Integrated Water Quality Monitoring and Assessment Methods

This document was prepared pursuant to Sections 303(d) of the Federal Clean Water Act

State of New Jersey
Department of Environmental Protection
Water Monitoring and Standards
Water Assessment Team

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1.0 Introduction

The US Environmental Protection Agency (USEPA) issued guidance (USEPA 2001) for the development of an Integrated Water Quality Monitoring and Assessment Report (Integrated Report) by the States beginning with the Year 2002 submittal. This guidance recommended for the first time that States integrate their Water Quality Inventory Report (Section 305(b) of the Clean Water Act) with their Impaired Waterbodies List (Section 303(d)). USEPA reiterated this recommendation in their guidance for the 2004 List (USEPA 2003). The Integrated Report is intended to provide an effective tool for maintaining high quality waters and improving the quality of waters that do not attain water quality standards. The Integrated Report also provides water resource managers and citizens with detailed information regarding the following:

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

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

The Integrated Report improves water quality reporting by providing detailed descriptions of data sources and assessment methods as a basis for sound, technical assessment decisions. In addition, assessment results are represented in a spatial context, presenting a clearer picture of water quality. Monitoring needs and schedules are described, facilitating the articulation of monitoring priorities and identifying opportunities for cooperation with other agencies and watershed partners. TMDL needs and schedules are defined to convey plans for water quality improvements. Finally, the public participation aspects provide opportunities for data submittal and open discussion of water quality assessment methods and results.

The USEPA Guidance for developing Integrated Reports (USEPA 2001, USEPA 2003) recommends placing the assessment results into one of five specific categories. (Note: The Department has chosen to use the term "sublist" rather than "category" when referring to the 5 parts of the Integrated List to eliminate confusion between the Category 1 of the Integrated List and Category 1 waters under Surface Water Quality Standards (SWQS)). However, these changes also bring new challenges. An example of a major shortcoming: under the USEPA guidance, a waterbody can be included in only one of the 5 sublists (i.e., the sublist that conveys the highest degree of impairment) as a result of the integrated assessment. Thus, if a waterbody meets all applicable surface water

quality standards except fecal coliform, the waterbody would be included only in Sublist 5 - *"Water quality standard is not attained and a TMDL is required"* - until the fecal coliform TMDL is completed, even though all other water quality standards are met. Since this approach may result in an overly negative view of water quality, the Department has chosen to develop the Integrated List by waterbody/parameter, not just by waterbody. (i.e. The Metedeconk River, NB at Jackson is listed on Sublist 1 for nitrates, Sublisty 3 for pH and TSS and on Sublist 5 for aquatic life, phosphorus and fecal coliform.) This will enable the Department to present each parameter for each waterbody in the appropriate sublist. Developing the list in this manner negates the necessity for a Sublist 2. The purpose of Sublist 2 was to identify those waterbodies where some of the parameters were meeting SWQSs and some parameters were unassessed. Since each parameter is listed individually, Sublist 2 is unnecessary. The sublists of the Integrated List are described in detail in Section 8.1 Integrated Listing Methodology.

The Integrated Report which combines the non-regulatory requirements of the Water Quality Inventory Report (305b) with the regulation-based List of Impaired Waterbodies (303d) which mandates TMDL development. The success of integrating the previous reports into a single report requires an awareness of requirements and procedures. In particular, Sublist 5 of the Integrated Report represents the USEPA reporting requirements under Section 303d (Impaired Waterbodies), and the remaining sublists represent assessment under Section 305b (Water Quality Inventory). The regulatory requirements (i.e., USEPA approval and adoption; public participation, etc.) for 303d impaired waterbodies listing, therefore, only applies to Sublist 5 of the Integrated Report.

The methods used to develop New Jersey's Integrated Report are described in this document (Methods Document). The goal of the Methods Document is to provide an objective and scientifically sound waterbody assessment methodology including:

- A description of the data that the Department will use to assess attainment of surface water quality standards;
- The quality assurance aspects of the data;
- A detailed description of the methods used to evaluate water quality standards attainment;
- The placement of waterbodies on one of 5 Sublists.

The Methods Document is a companion to the Integrated Report. It is anticipated that this is an evolving document that will be modified, as appropriate, to reflect changes in assessment methodology from one reporting cycle to the next.

2.0 Statutory Authority and Guidance

The rules, regulations, and guidance that are relevant for the development of the Integrated Report are briefly discussed below.

The Federal Water Pollution Control Act and its subsequent amendments are collectively known as the Clean Water Act (CWA). The CWA provides the statutory requirements for numerous water programs including Surface Water Quality Standards, Water Quality Inventory Report, Impaired Waterbodies List, and Total Maximum Daily Loads (TMDLs).

Surface Water Quality Standards (SWQS) include water quality goals, policies, numeric and narrative criteria, and applicable design flows and waterbody classifications. Federal SWQS are promulgated by the USEPA. As required, New Jersey has adopted SWQS that are at least as stringent as the federal standards. The New Jersey SWQS were adopted at N.J.A.C. 7:9B in January, 2002 and include designated uses, use classifications and water quality criteria for the State's waters based upon such uses and the Department's policies concerning these uses, classifications and criteria. The numerical criteria for some toxic parameters are found in USEPA's National Toxics Rule (CFR, 1989**).** The Delaware River Basin Commission (DRBC) adopted standards for the Delaware River, estuary, and tributaries to the head of tide (DRBC, 1996). The New Jersey Department of Health and Senior Services (NJDHSS) establishes sanitary quality standards and beach closure procedures for ocean, bay, and lake bathing beaches (NJDHSS, 2000**).** The terms "applicable SWQS" and "applicable criteria" refer to the legally binding SWQS and criteria for the waterbody depending on jurisdiction and waterbody classification.

Water Quality Inventory Reports (305(b)) are prepared every two years by States and the USEPA as required under Section 305(b) of the CWA and contain assessments of water quality and descriptions of water resources management programs. These reports are used by Congress and the USEPA to establish program priorities and funding for federal and state water resources management programs. The USEPA issues guidance as needed regarding the preparation of water quality inventory reports.

Impaired Waterbodies Lists (303(d)) are required under Section 303(d) of the CWA, and implementing federal regulations at 40 CFR 130.7. New Jersey regulations regarding Impaired Waterbodies Lists are found at N.J.A.C. 7:15-6. These regulations require identification of impaired waterbodies: those waters for which required pollution controls were not stringent enough to achieve the state's surface water quality standards. The state is required to establish TMDLs for the impaired waterbodies based on a priority ranking. Impaired Waterbodies Lists are required every two years and must be based on a documented methodology that includes an evaluation of existing and readily available data. Waterbodies continue to be included on subsequent Impaired Waterbodies Lists until: .) TMDLs are completed; 2) Applicable criteria are met; or 3) The original basis for the listing is shown to be flawed (See Section 7.3). Public participation in the development of Impaired Waterbodies Lists is required (See Section 11). The USEPA is required to review and approve each state's 303(d) List. In New Jersey, the final 303(d) List (Sublist 5) is adopted through the States Water Quality Management Plan as required in N.J.A.C. 7:15-6. (See Section 11).

A TMDL establishes allowable point and nonpoint source pollutant loads that a stream can assimilate and meet the applicable surface water quality standards criteria. TMDL implementation may result

in more stringent discharge permit limits and/or non-point source best management practices (BMPs).

Integrated Report Guidance: The USEPA provided guidance to the States for developing Integrated Reports (USEPA 2001, USEPA 2003). The guidance for the 2004 Integrated Report is available on the web atwww.epa.gov/owow/tmdl/tmdl0103/index.html and an overview of how the Department assesses waters based on this approach is described in Section 8.0 (Integrated Listing Guidance Methods). USEPA emphasized that the Integrated Report guidance does not alter the statutory provisions in sections 305(b) and 303(d) of the Federal Clean Water Act, nor does it change existing rules governing development of the Impaired Waterbodies Lists discussed above. However, the guidance does update previous guidance, and supercede previous guidance. The USEPA recommends the use of five sublists to convey water quality standards attainment status.

The Integrated Report Guidance emphasizes the importance of monitoring and assessing waterbodies in each sublist to obtain the information needed, assess progress toward attainment of SWQS, address data gaps, and ensure that waterbodies which currently meet SWQS continue to do so.

3.0 General Data Requirements for the Integrated Report

Data Sources: The Department reviews all existing and readily available data as required and is committed to using only data with acceptable quality assurance to develop the Integrated Report. Information on individual data sources used for development of an Integrated List will be provided in the Integrated Report. In determining which data are appropriate and readily available, the Department will consider quality assurance/ quality control, monitoring design, age of data, accurate sampling location information, data documentation and use of electronic data management.

Quality Assurance: The Department maintains a strong commitment to the collection and use of high quality data to support environmental decisions and regulatory programs. Quality Assurance Project Plans (QAPP) describe the procedures used to collect and analyze samples in order to certify high quality data. The Department maintains a policy that an **approved** QAPP accompany all environmental data collection activities performed by, or for use by, the Department as outlined in the Department's and the USEPA Region II's approved FY03-FY04 Departmental Quality Management Plan (NJDEP, 2003). The QAPP should be approved prior to the start of any sampling. The Department also published a Field Sampling Manual that includes approved procedures for sample collection, field quality assurance, sample holding times, and other data considerations (NJDEP, 1992). Use of this manual, or equivalent field procedures, is required. Samples must be analyzed at a laboratory certified by the Department's Office of Quality Assurance, or a federal laboratory (e.g., the USGS National Water Quality Laboratory in Denver). The laboratory must use analytical methods certified by the Department, (N.J.A.C. 7:18), the USEPA, or the USGS.

