, or partnership opportunities exist.

In addition, as part of developing the PPA Annual Progress Report (see Reporting section above), a programmatic review is conducted. DWMS also conducts programmatic reviews during the development of the Annual Reports associated with the gaps identified in this document. Doing so provides the opportunity to recognize achievements, mark progress and make strategic adjustments where needed.

GENERAL SUPPORT AND INFRASTRUCTURE PLANNING

NJDEP has evaluated the water quality monitoring information available in the State and compared this to what is needed over the next 10-year period to meet monitoring objectives and requirements. 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:
- WQX Web assistance
- Submission and storage of continuous water monitoring data files
- Statistical input for evaluation of overall monitoring network design & redesign (especially important for statewide status sites and AMNET)
- Recalibration of Coastal Plain AMNET Index
- Assistance from EPA in development and application of protocols for estuarine and ocean benthic macroinvertebrate assessments
- PFAS Methods for ambient surface water, ground water and wastewater
- Lake biomonitoring protocols
- Development of an e-DNA library for biological monitoring with contract laboratory
- Continued assistance with HAB response guidance
- Assistance on source tracking of pollutants including pathogens and contaminants of emerging concern

Training Needs:
- Continuing need for taxonomic training for biological monitoring
- Training for HAB taxonomic IDs and counting methods
- Continued training on implementation of source identification and source tracking techniques in the field and lab
- Evaluation and assessment of continuous water monitoring data

								EPA Assessment, Total Maximum Daily Load Tracking and Implementation System (ATTAINS)	
Data Type	**Databases / Assessments**	**State Website**	**Water Quality Portal**	**USGS NWIS**	**Rutgers University**	**EPA Website**	**GIS Downloads**		**Upon Request**
Raw	**Ambient Surface Water Quality Monitoring Network (ASWQMN)**		X	X					
	Regional Targeted Water Quality Network (RTWQN)	X	X						
	Probabilistic Water Quality and Biological Network (PWQBN)	X	X						
	Ambient Macroinvertebrate Network (AMNET)	X	X						
	Fish Index of Biotic Integrity Network (FIBI)	X	X						
	Headwaters Index of Biotic Integrity (HIBI)	X	X						
	Ambient Summer Bacterial Monitoring Network	X	X						
	Ambient Lakes Monitoring Network	X	X						
	National Lakes Assessment (NLA)					X			
	Special Projects	X	X						
	Fish Tissue Monitoring Network (FTM)	X	X						
	Cooperative Coastal Monitoring Program (CCMP)	X	X		X				

Table 1

Public Availability of Raw and Assessed Data

Bureau of Marine Water Monitoring (BMWM)

Bureau of Fresh Water and Biological Monitoring (BFBM)

Bureau of Environmental Analysis, Restoration and Standards (BEARS)

	Program	1	2	3	4	5	6	7	8
	National Shellfish Sanitation Program (NSSP)	X	X						
	Coastal Water Quality Network (CWQN)	X	X						
	Coastal Phytoplankton Monitoring Network	X	X						
	Vibrio Monitoring								X
	Aircraft Remote Sensing	X			X				
	Non-point Source Tracking								X
	Emergency Response								X
	Barnegat Bay Long Term Ambient Monitoring Program (BBLTAM)		X						
	Continuous Data Program (Buoys and sondes)	X			X				
	Special Projects		X						X
	Benthic Indicator								X
	Gliders				X				X
	Newark/NY Harbor Monitoring Network		X						
Assessed	NJ Water Quality Monitoring & Assessment Report (IR)	X				X	X	X	
	AMNET - Final Score	X	X				X	X	X
	FIBI - Final Score	X	X				X	X	X
	Shellfish Classifications	X					X	X	
	Community Water Monitoring Network	X	X						
	Watershed Ambassador Monitoring	X	X						
	TMDL and special projects	X	X						X