The QAPPs for all routine ambient monitoring programs operated by the Department are approved annually prior to initiation of sampling and prior to initiating research projects. The Interagency Toxics in Biota Committee (TIBC) reviews data and risk assessment methods used to develop fish consumption advisories. The Site Remediation Program (SRP) requires very extensive quality assurance documentation and QAPPs, which must be approved by the Department or the USEPA, as required. NJDHSS oversees quality assurance procedures for the monitoring programs conducted by local health authorities (e.g., Lake Beach Monitoring).

All data and information submitted to the Department for consideration in the development of the Integrated Assessment is required to follow the Department's quality assurance guidelines (NJDEP, 2002).

Locational Data: Accurate locational data are particularly important for the Integrated Report. For some parameters (e.g., dissolved oxygen, temperature, and pH), the applicable SWQS criterion depends on specific stream classification areas established by regulation (N.J.A.C.7:9B). In addition, sampling stations must be outside of mixing zones and zones of initial dilution. Accurate locational data are required to ensure comparison to appropriate SWQS criteria, as well as confirming that sampling stations are located outside of regulatory mixing zones. The Department will accept monitoring data if sampling locations are accurate to within 200 feet. Digital spatial data (GIS or GPS) or latitude/longitude information accompanied by USGS Quadrangle maps are acceptable methods of providing locational information. Only sampling data that are spatially referenced will be used to develop the Integrated Report. Location data for all the Department's monitoring stations are recorded utilizing a Global Positioning System.

Locational data are used to estimate the spatial extent of sampling station assessments using the methods discussed in Section 7. Previous USEPA guidance for Water Quality Inventory Reports included two types of spatial assessments: monitored waters and estimated waters, which are defined for this Integrated Report Methodology as follows:

- **Monitored Waters**: assessment results applied to a waterbody based on monitoring site data using the hydrologic method for estimating spatial extent (discussed in Section 7). Given the high degree of confidence in these results for monitored waters, they will be used to place a waterbody in Sublists 1 through 5.

- **Estimated Waters**: assessment results extrapolated from adjacent monitored waters using the hydrologic method for estimating spatial extent (discussed in Section 7). Extrapolations will be based on land use, possible pollution sources, and best professional judgement. Given the lower degree of confidence, estimated waters will, when coupled with monitored waters, be placed on any one of the Sublists as determined by the monitored waters. They will not require a TMDL if estimated as impaired but will most likely be included in any additional monitoring required by the TMDL of the monitored waters..

Sample: Very often a sample consists of one unique grab sample - one sample at one location at a station. Other times, a sample consists of many individual samples collected temporally or spatially at one station location (example- diurnal DO sampling). When data are collected in a vertical or horizontal cross section, multiple intervals within a 24 hour period, or at several locations within close proximity to each other, the data may be combined and assessed as one sample. The individual "subsamples" are assessed as follows: When comparing data to a "not to exceed at any time" criterion, the sample is represented by the worst case subsample. For example, if you have hourly DO readings from 6.0 mg/l to 3.0 mg/l, the 3.0 mg/l would be used to represent the sample. When comparing the data to a criterion based on an average or geomean, all the individual subsamples would be combined to determine the average or geomean. For example, if data were collected at the surface, mid way and bottom of the water column (DO readings of 3.0, 4.0 and 5.0 mg/l), the data from the 3 subsamples would be averaged (4.0mg/l).

Electronic Data Management: In general, only electronic data are considered "readily available", due to the significant effort needed to computerize and analyze hard copy data. The Department uses electronic data from THE USEPA's Storage and Retrieval (STORET) system; USGS's National Water Information System (NWIS), and other special programs (e.g. THE USEPA's Helicopter Beach Monitoring Program and local monitoring entities.) Typically, the Department uses Microsoft databases (i.e., Excel, Access) for database management and retrieval, however, STORET formatting is encouraged as a standard for data management. Additional information on STORET is available from USEPA at http://www.epa.gov/STORET. A template for data not submitted in STORET format can be viewed at http://www.state.nj.us/dep/wmm/sgwqt/wat/datasolicitation.htm.

Reference Reports: In order to establish a strong technical foundation for the Integrated Report, the Department requests "citable" hard-copy reference reports for each data source. This request ensures that the monitoring entities are responsible for compiling the data, completing a detailed quality assurance review, and addressing questions regarding the dataset. Furthermore, citable reports offer those who review the New Jersey Integrated Report an opportunity for independent evaluation of the

underlying data. Written reports are available for most datasets and range from very basic raw data reports (that include a brief description of the monitoring program and tables of raw data) to very thorough peer-reviewed reports. The availability of reports used in developing the Integrated List will be noted in the Integrated Report.

Modified Water Quality Assessment: A modified assessment method is used for datasets that do not meet the recommended data requirements as outlined for each assessment, but still have value in assessing water quality. Examples of this type of data may include: 1) datasets of less than 8 samples; 2) sampling less than quarterly frequency; or 3) the duration of sampling is less than 2 years. Datasets of these types are evaluated on a case-by-case basis to determine if the data characterize the range of water quality variation that adequately represent conditions of existing water quality. Other examples of data sets that may be assessed by the modified method include: pathogenic indicators data sampled during the swimming months to determine compliance of recreational standards, nutrient data sampled during the growing season to determine eutrophic conditions, or temperature data sampled from late spring to early fall to determine conditions during the warmer months.

If it is determined that data do not adequately represent existing water quality conditions based on these or other possible qualifying factors, the result will be an assessment of "insufficient data." Additionally, a single exceedance is not sufficient to determine the attainment status of a site, therefore, "non attainment" waters require at least two exceedance to confirm water quality does not meet SWQS. This ensures that even with additional sampling, which would meet the recommended data requirements, the assessment result will not change. The assessment results and the basis and rational for using the data will be provided in the Integrated Report when the modified water quality assessment is used.

Development of an Assessment Method for Probabilistic Sampling Results: Probabilistic sampling design is based on a random selection of sampling locations so each location has an equal chance of being sampled. This approach strengthens the statistical basis for data analysis since many statistical tests assume a probabilistic sampling design. Therefore, alternative assessment methods may be appropriate and necessary to evaluate data from probabilistic designs.

The USEPA recommends that states include probabilistic sampling to increase the number and percentage of waterbodies assessed. While probabilistic sampling can provide reasonable estimates of water quality with known confidence, application of the results to specific stream reaches is challenging. As discussed in Appendix II, the Department's redesigned ASMN includes a probabilistic sampling component through the statewide status stations that are selected at random every year from the pool of approximately 800 sites based on the AMNET. These 800 sites are considered to be representative of a variety of watershed characteristics including land use, basin size and population density, based on an analysis done by USGS for the 2000 New Jersey Water Quality Inventory Report (NJDEP, 2001a). New Jersey's probabilistic design is currently stratified by WMA: from 1998 to 2000, two statewide status sites per WMA were sampled quarterly for one year. While this approach facilitates broad spatial distribution of the randomly selected sites, the results cannot be readily applied to specific stream reaches as required for assessments in the Integrated Report (at this time).

Although the USEPA's 2002 Guidance states that assessment units sampled through a probabilistic design may not have enough data to make attainment decisions and should be placed in Sublist 3, this

approach minimizes the usefulness of probabilistic monitoring resources for Integrated Reporting. The statewide status stations were evaluated using the following approaches to determine designated use attainment for specific stream reaches where the stations were located:

- Statewide status station data was compared to data from sites with 8 or more samples if their spatial extent overlap determined by the spatial extent method described in Section 6.
    - ♦ If assessment results were the same, the spatial assessment was extended to include the statewide status station.
    - ♦ If assessment results were not the same, the modified assessment method described above was used for stations with less than 8 samples
- Assess the waterbody as "Full Attainment" if the maximum concentration at a statewide status station was less than 50% of the applicable criterion (this percentage is recommended because it indicates very good water quality and could be tested with data from sites with greater than 8 samples). Otherwise, if the data was higher than 50% of the criterion but did not exceed the criterion, it was assessed as "Insufficient Data."

The Department is evaluating the following approach for improving the integration of probabilistic monitoring data into the overall assessment:

- Compile data from statewide status sites based on various factors such as fall line, drainage area and land use utilizing GIS and the work completed to determine basin size and land uses for each of the 800 AMNET sites.
- If results indicate we can state with confidence (e.g., 95% level) that statewide status stations with smaller than "X drainage" and more than "Y undeveloped land" meet applicable criteria for one or more parameters, assess all statewide status sites with these characteristics as "full attainment".
- Conversely, if sites with other characteristics are estimated with significant confidence to not attain applicable SWQS, assess all sites in that group as "Non-Attainment".

Beginning in 2001, the statewide status stations are now sampled quarterly for two years. The longer sampling period eliminates the problem of applying results to specific stream reaches as required for assessments in the Integrated Report. The 8 water quality samples over two years is considered adequate by the Department in determining current water quality conditions for a stream reach and the above approach for statewide status stations are no longer applied.

4.0 Numeric Water Quality Criteria Assessment

Numeric water quality criteria are available for conventional parameters (i.e. dissolved oxygen, pH, temperature), toxics (i.e. metals, organics, unionized ammonia, radioactivity), and sanitary quality (i.e., pathogens). Water quality data are compared to applicable numerical criteria and may be assessed alone or in combination to determine designated use attainment (e.g., pH and TSS data are integrated to evaluate industrial water supply designated uses).

Surface Water Quality Standards Considerations: The following aspects of the applicable numeric water quality criteria (N.J.A.C 7:9B, the USEPA's National Toxics Rule and DRBC Water Quality Regulations) are considered in each assessment:

- **Design Flows**: Design flows in the NJ SWQS are defined in N.J.A.C. 7:9B-1.5 and also apply to the USEPA's National Toxics Rule as follows:
  a) carcinogenic effect-based human health criteria, toxic substances with a bioaccumulation or bioconcentration factor greater than 200 Liters/kilogram and for bromodichloromethane, the design flow shall be the flow which is exceeded 75 percent of the time for the appropriate "period of record" as determined by the United States Geological Survey;
  b) non-carcinogenic effect based criteria: minimum average 30 consecutive day flow with a statistical recurrence interval of 5 years (MA30CD5);
  c) acute aquatic life protection criteria: minimum average 1 day flow with a statistical recurrence interval of 10 years (MA1CD10); and
  d) chronic aquatic life protection criteria for ammonia, the design flow shall be the minimum average 7-day flow with a statistical recurrence interval of 10 years (MA30CD10)
  e) design flow for all other criteria is the minimum average 7-day flow with a statistical recurrence interval of 10 years (MA7CD10).

  Ideally, data should be collected when streams are at or above "design flows" in the applicable numeric water quality standard. Since this is not always possible, flow data will be reviewed when violations occur. Data collected at flows below "design flows" will not be used to identify waters as impaired.

- **Antidegradation:** Antidegradation policies are as follows:
  1. These antidegradation policies apply to all surface waters of the State.
  2. Existing uses shall be maintained and protected. Designated uses shall be maintained or, as soon as technically and economically feasible, be attained wherever these uses are not precluded by natural conditions.
  3. No irreversible changes may be made to existing water quality that would impair or preclude attainment of the designated uses of a waterway.
  4. No changes shall be allowed in waters which constitute an outstanding National or State resource or in waters that may affect these outstanding resource waters.
  5. Where water quality exceeds levels necessary to support the designated uses, including but not limited to, propagation of fish, shellfish, and wildlife and recreation in and on the water, that quality shall be maintained and protected unless the Department finds, after full satisfaction of the intergovernmental coordination and public participation provisions of the Department's continuing planning process as set forth in the Statewide Water Quality Management Plan (see N.J.A.C. 7:15), which includes, but is not limited

to, the NJPDES Regulations (N.J.A.C. 7:14A), that allowing lower water quality is necessary to accommodate important economic or social development in the area in which the waters are located.

6. These antidegradation policies shall be applied as follows:
   i. The quality of Nondegradation waters shall be maintained in their natural state (set aside for posterity) and shall not be subject to any manmade wastewater discharges. The Department shall not approve any activity which, alone or in combination with any other activities, might cause changes, other than toward natural water quality, in the existing surface water quality characteristics.
   ii. For Pinelands waters, the Department shall not approve any activity which alone or in combination with any other activities, might cause changes, other than toward natural water quality, in the existing surface water quality characteristics. This policy shall apply as follows:
      (1) This policy is not intended to interfere with water control in the operation of cranberry bogs or blueberry production.
      (2) Dischargers holding valid NJPDES permits as of May 20, 1985, shall be allowed to continue discharging under the terms of their existing NJPDES permits provided that the discharge is not creating any water quality problems and that the designated uses are being attained. If a water quality problem has been created or the designated uses are not being attained, the NJPDES permit shall be modified to eliminate the water quality problem or attain the designated uses.
      (3) Existing dischargers shall be subject to all the provisions of this subchapter when they apply for modification or expansion of their existing discharge.
   iii. Category One Waters shall be protected from any measurable changes (including calculable or predicted changes) to the existing water quality. Water quality characteristics that are generally worse than the water quality criteria, except as due to natural conditions, shall be improved to maintain or provide for the designated uses where this can be accomplished without adverse impacts on organisms, communities or ecosystems of concern.
   iv. For Category Two Waters, water quality characteristics that are generally better than, or equal to, the water quality standards shall be maintained within a range of quality that shall protect the existing/designated uses, as determined by studies acceptable to the Department, relating existing/designated uses to water quality. Where such studies are not available or are inconclusive, water quality shall be protected from changes that might be detrimental to the attainment of the designated uses or maintenance of the existing uses. Water quality characteristics that are generally worse than the water quality criteria shall be improved to meet the water quality criteria.
7. Where a lower classification of water (including the different antidegradation waters) may impinge upon a higher classification of water the Department shall ensure that the quality and uses of the higher classification water are protected.
8. A waterway or waterbody from which raw water is transferred to another waterway or waterbody shall be treated as a tributary to the waterway or waterbody receiving the transferred water.
9. Modifications of water quality-based effluent limitations established to implement this antidegradation policy may be granted pursuant to N.J.A.C. 7:9B-1.8 and 1.9.

- **Frequency of Exceedance**: The acceptable frequency of exceedance of applicable SWQS for conventional water quality parameters is 10% based on the USEPA Guidance for the Preparation of Water Quality Inventory Reports (USEPA, 1997b). In addition, the Department has established a minimum of 2 exceedence of a SWQS to confirm impaired waters. For toxics, the allowable frequency of exceedance is 1 in 3 years.

- **Magnitude of Exceedance**: The SWQS and the USEPA guidance do not provide methods to consider the magnitude of the exceedance. Therefore, the magnitude of an exceedance is not considered.

- **Duration of Exceedance**: The SWQS include duration considerations for average concentrations over 1 hour for acute aquatic life criteria, 4 days for chronic aquatic life, 30 days for non-carcinogens and 70 years for carcinogens. In general, based on the current monitoring protocols (i.e., grab samples) it is not possible to consider the duration of exceedance. Therefore, individual exceedances were considered to extend over the applicable duration, providing a more conservative assessment.

- **Natural Conditions**: Waterbodies that do not meet applicable SWQS criteria potentially due to natural conditions will be carefully evaluated. If the excursions cannot be conclusively attributed to natural conditions, the waterbody will be classified as "non-attainment" providing a conservative analysis. If excursions can be attributed to natural conditions, the natural water quality will be used in place of the criteria, and the elevated levels will not be considered exceedances of the applicable criteria, as per N.J.A.C. 7:9B-1.5. These waterbodies may be candidates for development of site-specific criteria.

- **Threatened Waters:** Threatened waters are evaluated using the USEPA guidance "If water quality now meets applicable water quality criteria but adverse water quality trends indicate that water quality criteria will not be met in 2 years, the waterbody is assessed as threatened and classified as non-attainment" based on guidance for the Integrated Report (USEPA, 2001).

- **Censored Data:** Censored data are data with concentrations that are less than the minimum reporting level of an analytical procedure. These data are usually labeled with a "<" symbol followed by the reporting limit in the data report received from the laboratory. For example, total phosphorus below the minimum reporting level would be "< 0.01 mg/l". These values are set to one-half of the reporting limit for assessments, so that for the above example, 0.005 mg/l would be used in the assessment of total phosphorus. If the concentration and criteria are both below the minimum reporting level, the data will not be used to make an assessment.

- **Weight of Evidence:** Weighing data is necessary when evaluating numerous data sets that have different data collection and analysis methods, temporal or spatial sampling variability, or direct applicability to the water quality standards. This weighing will be applied in the following situations: newer data has more weight than older data unless past conditions are more representative of current conditions; larger data collection sets have more weight than nominal data sets; direct indicators of designated uses have more weight than surrogate indicators; and, higher quality data is given more weight based on sampling protocol, equipment, training and experience of samplers, quality control program, lab and analytical procedures. If the Department has the occasion to assess different weights to data, the specific rationale used will be detailed in the Integrated Report

4.1 Conventional Water Quality Parameters Assessment

Conventional water quality include parameters such as dissolved oxygen, pH, total phosphorus, total suspended solids, total dissolved solids, sulfate, temperature, chloride, and nitrate.

Data Requirements Specific for Conventional Parameters

In addition to the requirements provided in Section 3 (General Data Requirements), the data requirements for analysis of conventional water quality parameters (see table 4.1) are based upon sampling frequency, duration, and data age. The recommended sampling frequency is at least 8 samples collected at least quarterly for a minimum of 2 years. If data collection does not meet these recommended requirements, then a modified assessment method (see Section 3 Modified Assessment Method) may be applied to more limited data sets with a minimum data requirement of at least 4 samples. These data requirements are intended to ensure that existing water quality conditions are accurately portrayed and do not characterize transitional conditions or use obsolete data.

Table 4.1: Data Requirements Specific to Conventional Water Quality Parameters

Data Considerations	Data Requirements
Minimum Number of Samples	At least 8 samples. Fewer than 8 samples (but not less than 4) may be considered on a case-by-case basis. See Modified Water Quality Assessment under 3.8.
Minimum Sampling Frequency	Data collected quarterly, over a 2-year period. For DO, weekly sampling in the ocean during the summer. Other frequencies may be considered on a case-by-case basis. See Modified Water Quality Assessment under Section 3.
Data Age	Most recent 5 years of readily available data. Data more than 5 years old may be used on a case-by-case basis. (For example, older data could be used if conditions in the water body have not changed, or if the older data are used in conjunction with newer data to demonstrate water quality trends where appropriate analytical methods are used and results can easily be compared with more recent data.)
Spatial Extent of Assessment	Determined for each site using the spatial assessment method described in Section 7.