Appendix A. NJDEP's Ambient Monitoring Programs

Baseline Non-tidal Freshwater Resource Monitoring Networks

Category		ASWQMN	RTWQN	PWQBN	BBLTAM (Freshwater Trib Sites)	NRSA	AMNET	FIBI / Headwaters IBI	Ambient Summer Bacterial	RMN – NJ	NWQI	Ambient Lakes	NLA	FTM	AGWQMN	NWCA	NJWET
		Rivers and Streams										*Lakes*		*Rivers, Streams, Lakes*	*Groundwater*	*Wetlands*	
Legislative / Regulation Mandates	Clean Water Act	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	106 Water Grant Requirement	x	x	x												x	x
	NJ Watershed Protection and Management Act	x	x	x													
	NJ Water Quality Planning Act	x	x	x													
	National Ground Water Monitoring Network														x		
Sample Matrix	Water Column	x	x	x	x	x	x	x	x	x	x	x	x			x	
	Sediment	x											x			x	
	Tissue													x			
	Biological			x	x	x	x	x				x	x			x	x
	Groundwater														x		
Designated Use Support	Aquatic Life	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x
	Recreational	x	x	x			x		x			x	x	x			
	Water Supply	x	x	x											x		
	Fish Consumption	x	x	x										x			
Data Users	NJDEP WMS	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	NJDEP DWQ	x	x				x		x								
	NJDEP SRP	x		x											x		
	NJGWSA	x	x	x											x		
	NJDEP OS				x		x									x	x
	NJDEP Fish and Wildlife							x									x
	NJWSA	x															
	DRBC	x		x		x		x	x					x			x
	USEPA and its Consultants	x		x	x	x	x	x		x	x	x	x		x	x	x
	USGS	x	x	x	x	x	x	x	x	x		x			x		
	Fishermen and Anglers							x				x	x				
	Academia and Public	x	x	x	x	x	x	x	x			x	x		x	x	x
	Watershed Associations	x					x		x			x		x		x	x
	NJDEP LUM																x
Public Data Availability	EPA STORET / WQ Portal	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	NWIS / WQ Portal	x			x										x		
	WQDE		x	x	x		x	x	x		x	x		x	x		x
	Program Website						x	x				x			x		x
Tiers		I	II	I	III	I	I, III	I, III	II	I	III	I, II	I	II	I	I,II,III	I,II,III

Parameters
Freshwater Non-tidal Freshwater Resource Monitoring Networks

Parameters	Rivers and Streams										Lakes		Rivers, Streams, Lakes	Groundwater	Wetlands	
	Ambient Surface Water Quality Monitoring Network (ASWQMN)	Regional Targeted Water Quality Network (RTWQN)	Probabilistic Water Quality and Biological Network (PWQBN)	Barnegat Bay Long Term Ambient Monitoring Program (BBLTAM) Freshwater Trib Sites	NJ component of EPA National Rivers and Streams Assessment (NRSA)	Ambient Macroinvertebrate Network (AMNET)	Fish Index of Biotic Integrity Network (FIBI) Headwaters Index of Biotic Integrity (HIBI)	Ambient Summer Bacterial Monitoring Network	EPA Regional Monitoring Network (RMN) – NJ	National Water Quality Initiative (NWQI)	Ambient Lakes Monitoring Network	National Lakes Assessment (NLA)	Fish Tissue Monitoring Network (FTM)	NJGWS Ambient Ground Water Quality Monitoring Network (AGWQMN)	NJ Component of NARS 2011 National Wetland Condition Assessment (NWCA)	EPA WPDG Statewide Wetland Condition Assessment (NJWET)
Field Parameters (DO, Temperature, Specific Conductance, pH, Turbidity, Discharge)	x	x	x	x	x	x	x		x	x	x	x		x	x	x
Nutrients (Total Phosphorus, TKN, Nitrate-Nitrite)	x	x	x	x	x	x	x			Total Phosphorus, Nitrite/Nitrate	+ Ammonia Nitrogen			USGS Schedule 25	x	
Continuous (DO, Temperature, Specific conductance, pH, turbidity)	x	x	x	x		x	x		Air and Water Temperature	x						
Chlorophyll				x	Microcystin, Periphyton,Chl-a						Chl-a, Secchi Depth, Algal Blooms, Microcystin	Zooplankton, Phytoplankton, Microcystin			Chl-a, Microsystin	
Biological			Benthic macroinvertebrate and fish assemblages		Fish Communities,Fish Tissue, Benthic Communities	Benthic Macroinvertebrate Regional Indices	Fish, Salamanders, Frogs, and Crayfish Regional Indices		Benthic Macroinvertebrate	Benthic Macroinvertebrate		Sediment Diatoms, aquatic macroinvertibrates			Vegetation, Algae/Diatoms	Vegetation
Visual (Physical Habitat)		x			x	x				x		+ Water Clarity			x	x
Pathogen					Enterococci			E. Coli		E. Coli		Bacteria			Microsystin (algal toxin)	
Basic cations and anions	x	x	x	x	x									USGS Schedule 1923		
Other	Sediment				Alkalinity, DOC, TSS					Turbidity, TSS	Alkalinity, Hardness	Sediment Cores, Color		Trace elements, VOCs, DOC	Sediment Cores	
Metals	x	x	x										Fish Tissue Data for Mercury		x	
Toxics / Pesticides / Radionuclides	x											Pesticide Screen	PCBs, OCPs and PBDEs	Pesticide filtration, Radionuclides	x	