Conventional Water Quality Parameters Assessment Method

Nutrients: The applicable numerical water quality criterion for total phosphorus in Category 2 streams is 0.1 mg/l or part per million (ppm) total phosphorous (TP); the applicable criterion for lakes is 0.05 ppm TP. In the past, the Department has assessed streams at lake inlets and outlets using 0.05 ppm TP to evaluate whether streams could contribute to lake eutrophication and to infer in-lake concentrations in the absence of monitoring data from the lake. Presently, all streams are assessed using 0.1 ppm TP except for sampling stations directly at lake inlets that use the lake criterion of 0.05 ppm TP.

In addition to the numerical water quality criteria for total phosphorus, the SWQSs include narrative nutrient policies at N.J.A.C. 7:9B-1.5(g) that apply to all freshwaters of the state (See Section 5.0).

Dissolved Oxygen: When assessing diurnal dissolved oxygen data, the individual analyses for a 24-hour period are averaged together for comparison to the 24-hour average criteria. For evaluation of the "not less than at any time" criteria, the lowest DO value of the 24 hour period will be compared to the "not less than any time" criteria.

- **Rivers** – Diurnal dissolved oxygen data collected by the Department and the USGS follow a protocol of hourly dissolved oxygen sampling for at least a three-day period. It is recommended that the minimum diurnal sampling follow this protocol.

- **Ocean Waters** - Water column DO levels are collected by the USEPA Region II helicopter survey (June to September) and by monitoring conducted by the Department's Bureau of Marine Water Monitoring. Although the USEPA monitors transects that extend nine miles off the New Jersey coast; for the purposes of this NJ Integrated Report the assessment of data will be confined to data collected within 3 miles of the shore. The USEPA collects bottom samples while the Department collects surface water samples.
- Estuarine stations - Data represents mid-water column.

The assessment methodology for conventional water quality parameters is outlined in Table 4.2 below.

Table 4.2: Conventional Water Quality Parameters Assessment Method	
Assessment Method	**Result**
Water Quality Assessment for Recommended Sampling Protocol	
10% or less of samples exceed applicable SWQS or excursions due to natural conditions	Full Attainment
Threatened Waters: Less than 10% of samples exceed applicable SWQS, but degrading WQ trends indicate SWQS are likely to be exceeded in more than 10% of samples within 2 years	Non Attainment
More than 10% of samples exceed applicable SWQS and at least two (2) samples exceed applicable SWQS	Non Attainment
More than 10% of samples exceed applicable SWQS, however, only one (1) sample exceeds applicable SWQS	Insufficient Data
Modified Water Quality Assessment	
No samples exceed applicable SWQS or excursions due to natural conditions	Full Attainment
One (1) sample exceeds applicable SWQS	Insufficient Data
Data does not adequately represent existing water quality conditions	Insufficient Data
Two (2) or more samples exceed applicable SWQS	Non Attainment

4.2 PathogenWater Quality Assessment

Fecal coliform levels in water are used as the primary pathogenic indicator of sanitary quality. Much of New Jersey's surface water, particularly along the coast and in the Pinelands, is used for swimming, wading, surfing, canoeing and other sports in which people come into full or partial contact with surface waters.

Fecal coliform is currently being used to assess sanitary quality. However, as outlined in the United States Environmental Protection Agency National Beach Guidance Document, the CWA amendments (known as the Beach Act) requires all states to adopt enterococcus as the indicator of choice for evaluating the quality of ocean and tidal recreational bathing waters and either enterococcus or E. coli to assess fresh waters by April 10, 2004. The Department is taking the necessary steps to comply with these requirements. The Department of Health and Human Services (DHHS) is readopting Chapter IX of the State Sanitary Code with amendments (N.J.A.C. 8:26) which will change fecal coliform to enterrococci as an indicator for beaches (marine and freshwater) reflecting recent United States Environmental Protection Agency (USEPA) requirements under the Beach Act. In addition to the action by the DHHS, the Department is reviewing the SWQS at NJAC 7:9B to determine whether E. Coli or Enterococcus is the appropriate freshwater indicator.

Data Requirements Specific for Pathogenic Indicators

In addition to the requirements provided in Section 3 (General Data Requirements), additional data requirements for pathogenic indicator data (see table 4.3) are based upon sampling frequency, duration, and data age.

Table 4.3: Data Requirements for Assessment of Pathogenic Indicators

Data Considerations	Data Requirements
Minimum Sampling Frequency	Five samples collected within 30 days at least once per year is recommended. Samples may be collected quarterly for a minimum of 2 years. However, the calculation of a geometric mean requires five samples collected within 30 days.
Data Age	Most recent 5 years of readily available data. Data more than 5 years old may be used on a case-by-case basis. (For example, older data could be used if conditions in the water body have not changed, or if the older data are used in conjunction with newer data to demonstrate water quality trends where appropriate analytical methods are used and results can easily be compared with more recent data.)
Spatial Extent of Assessment	Determined for each site using the spatial assessment method described in Section 7.

Assessment Method for Pathogenic Indicators

The Department has adopted numeric criteria specific to the classification of the waterbody for primary and/or secondary contact recreation. Primary and secondary contact recreation are defined as follows:

- Primary Contact Recreation: Recreational activities that may involve significant ingestion risks and include, but are not limited to, wading, swimming, diving, surfing, and water skiing.
- Secondary Contact Recreation: Recreational activities where the probability of water ingestion is minimal and include, but are not limited to, boating and fishing.

The assessment method for pathogenic indicators is summarized in Table 4.4.

Table 4.4: Pathogenic Indicator Assessment Method

Assessment Method	Result
Less than 10 % of individual samples exceed the individual sample criterion and, when applicable, the geometric mean less than the geometric mean criterion, or excursions were due to natural conditions	Full Attainment
Threatened Waters: Less than 10% of samples exceed applicable SWQS, but degrading WQ trends indicate SWQS are likely to be exceeded in more than 10% of samples or the geometric mean may be greater than the geometric mean criterion within 2 years.	Non Attainment
More than 10% of individual samples exceed the individual sample criterion, with at least two (2) samples exceeding or, when applicable, the geometric mean greater than the geometric mean criterion	Non Attainment
More than 10% of individual samples exceed the individual sample criterion, with only one (1) sample exceeding and, when applicable, the geometric mean less than the geometric mean criterion	Insufficient Data

4.3 Toxic Water Quality Parameters Assessment

Toxic parameters include unionized ammonia, metals, and organics. Organics include current and historical pesticides and volatile organic compounds (VOCs).

Data Requirements

In addition to the requirements provided in Section 3 (General Data Requirements), additional data requirements for toxics data (see table 4.5) are based upon sampling frequency, duration, and data age.

Table 4.5: Data Requirements Specific to Toxic Water Quality Parameters	
Data Considerations	**Data Requirements**
Minimum Number of Samples	At least 8 samples. Less than 8 samples may be considered on a case-by-case basis. See Modified Water Quality Assessment under Section 3.8
Minimum Sampling Frequency	Data collected quarterly, over a 2-year period. Other frequencies may be considered on a case-by-case basis. See Modified Water Quality Assessment under Section 3.
Data Age	Most recent 5 years of readily available data. Data more than 5 years old may be used on a case-by-case basis. (for example, older data could be used if conditions in the water body have not changed, or if the older data are used in conjunction with newer data to demonstrate water quality trends where appropriate analytical methods are used and results can easily be compared with more recent data).
Spatial Extent of Assessment	Determined for each site using the spatial assessment method described in Section 7

The Department began collecting data for organics at its statewide status stations in 1997 through the redesigned ASMN. The statewide status stations are selected at random every year from the pool of ~800 AMNET sites. This probabilistic design is discussed in Section 3.0. While this approach facilitates broad spatial distribution of the randomly selected sites, the data quantity and frequency is insufficient to meet the data requirements for assessments in the Integrated Report. The Department is investigating statistical approaches for developing probabilistic assessment methodologies that would enable this data to be utilized in future Integrated Lists.

Form of Metal: Surface Water Quality Standards (SWQS) criteria for metals include human health (HH), acute aquatic life (AQLa), and chronic aquatic life (AQLc). HH criteria are based on the total recoverable (TR) form of the metal to protect human health from all forms of the metals. Most AQL criteria (both acute and chronic) are based on dissolved fraction (DF) form of the metal; exceptions are AQLc only for mercury and AQL acute and chronic for selenium. AQL criteria for cadmium, copper, lead, nickel, silver, and zinc are calculated based on hardness at the time of sampling. The applicable criterion decreases as hardness decreases, due to the increased bio-availability of metals in low hardness waters.

To the extent available, total recoverable (TR) and dissolved fraction (DF) data will be compared to TR and DF criteria, respectively. Note that only TR data are collected in the Ambient Stream Monitoring Network (ASMN). TR concentrations above the DF criteria will trigger additional sampling for DF data to confirm exceedance of DF criteria.

Minimum Detection Limit: In some cases, the analytical minimum detection limit (MDL) is higher than the applicable criterion (i.e., concentrations at or below the criterion are not measurable). This occurs for arsenic (MDL: 1 part per billion (ppb), HH criterion: 0.017 ppb); and mercury (MDL: 0.04 ppb, AQLc criterion: 0.012 ppb). In low hardness waters, AQLc criteria for cadmium, copper and lead will not be measurable in some samples. An exceedance will not be identified if the criterion

and metal concentration are below the MDL; analyses with lower MDLs will be sought. An exceedance is identified if the criterion is below the MDL and the metal concentration is above the MDL and thus the criterion.

Assessment Method for Toxic Water Quality Parameters
Unionized ammonia is calculated from total ammonia concentrations using pH and temperature at the time of sampling. Table 4.6 below, summarizes the assessment methodology for toxic parameters.

Table 4.6: Toxic Water Quality Parameters Assessment Method

Assessment Method	Result
Water Quality Assessment for Recommended Sampling Protocol	
Less than or equal to 1 exceedance in 3 years of applicable SWQS criteria; or excursions were due to natural conditions	Full Attainment
Threatened Waters: Less than or equal to 1 exceedance in 3 years of applicable SWQS criteria, but degrading WQ trends indicate SWQS are likely to be exceeded within 2 years	Non Attainment
Two (2) or more samples exceeded SWQS criteria	Non Attainment
Water Quality Assessment for Modified Assessment	
All samples meet SWQS or excursions were due to natural conditions	Full Attainment
One (1) sample exceeded applicable SWQS	Insufficient Data
Data does not adequately represent existing water Quality conditions	Insufficient Data
Two (2) or more samples exceeded SWQS	Non Attainment

Note: In accordance with the USEPA guidance (USEPA, 2001), the Department may use the mean of the measured ambient concentration compared to the criterion when assessing impairment of a chemical human health criterion based on a long term exposure. If the mean exceeds the criterion, the water quality standard is not being attained. If the mean does not exceed the criterion, the water quality standard is being attained.

5.0 Narrative Criteria and Policies

Narrative criteria are descriptions of the conditions necessary for a waterbody to attain its designated uses. To implement narrative data, which is qualitative in nature, the Department has identified assessment approaches, also known as "translators", to quantitatively interpret narrative criteria. New Jersey's SWQS contain the following narrative criteria:

Toxics:

> **Toxic substances –"** None, either alone or in combination with other substances, in such concentrations as to affect humans or be detrimental to the natural aquatic biota, produce undesirable aquatic life, or which would render the waters unsuitable for the desired use."
>
> **and**
>
> **"**Toxic substances shall not be present in concentrations that cause acute or chronic toxicity to aquatic biota, or bioaccumulate within the organism to concentrations that exert a toxic effect on that organism or render it unfit for human consumption."

This narrative criteria is supplemented by the Department's toxics policy:

> **Toxics policy**: "Toxic substances in waters of the State shall not be at levels that are toxic to humans or the aquatic biota, or that bioaccumulate in the aquatic biota so as to render them unfit for human consumption"

In addition to the numeric criteria for individual toxic parameters specified in the SWQS which protect aquatic life as well as human health, the Department uses several translators to assess compliance with the narrative toxic criteria. These translators include: fish consumption advisories (Section 6.4), shellfish closure data (Section 6.5), and drinking water designated use assessments (Section 6.6) with regard to human health; and dissolved oxygen and macroinvertebrate data to assess toxic effects on aquatic life (Section 6.1).

Nutrients: In addition to the numerical water quality criteria for total phosphorus, the SWQS include narrative nutrient policies at N.J.A.C. 7:9B-1.5(g) that apply to all freshwaters of the state. The narrative nutrient policies preclude nutrient concentrations that cause objectionable algal densities, nuisance aquatic vegetation or render waters unsuitable for designated uses.

Nutrient Criteria:
Lakes: Phosphorus as total P shall not exceed 0.05mg/l in any lake, pond or reservoir, or in a tributary at the point where it enters such bodies of water, except where watershed or site-specific criteria are developed pursuant to N.J.A.C. 7:9B-1.5(g)3.
Streams: Except as necessary to satisfy the more stringent criteria above or where watershed or site-specific criteria are developed pursuant to N.J.A.C 7:9B-1.5(g)3, phosphorus as total P shall not exceed 0.1mg/l in any stream, unless it can be demonstrated that total P is not a limiting nutrient and will not otherwise render the waters unsuitable for the designated uses.

Nutrient Policy: Except as due to natural conditions, nutrients shall not be allowed in concentrations that cause objectionable algal densities, nuisance aquatic vegetation, abnormal diurnal fluctuations in dissolved oxygen or pH, changes to the composition of aquatic ecosystems, or otherwise render the waters unsuitable for the designated uses.

In addition to assessing the numeric criteria for phosphorus, the Department assesses the narrative nutrient policy as explained in Section 6.1 under the Recreational Designated Use Assessment- Aesthetics as a translator.

It is anticipated, based on federal guidance, that differing eutrophication indicators will be needed to assess attainability of site-specific (i.e., lakes, reservoirs, streams, rivers) designated uses (i.e., aquatic life, recreation and water supply). For example, because of spatial and residence time concerns, NJDEP may need to monitor the following parameters for assessing the designated use attainment of aquatic life protection in a reservoir: dissolved oxygen, biological indicators, transparency, total phosphorous, and total nitrogen. In contrast a flowing stream for the same aquatic life protection may require information on biological indicators, periphyton biomass, dissolved oxygen, pH, soluble reactive phosphorous and total nitrogen. Similar concerns will need to be addressed in finding the appropriate monitored indicators protective of recreational and water supply designated uses for stream, lakes and reservoirs.

The NJDEP, in alignment with the EPA's recommendation (USEPA 2002), is investigating eco-regional specific nutrient criteria based on linking stressors (i.e., total phosphorous, nitrogen) with biological responses (i.e., periphyton diatoms, biomass, chlorophyll a, diurnal DO, turbidity, etc.).

Active field investigations and site specific studies are currently underway to investigate the relationships between nutrients (stressors) and response indicators (e.g. chlorophyll a, algal biomass and algal community structure) to determine if predictive stressor–response models may be constructed that are protective of designated uses and which can be used in future assessments. These will be incorporated into the Methods Document as they are developed.

In the meantime, the Department has developed a "Technical Manual for Phosphorus Evaluations (N.J.A.C. 7:9-1.14 (c)) for NJPDES Discharge to Surface Water Permits" (http://www.state.nj.us/dep/dwq/techmans/phostcml.pdf), which outlines the steps to be taken to demonstrate compliance with the nutrient criteria and policy when the numeric criteria is exceeded. Further explanation can be found in Section 8.3 under the heading Delisting Protocol for Phosphorus.

Radioactivity: Prevailing regulations including all amendments and future supplements thereto adopted by the U.S. Environmental Protection Agency pursuant to Sections 1412, 1445, 1450 of the Public Health Services Act, as amended by the Safe Drinking Water Act (PL 93-523)

The Department's assessment methodology for radioactivity is covered under the Drinking Water Designated Use Assessment in Section 6.6.

Natural Conditions: The natural water quality shall be used in place of the promulgated water quality criteria of N.J.A.C. 7:9B-1.14 for all water quality characteristics that do not meet the promulgated water quality criteria as a result of natural causes.

Waterbodies that do not meet applicable SWQS criteria potentially due to natural conditions will be carefully evaluated. If the excursions cannot be conclusively attributed to natural conditions, the waterbody will be classified as "non-attaining" providing a conservative assessment. If excursions can be attributed to natural conditions, the natural water quality will be used in place of the criteria, and the elevated levels will not be considered exceedances of the applicable criteria, as per N.J.A.C. 7:9B-1.5. These waterbodies may be candidates for development of site-specific criteria. Although the Department believes some exceedences (i.e. pH and arsenic) may be due to natural conditions, the Department has not developed assessment methods to attribute the non attainment to natural causes. The Department will include methods for evaluating "natural conditions" as they are developed.

6.0 Assessment Method for Designated Use Attainment

The SWQS identify specific designated uses for the waters of the State according to their waterbody classifications. Designated uses include aquatic life, recreation, fish consumption, drinking water, industrial water supply, and agricultural water supply. The Department uses both numeric and narrative criteria to protect designated uses. Narrative criteria are descriptions of the conditions necessary for a waterbody to attain its designated uses while numeric criteria are concentration values deemed necessary to protect designated uses. To implement narrative data which is qualitative in nature, the Department has identified assessment approaches, also known as "translators", to quantitatively interpret narrative criteria. Section 5 outlines the assessment methodologies for designated use attainment that include the utilization of both numeric and narrative criteria.

6.1 Aquatic Life Designated Use Assessment

The water quality requirements of many diverse species of aquatic life vary and are difficult to measure. Attainment of many of the numerical SWQS criteria are intended to protect aquatic life from the detrimental effects of poor water quality (e.g., dissolved oxygen, temperature, toxic pollutants). Attainment of SWQS for these parameters is discussed in Section 4. It is also important to evaluate important aquatic communities as direct indicators of aquatic life designated use attainment. Currently, numerical biocriteria for assessment of aquatic life designated uses have not been adopted in the SWQS. The assessment of aquatic life designated uses is based on evaluation of existing and readily available biological community data.

Aquatic Life Designated Use Assessment for Lakes

Note: Because of the unique nature of waterbodies contained within the Pinelands Region of New Jersey, lakes within this region are assessed separately from non-Pinelands lakes using unique indicators and data provided by the New Jersey Pinelands Commission. Assessment methods for the non-Pinelands portions of the State are described immediately below. Methods employed in the Pinelands are described following the non-Pinelands methods.

Aquatic Life Designated Use Assessment Method for Non Pinelands Lakes

Data Sources

Fish populations are sampled using methods such as electrofishing, shoreline seining, and/or gillnetting. Population assessments are then performed by experienced fishery biologists for the purpose of determining the lake's actual or potential recreational value as a fishery. These assessments are based upon the diversity of a wide range of fish species and not just of species possessing recreational value. Species stocked by the Department are also identified and addressed in these assessments.