Partners Freshwater Non-tidal Freshwater Resource Monitoring Networks																
	Rivers and Streams										Lakes		Rivers, Streams, Lakes	Groundwater	Wetlands	
	Ambient Surface Water Quality Monitoring Network (ASWQMN)	Regional Targeted Water Quality Network (RTWQN)	Probabilistic Water Quality and Biological Network (PWQBN)	Barnegat Bay Long Term Ambient Monitoring Program (BBLTAM) Freshwater Trib Sites	NJ component of EPA National Rivers and Streams Assessment (NRSA)	Ambient Macroinvertebrate Network (AMNET)	Fish Index of Biotic Integrity Network (FIBI) Headwaters Index of Biotic Integrity(HIBI)	Ambient Summer Bacterial Monitoring Network	EPA Regional Monitoring Network (RMN) – NJ	National Water Quality Initiative (NWQI)	Ambient Lakes Monitoring Network	National Lakes Assessment (NLA)	Fish Tissue Monitoring Network (FTM)	NJGWS Ambient Ground Water Quality Monitoring Network (AGWQMN)	NJ Component of NARS 2011 National Wetland Condition Assessment (NWCA)	EPA WPDG Statewide Wetland Condition Assessment (NJWET)
NJDEP WMS BEARS	x	x	x			x			x		x		x			
NJDEP DWQ	x															
NJDEP SRP	x															
NJDEP OS	x						x				x	x			x	x
USGS	x	x	x	x		x	x							x		
NJWSA	x															
NJGWS														x		x
DRBC					x								x			
County Health Departments and Watershed Associations								x								
New Jersey Department of Health's Sanitary Bacteriology Laboratory								x								
Great Lakes Environmental Commission					x							x				
Academia / Consultants				x			x							x		
USEPA						x			x		x	x	x		x	x
Rutgers Cooperative Extension											x	x				
NRCS - NJ										x					x	x
Citizen Scientists / Volunteers								x								
External Labs													x			
NJDEP LUM																x