Data Requirements Specific to Aquatic Life Designated Use Assessments in Lakes

In addition to the requirements provided in Section 3 (General Data Requirements) the following are specific data requirements for the assessment of aquatic life designated uses in lakes are noted in Table 6.1 below.

Table 6.1: Data Requirements Specific to Aquatic Life Designated Use Assessments for Non-Pinelands Lakes

Data Considerations	Data Requirements
Sampling frequency	Sufficient to establish recruitment capability
Field QC	Field identification should be carried out by qualified fishery biologists[1]
Assessment references	Nielsen, L. and Johnson, D. 1983, Fisheries Technique. American Fisheries Society. Murphy, B. and Willis, D. 1996. Fisheries Technique, 2nd ed. American Fisheries Society.
Spatial extent	Assessment should be lake-wide

[1]Note: An "experienced" fishery biologist is one who possesses, at the minimum, the following qualifications: A Bachelor's degree in one of the Biological Sciences or Natural Resource Management with a major concentration in Fisheries Science and/or Wildlife Science and one year of professional experience in fisheries biology and/or development of fisheries management programs. A Master's degree in fisheries management or a related field can be substituted for one year of experience in fish taxonomic identification and field collection.

The aquatic life designated use assessment methods for non-Pinelands lakes are outlined in Table 6.2a.

Table 6.2a: Aquatic Life Designated Uses Assessment Method for Non-Pinelands Lakes

Aquatic Life Designated Uses Assessment Methods	Result
Fishery is well balanced, exhibiting good diversity. Consistent recruitment.* No one species dominates the community. No observable factors limiting the fishery.	Full Attainment
Threatened Waters**: Fully supported fishery, however, anticipated changes in surrounding land use, lake water levels or in-lake water quality have the potential to cause future declines in fishery quality.	Non Attainment
Fishery assessments incomplete or insufficient to assess fishery status	Insufficient Data
Fisheries present, however, fish diversity not at potential expected for the type of lake in question. Predators to prey populations are not in balance, inconsistent recruitment*.	Non Attainment
Fishery exhibits poor diversity. Fishery dominated by a few tolerant species (carp, goldfish, mudminnows, killifish, etc) and/or general overall number of individuals is low. Poor recruitment* and growth of individuals.	Non Attainment

**Recruitment* refers to the number of young fish, which survive to ultimately become large enough to reproduce and/or become harvestable. For example: reproduction of a number species of fish in a lake may be good but there may be insufficient habitat cover resulting in many of these fish being eaten by their larger counterparts before they grow to sufficient size to either reproduce or be sought after by anglers. In such a scenario, recruitment is regarded as poor.
**Note that because of the nature of the information that form the basis of the *"Threatened"* category as it applies to lake aquatic life assessments, the strict 2-year window applied to conventional parameters is not applied here. "Threatened" status here operates within a broader time window, which could encompass a period of, for example, 5 years.

Aquatic Life Designated Use Assessment Method for Pinelands Lakes

The Pinelands Commission (Commission) has developed an extensive biological database which the Department has use to assess the Aquatic Life Designated Use for selected lakes in the Rancocas and Mullica watersheds (Watershed Management Areas 19 and 14, respectively). The basis for these assessments are extensive studies performed by the Commission of lake finfish and anuran assemblages along anthropogenic disturbance gradients. Fish and anuran data employed for the Mullica assessments are taken from Zampella, R.A., et al. 2001 and written communication; biological assessments for the Rancocas are taken from Zampella, R.A., et al. 2003, and written communication.

Assessments of full attainment and non attainment were established when the Commission's bioassessments delineated sites which represented clearly background or clearly disturbed situations respectively, in other words, the assessments came from the two non-ambiguous ends of the disturbance gradient. Sites lying within the more central portions of the disturbance gradient were assessed as having insufficient data and will await additional indicators or protocols to ascertain their Aquatic Life Support status.

Table 6.2b. Aquatic Life Designated Use Assessment Method for Pinelands Lakes

Pinelands Biological Assessment Status	**Result**
All biological indicators located in highest quintile range or all but one biological indicator located in highest quintile range and remaining indicator in second to highest range.	Full Attainment
All biological indicators located in lowest quintile range or all but one biological indicator located in lowest quintile range and remaining indicator in second to lowest range.	Non Attainment
Biological indicators not as above, assessments tending to lie within the middle quintile ranges.	Insufficient Data

Aquatic Life Designated Use Assessment Method for Tidal Waters

Dissolved oxygen (DO) is necessary for most aquatic life forms and monitoring data for DO in tidal waters is readily available through existing monitoring networks. Therefore, DO status is used as an indicator for tidal water aquatic life designated use assessment. However, because many open water aquatic species are mobile and/or naturally tolerant of transient low DO occurrences, DO is an indirect indicator of aquatic life designated uses. Additional data and assessments are needed to develop a direct indicator of aquatic life designated use attainment in tidal waters.

Data Requirements Specific to Aquatic Life Designated Use Assessment in Tidal Waters

In addition to the requirements provided for in Section 3 (General Data Requirements), data requirements for assessments of aquatic life designated uses in tidal waters are described below and summarized in Table 6.3.

- **Estuarine Waters -** The aquatic life assessment method is based upon quarterly subsurface dissolved oxygen (DO) levels recorded within a recent five-year time span. Water column DO levels are based upon criteria contained within New Jersey's Surface Water Quality Standards (N.J.A.C. 7:9B). Assessment and listing methodology are summarized in Table6.4.
- **Ocean Waters** -Aquatic life assessment for New Jersey jurisdictional ocean waters is based on water column DO levels (Sampled June to September) collected by the USEPA Region II helicopter survey and by monitoring conducted by the NJDEP's Bureau of Marine Water Monitoring. Although the EPA monitors transects that extend nine miles off the New Jersey coast; for the purposes of this Integrated Report the assessment of data will be confined to only the innermost 1 and 3 mile transect points (Figure 1). Assessments are based on dissolved oxygen values recorded one meter above the ocean bottom. Water column DO levels are based on criteria contained within New Jersey's Surface Water Quality Standards (N.J.A.C. 7:9B). The assessment and listing methodology for DO are summarized on Table 4.2 for conventional parameters. The USEPA Region II, over many years of monitoring, has found that surface DO levels are consistently acceptable (DO is at or above 5mg/l) within the waters they survey. In response, the USEPA has discontinued monitoring of DO in surface waters, and the NJDEP assumes that surface DO is at or above 5mg/l. In contrast, nearshore DO monitoring by the NJDEP has found frequent contravention of the subsurface DO standard within the southerly portions of the coast. These have been factored into the Department's use support assessment of ocean waters.

Table 6.3: Data Requirements for Assessment of Aquatic Life Designated Uses in Tidal Waters

Data Considerations	Data Requirements
Minimum Sampling Frequency	Quarterly sampling in tidal rivers, back bays and inlets; weekly sampling in the ocean during the summer
Data Age	Most recent 5 years of readily available data
Tidal Considerations	None
Spatial Extent	Determined for each site using the spatial assessment method described in Section 7

Aquatic Life Designated Use Assessment Method for Tidal Waters
Dissolved oxygen measurements were compared to applicable criteria as described in Table 6.4. For ocean stations, bottom measurements were used; for estuarine stations, mid-water column measurements were used.

Note: In contrast to surface DO levels, the EPA monitoring has found benthic low DO conditions off the New Jersey coast for most of its length during the quiescent periods of the summer and early fall. These are brought about by thermal stratification that establishes during this period. Storms and the onset of autumn bring about surface to bottom mixing resulting in a breakup of these low DO conditions until the onset of warmer temperatures again in June. The impacts to benthic aquatic life and the possible anthropogenic contributions to these benthic conditions are currently unknown.

Table 6.4: Aquatic Life Designated Use Assessment Method for Tidal Waters

Aquatic Life Designated Use Assessment Method for Tidal Waters	**Result**
10% or less of samples exceed applicable SWQS criterion for dissolved oxygen or excursions were due to natural conditions	Full Attainment
Threatened Waters: Less than 10% of samples exceed applicable SWQS criterion for dissolved oxygen, but degrading WQ trends indicate SWQS are likely to be exceeded in more than 10% of samples within 2 years	Non Attainment
More than 10% of samples and at least 2 samples exceeded applicable SWQS criterion for dissolved oxygen	Non Attainment

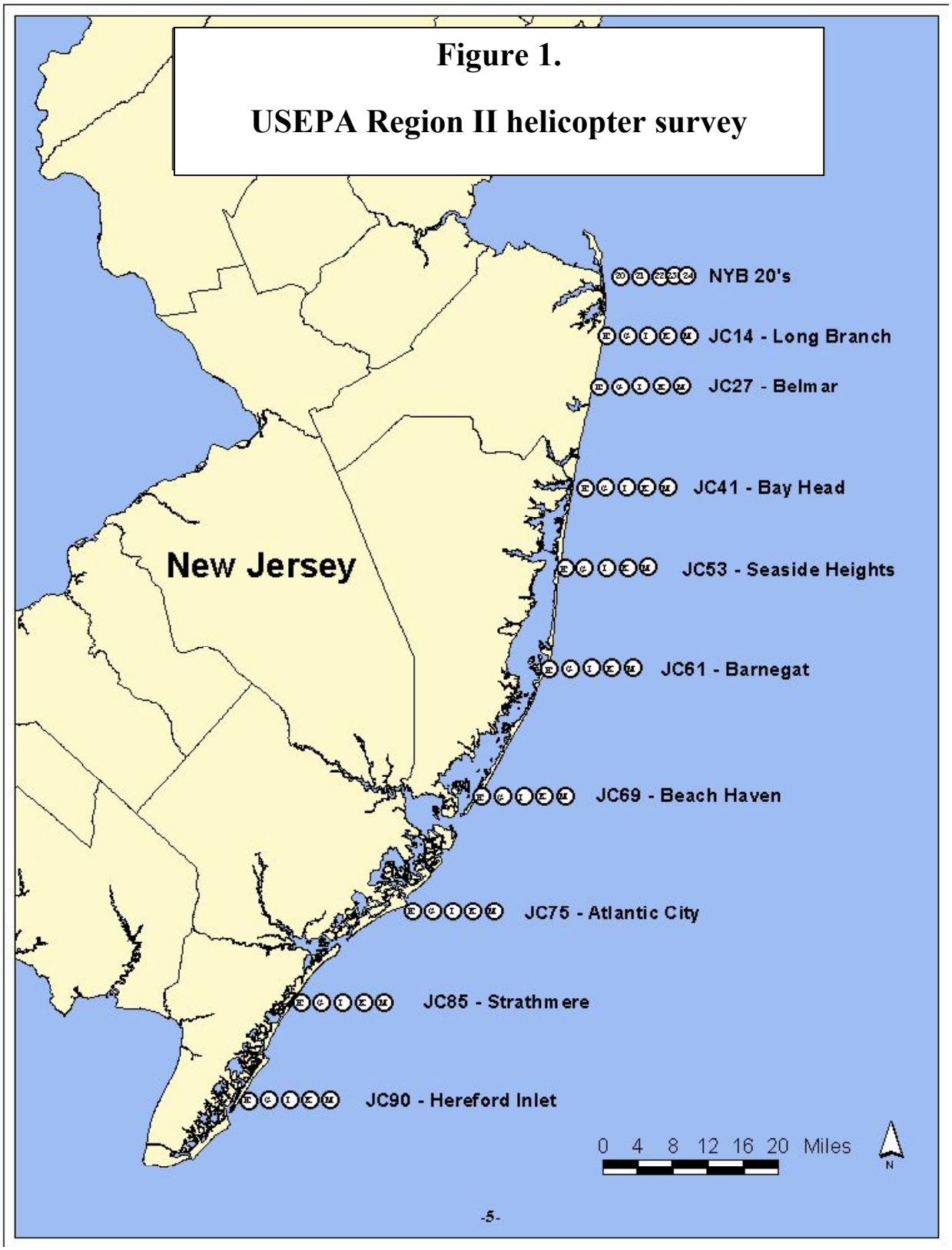


Figure 1.
USEPA Region II helicopter survey
NYB 20's
JC14 - Long Branch
JC27 - Belmar
JC41 - Bay Head
New Jersey
JC53 - Seaside Heights
JC61 - Barnegat
JC69 - Beach Haven
JC75 - Atlantic City
JC85 - Strathmere
JC90 - Hereford Inlet
0 4 8 12 16 20 Miles
N
-5-

Aquatic Life Designated Use Assessment in Rivers

Introduction

Whenever possible the Department prefers to assess the health of aquatic biota directly through assessment of various biotic communities. Such is done in most freshwater rivers and stream of the State through the assessment of benthic macroinvertebrates (bottom dwelling organisms, such as insects, crustaceans, snails, and worms) assessed between the months of April and November, inclusive. As with lakes, the unique nature of streams contained within the Pinelands Region of New Jersey require that alternative assessment methods be employed in this region. Hence, Pineland streams are assessed separately from non-Pinelands streams using unique indicators recommended by and data supplied by the New Jersey Pinelands Commission. The methods are discussed later in this section.

Initially all streams in the state were assessed via macroinvertebrates. In response to concerns raised by the NJ Pinelands Commission, as well as for other reasons, an Interagency 303d Technical Workgroup with representation from the Department, USEPA Region II, and USGS was formed. The workgroup was tasked with developing a water quality assessment procedure (see Table 6.5a) for application of the macroinvertebrate network in New Jersey and developing a series of recommendations as to how the individual sites should be assessed with respect to the Integrated List. A summary of this effort is delineated in Appendix I. This procedure has been applied in assessing the results from the previous NJ Impaired Waterbodies List [303(d)] as well as current AMNET results.

The protocol is as follows:

- Past macroinvertebrate assessments performed in Pinelands waters have been assessed as "further assessment required" and had been placed on Sublist #3 in the 2002 Integrated List. An alternative assessment method for these waters using benthic macroinvertebrates is under development. In the interim, an alternative method has been applied to this subset of AMNET sites on Sublist 3 which is described below under "Designated Use Assessment of Pinelands Waters".
- For past and current assessments of remaining sites, not located in PL waters, nonimpaired and severely impaired status are accepted as assessments of high confidence and are listed accordingly, with impaired sites going on Sublist #5.
- Of moderately impaired sites - sites located on small headwater streams, immediately below lakes and wetlands, as well as sites sampled in winter - are to be classified as "further assessment required" and placed on Sublist #3.

For current and future benthic macroinvertebrate monitoring, the workgroup has developed the following guidelines for sampling when employing the New Jersey Impairment Score (NJIS) scoring system and New Jersey's Rapid Bioassessment Protocol (RBP):

1. The current scoring system and protocol are not to be applied to the NJ Pinelands Area because of the unique nature of the low pH adapted organisms within these waters (i.e., PL designated surface waters as per N.J.A.C. 7:9B). These waters include both "Preservation" and "Protection" areas within the Pinelands, the Mullica and Great Egg Harbor River watersheds as well as the eastern portions of some Delaware tributaries.

2. Monitoring sites must be located at points that represent the downstream terminus of a catchment area of 6 sq. mi. or greater;
3. Sites should not be located within 500 feet of a lake or impoundment outlet; and
4. Sites should be sampled between April and November, inclusive.

Aquatic Life Assessment for Non-Pineland Rivers

The assessment method employed in non-Pineland rivers is supported by the finding that the occurrence of different aquatic species and communities is limited by environmental conditions, tolerances to pollution, and/or habitat degradation. The occurrence of these tolerant and intolerant organisms is consequently used to screen streams for potential impairments for aquatic life designated uses. All macroinvertebrate sampling is conducted in accordance with USEPA guidance (USEPA 1989) and the Department's field sampling procedures (NJDEP 1992). Quality control measures must be consistent with USEPA procedures (USEPA 1999) and all specimen identifications must be performed by a qualified biologist.

The methodology for assessing the aquatic life designated use in rivers not located within the Pinelands boundary is outlined in Table 6.5a below. The methodology for assessing the aquatic life designated use in selected Pinelands rivers is described immediately following Table 6.5a, and is outlined in Table 6.5b.

Table 6.5a: Aquatic Life Designated Use Assessment for Non-Pineland Rivers

Data Assessment	Result
Non-PL waters assessed as Non-Impaired[1]	Attainment
Non-PL waters assessed as Severely Impaired[1]	Non Attainment
Non-PL waters assessed as Moderately Impaired and falling under categories 1 – 5 below:	
1) Sites at points that drain a catchment area of less than 6-sq. mi.	Further Assessment Required
2) Sites at points that drain a catchments area of 6 sq. mi. or greater:	Non Attainment
3) Sites located within 450 feet of a dam (impoundment outlet)	Further Assessment Required
4) Sites assessed based upon April to November (inclusive) samples	Non Attainment
5) Sites assessed based upon December to March samples	Further Assessment Required

Note:

- Benthic samples are normally collected between the months of April and November, inclusive.
- Assessment are based up a single filtered sample collected as per the USEPA Rapid Bioassessment Protocols. See the Department's Bureau of Freshwater and Biological Monitoring's website at: http://www.state.jn.us/dep/wmm/bfbm/amnet.html

[1] The Department uses the Rapid Bioassessment Protocol developed by USEPA. A non-impaired community is defined as a community comparable to other relatively undisturbed streams within the region, with maximum taxa richness, balanced taxa groups, and a good representation of intolerant individuals. To be classified as Non-impaired, the site must receive a Rapid Bioassessment Protocol score of between 24 and 30. Severely impaired sites are represented by few taxa that are very abundant. Only tolerant taxa are present. Sites with scores of 6 or less are classified as Severely Impaired. Sites with scores between 9 and 21 are considered Moderately Impaired with reduced macroinvertebrate richness. Taxa composition changes result in reduced community balance and loss of intolerant taxa.

Designated Use Assessment of Pinelands Streams

Because of their unique nature, streams within the Pinelands Region of New Jersey (both Preservation and Protection Areas) are assessed separately from non-Pinelands streams using unique indicators recommended by and data supplied by the New Jersey Pinelands Commission.