Baseline for Tidal and Non-tidal Marine Resource Monitoring Networks

		Estuary and Ocean						Estuary					Ocean	
		NJ Shellfish Sanitation Program (NSSP)	Coastal Phytoplankton Monitoring Network	Air Craft Remote Sensing	Cooperative Coastal Monitoring Program (CCMP)	Non-Point Source Tracking	Emergency Response	Vibrio Monitoring (Vp)	Coastal Water Quality Network (CWQN)	Barnegat Bay Long Term Ambient Monitoring Program (BBLTAM)	Continuous Data Program (Buoys)	National Coastal Condition Assessment (NCCA)	Benthic Indicator	Gliders
Legislative / Regulation Mandates	Clean Water Act					x			x	x		x	x	x
	Food Drug Administration (FDA)	x	x	x		x	x	x			x			
	106 Water Grant Requirement													
	EPA Beach Act		x	x	x	x								
Sample Matrix	Water Column	x	x	x	x	x	x	x	x	x	x	x	x	x
	Sediment											x	x	
	Biological													
	Tissue						x	x				x		
Designated Use Support	Aquatic Life		x	x	x	x	x	x	x	x	x	x	x	x
	Recreational				x		x							
	Shellfish Consumption	x												
Data Users	NJDEP WMS	x	x	x	x	x	x	x	x	x	x	x	x	x
	NJDEP DWQ	x	x		x				x					
	NJDEP OS	x	x	x	x				x	x	x			
	USEPA and its Consultants	x	x		x				x	x	x	x		
	USGS									x	x			
	Academia and Public	x	x	x	x	x	x		x	x	x	x		
	Watershed Associations													
	NJDEP LUM													
	Fishermen and Anglers	x					x				x			
Public Data Availability	EPA STORET / WQ Por	x			x	Upon Request	Partial, Upon Request	Partial, Upon Request	x	x		x	Upon Request	Upon Request
	NWIS / WQ Portal								x	Partial				
	WQDE	x	x						x	x				
	Program Website	x	x		x						x			
	Rutgers Univeristy			x	x						x			
Tiers		I, III	I	I	I	II, III	II, III	II	I	III	II, III	I	I	I

Tidal and Non-tidal Marine Resource Monitoring Networks

	Estuary and Ocean						Estuary					Ocean	
	NJ Shellfish Sanitation Program (NSSP)	Coastal Phytoplankton Monitoring Network	Air Craft Remote Sensing	Cooperative Coastal Monitoring Program (CCMP)	Non-Point Source Tracking	Emergency Response	Vibrio Monitoring (Vp)	Coastal Water Quality Network (CWQN)	Barnegat Bay Long Term Ambient Monitoring Program (BBLTAM) Bay Sites	Continuous Data Program (Buoys)	National Coastal Condition Assessment (NCCA)	Benthic Indicator	Gliders
Academia			x						x			x	x
Barnegat Bay Partnership									x				
State County Heath Department		x			x	x			x				
MATES									x				
USEPA													
Forest Fire Service			x										
Stake Holder													
Government Agencies							x		x				
Coastal County Government				x		x							
Municipal Government				x									
Volunteer Group													
Interstate Shellfish Sanitation Conference (ISSC)	x						x						
US Food & Drug Administration (FDA)	x						x	x					
Shellfish Industry	x						x	x					

Parameters
Tidal and Non-tidal Marine Resource Monitoring Networks

	Estuary and Ocean						Estuary					Ocean	
	NJ Shellfish Sanitation Program (NSSP)	Coastal Phytoplankton Monitoring Network	Air Craft Remote Sensing	Cooperative Coastal Monitoring Program (CCMP)	Non-Point Source Tracking	Emergency Response	Vibrio Monitoring (Vp)	Coastal Water Quality Network (CWQN)	Barnegat Bay Long Term Ambient Monitoring Program (BBLTAM) Bay Sites	Continuous Data Program (Buoys)	National Coastal Condition Assessment (NCCA)	Benthic Indicator	Gliders
Field Parameters (DO, Temperature, Specific Conductance, pH, Turbidity)					x	x	x	x	x	x			x
Nutrients (Total Phosphorus, TKN, Nitrate-Nitrite)					x			x	x		x		
Continuous (DO, Temperature, Specific conductance, pH, Turbidity)										x			
Chlorophyll-a		x	x				x	x	x	x			
Biological												Macroinvertebrates	
Pathogen	Fecal coliform			Enterococci	Fecal coliform, Enterococci, Phage	Fecal coliform, Phage, Enterococci, ARA	Vibrio	Enterococci	Enterococci				
Metals											x		
Toxics / Pesticides / Radionuclides											x		

Partners
Tidal and Non-tidal Marine Resource Monitoring Networks

	Estuary and Ocean						Estuary					Ocean	
	NJ Shellfish Sanitation Program (NSSP)	Coastal Phytoplankton Monitoring Network	Air Craft Remote Sensing	Cooperative Coastal Monitoring Program (CCMP)	Non-Point Source Tracking	Emergency Response	Vibrio Monitoring (Vp)	Coastal Water Quality Network (CWQN)	Barnegat Bay Long Term Ambient Monitoring Program (BBLTAM) Bay Sites	Continuous Data Program (Buoys)	National Coastal Condition Assessment (NCCA)	Benthic Indicator	Gliders
Academia			x						x			x	x
Barnegat Bay Partnership									x				
State County Heath Department		x			x	x			x				
MATES									x				
USEPA													
Forest Fire Service			x										
Stake Holder													
Government Agencies							x		x				
Coastal County Government				x		x							
Municipal Government				x									
Volunteer Group													
Interstate Shellfish Sanitation Conference (ISSC)	x						x						
US Food & Drug Administration (FDA)	x						x	x					
Shellfish Industry	x						x	x					

	Estuary and Ocean												Ocean	
Partners Tidal and Non-tidal Marine Resource Monitoring Networks	NJ Shellfish Sanitation Program (NSSP)	Vibrio Monitoring (Vp)	Coastal Phytoplankton Monitoring Network	Air Craft Remote Sensing	Non-Point Source Tracking	Cooperative Coastal Monitoring Program (CCMP)	Coastal Water Quality Network (CWQN)	Barnegat Bay Long Term Ambient Monitoring Program (BBLTAM) Bay Sites	Coastal Water Quality Network (CWQN)	Emergency Response	Continuous Data Program (Buoys)	National Coastal Condition Assessment (NCCA)	Benthic Indicator	Gliders
Academia				x				x					x	x
Barnegat Bay Partnership								x						
State / County Heath Departments	x	x	x		x	x		x		x				
USGS								x						
USEPA														
Forest Fire Service				x										
Government Agencies								x		x				
Coastal County Government						x				x				
Municipal Government						x								
Citizen Scientists / Volunteers					x									
Interstate Shellfish Sanitation Conference (ISSC)	x	x												
US Food & Drug Administration (FDA)	x	x								x				
Shellfish Industry	x	x								x				

Baseline Non-tidal Freshwater Resource Monitoring Networks						
		Lakes		Rivers,	Groundwater	Wetlands	
		Ambient Lakes Monitoring Network	National Lakes Assessment (NLA)	Fish Tissue Monitoring Network (FTM)	NJGWS Ambient Ground Water Quality Monitoring Network (AGWQMN)	NJ Component of NARS National Wetland Condition Assessment (NWCA)	NJ Statewide Wetland Monitoring and Assessment Network (NJWETMAN)
Legislative / Regulation Mandates	Clean Water Act	x	x	x	x	x	x
	106 Water Grant Requirement						
	NJ Watershed Protection and Management Act					x	x
	NJ Water Quality Planning Rule						
	National Ground Water Monitoring Network				x		
Sample Matrix	Water Column	x	x			x	
	Sediment		x			x	x
	Tissue			x			
	Biological		x			x	x
	Groundwater				x		
Designated Use Support	Aquatic Life	x	x	x		x	x
	Recreational	x	x				
	Water Supply				x		
	Fish Consumption			x			
Data Users	NJDEP WMS	x	x	x	x	x	x
	NJDEP DWQ					x	x
	NJDEP SRP				x		
	NJGWSA				x	x	x
	NJDEP OS					x	x
	NJDEP Fish and Wildlife					x	x
	NJWSA						
	DRBC			x		x	x
	USEPA and its Consultants	x	x		x	x	x
	USGS	x			x		
	Fishermen and Anglers	x		x			
	Academia and Public	x	x		x	x	x
	Watershed Associations	x		x		x	x
	NJDEP LUM						x
Public Data Availability	EPA STORET / WQ Portal	x	x	x	x	x	
	NWIS / WQ Portal						
	WQDE	x		x	x		
	Program Website	x					x
Tiers		I, II	I	II	I	I,II,III	I,II,III