In the 2002 Integrated List, the Department had placed benthic macroinvertebrate assessments taken from streams within the Pinelands Area on Sublist 3 (Insufficient Data) because the existing

protocols would not apply to these waters. The Pinelands Commission (Commission) has developed an extensive biological database which the Department has now used to assess the Aquatic Life Designated Use for selected wadable streams in the Rancocas and Mullica watersheds (Watershed Management Areas 19 and 14, respectively). The basis for these assessments are extensive studies performed by the Commission of stream vegetation, finfish and anuran assemblages along anthropogenic disturbance gradients. For both the Mullica (Zampella, R.A., et al. 2001 and written communication) and the Rancocas (Zampella, R.A., et al. 2003 and written communication) drainages, stream vegetation and finfish assemblages are employed as the basis for the stream assessments contained in the Integrated List. In contrast, for Pinelands lake assessments, fish and anuran assemblages are employed

Using the Commission's data, assessments of full attainment and non attainment were established when the bioassessments delineated which sites represented clearly background or clearly disturbed situations respectively, in other words, the assessments came from the two non-ambiguous ends of the disturbance gradient. Sites lying within the more central portions of the disturbance gradient were assessed as having insufficient data and will await additional indicators or protocols to ascertain their Aquatic Life Support status.

Table 6.5b. Aquatic Life Designated Use Assessment Method for Pinelands Streams

Pinelands Biological Assessment Status	Result
All biological indicators located in highest quintile range or all but one biological indicator located in highest quintile range and remaining indicator in second to highest range. If only one indicator available, it is located in the highest quintile range.	Full Attainment
All biological indicators located in lowest quintile range or all but one biological indicator located in lowest quintile range and remaining indicator in second to lowest range. If only one indicator available, it is located in the lowest quintile range.	Non Attainment
Biological indicators not as above, assessments tending to lie within the middle quintile ranges.	Insufficient Data

Flow Effects: Research by the USGS has indicated that insufficient base flow can have detrimental effects on aquatic macroinvertebrate populations. The Department is currently investigating this issue closely through several research projects being performed in cooperation with the USGS. The Department realizes that in some cases, non attainment of use may be due to extended drought conditions and this, in turn, may influence how the individual AMNET sites are (or will) be assessed with regards to use support. If sites reflect impaired status due to extensive drought induced low flow conditions that are not known to be anthropogenically aggravated, they will be assigned to sublist 3 pending a re-assessment.

6.2 Recreational Designated Use Assessment (Human Health and Aesthetic Quality)

The Recreational Designated Use Assessment evaluates both human health and aesthetic impacts on recreational use of the waterbody.

Recreational Designated Use Attainment (Human Health)

Human health issues are addressed by the comparison of pathogenic indicator data to numeric criteria. Waterbodies in general are assessed by comparing water quality data to appropriate SWQS for pathogenic indicators as outlined in Section 4.2. The Department of Health and Human Services regulates public recreational bathing beaches under Chapter IX of the State Sanitary Code N.J.A.C. 8:26 Public Recreational Bathing. The Department has a Cooperative Coastal Monitoring Program in which various agencies perform sanitary surveys and monitor concentrations of bacteria in near-shore coastal and estuarine waters.

Data Requirements Specific to Human Health Related Recreational Use

In addition to the requirements provided in Section 3 (General Data Requirements), Chapter IX of the State Sanitary Code N.J.A.C. 8:26 prescribes additional sampling techniques and beach opening and closing procedures. Specific data requirements for assessments of recreational designated uses using beach closure data are described in Table 6.6 below.

Table 6.6: Data Requirements for Human Health Related Recreational Use

Data Considerations	Data Requirements
Minimum Sampling Frequency	Weekly sampling mid May to mid September. Frequency may be reduced to biweekly based on 3 months of consecutive satisfactory samples from the previous year. When water sample exceeds the standard, the beach must be resampled the following day
Data Age	Data collected within the last 5 years
Spatial Extent of Assessment	Lake Beaches*:* See Section 6 Ocean and bay beaches: 138 back bay beaches estimated to be 150 feet long (beachfront) x 100 feet wide (3.9 square statute miles); 127 miles of ocean beaches estimated to be 150 feet wide.

Recreational Designated Use (Human Health) Assessment Method

Unlike the assessment for pathogenic indicators outlined in Section 4.2, this assessment considers the availability of recreational beach amenities and physical access to the water in addition to the sanitary quality of the water. All waterbodies in this assessment are accessible to the public and are designated bathing areas with lifeguards.

Closure procedures are outlined in Section 8:26-8.8 of New Jersey's Sanitary Code. A beach is closed after 2 consecutive samples have exceed 200 fecal coliforms per 100 milliliters.

Table 6.7 Recreational Designated Use (Human Health) Assessment Method	
Beach Closing Data Assessment	**Result**
Less than one beach closure per year of 7 or more consecutive days; or, an average of less than 2 beach closures per year.	Full Attainment
One beach closure per year of 7 or more consecutive days; or, an average of 2 or more beach closures per year	Non Attainment

6.3 Lake Aesthetic Quality Assessment

The aesthetic quality of lakes is an important aspect in the maintenance of recreational uses since swimming and boating uses may be impaired by nuisance algal growth and sedimentation due to eutrophication. Recreational use support is also assessed from a sanitary perspective in Section 6.2. Many of the lakes in New Jersey are constructed impoundments and highly prone to eutrophication. Eutrophication occurs naturally as lakes age, however, this process can accelerate from excessive inputs of nutrients and suspended sediments from surrounding watersheds. Eutrophic lakes are characterized by excessive growth of aquatic weeds and algae, and shallow depths as sediments fill the lake. Severely eutrophic lakes may experience elevated temperatures and low dissolved oxygen.

Assessment Method for Recreational Use Support, Based Upon Lake Aesthetic Quality

To assess aesthetics, the Department utilizes the narrative nutrient policies which preclude "nutrient concentrations that cause objectionable algal densities, nuisance aquatic vegetation or render waters unsuitable for designated uses." For a majority of lakes currently on the Integrated List, whether or not a lake is impaired aesthetically is based upon the type of report used to bring the lake to the Department's attention. In the past, lake impairment issues were brought to the Department's attention principally through four reporting avenues:

1. New Jersey Lake Management Program Reports (NJLMP);
2. Clean Lakes Program Phase I Diagnostic Studies (CLP);
3. Lake Water Quality Assessment Reports (LWQA); and
4. Lake Intensive Surveys performed prior to 1980 (LIS).

Lake Reports through Programs 1 and 2 above occurred most often in response to perceived impairments by local authorities for lake recreational uses brought about by eutrophication. LWQA reports and LIS (No 3 and 4) represent lake investigations performed by the Department for assessing general water quality in New Jersey lakes and were not always in response to reported impaired recreational uses. In order to insure that the TMDL process is appropriately applied to eutrophic lakes with known recreational impairment, the Department has assigned eutrophic lakes to the following categories within the Integrated Assessment as noted in table 6.8 below.

Table 6.8 Recreational Use Support Assessment Methodology for Eutrophic Lakes	
Lake Assessment	**Recreational use support status**
• New Jersey Lake Management Program Report	Non Attainment*
• Clean Lakes Program Phase I and II Diagnostic Studies	Non Attainment*
• Lake Water Quality Assessment Report	Status not determined
• Lake Intensive Survey	Status not determined
• All lakes assessed as mesotrophic, regardless of assessment method or lakes, which have been successfully remediated and have had their recreational use restored.	Full Attainment
*Unless information indicates that the use impairment has been subsequently remediated in which case the use may be regarded as fully supporting.	

Note that use support determinations in the context here are solely based upon an assumption of recreational use impairment and not on trophic status alone. Eutrophic lakes are not automatically assumed to be use impaired. Rather, it is lakes with actual, or assumed use impairments that are assessed here as use impaired and subsequently listed on sublist 5.

The Department is currently reviewing all information sources that document restoration efforts for use impaired lakes. If it is shown that the recreational uses have been restored, the lake will be categorized as fully meeting its recreational use and placed into the corresponding sublist of the Integrated List. Conversely, if a lake was investigated by report categories 1 or 2 and it is subsequently learned that no use impairment was present[1], the lake will be reclassified (from non attainment) to full attainment status. For lakes in which recreational use status is assessed as "status not determined" the Department will review all readily available information in order to determine its recreational use support status and to revise the Integrated List accordingly

Although many of the lake assessments discussed here may be twenty years old the condition of the lake (with regards to recreational non support) is considered the same as that delineated in the original assessment. This rationale is based on the observation that unless a remedial action has taken place on an impaired lake, its condition (in regards to use impairment), through natural lake succession, is not expected to improve through time.

Lake Trophic Status Assessment Method

For the purposes of completeness, the methods used to determine the trophic status of lakes utilized by the Department's Clean Lakes Program are explained. Lake trophic status assessments were conducted using the USEPA's Clean Lakes Program Guidance Manual (USEPA, 1980). Consideration may also have been given to documented impairments caused by other factors, such as excessive macrophyte growth, sedimentation or bacterial contamination affecting lake beaches. In

[1] Some lakes underwent Phase I investigations, as it turns out, so as to develop an informed long-term lake management policy. In such cases, there were no existing use impairments to the lake's recreational use.

addition, the USEPA's Clean Lakes Program Guidance Manual provides target levels (Table 6.9) for some in-lake parameters for the purpose of guiding lake remediation.

It must be reiterated that use support determinations are solely based upon an assumption of recreational use impairment and not on trophic status alone. Eutrophic lakes are not assumed to be use impaired. Rather, it is eutrophic lakes with actual, or assumed use impairments that are assessed as use impaired.

Table 6.9: Lake Remediation Target Levels For Selected Parameters As Per The USEPA's Clean Lakes Program Guidance Manual.

Data Assessment	Trophic Status Classification
If all of the following exist: • Total phosphorus less than 0.02 ppm TP (winter mean) • Chlorophyll *a* less than or equal to 5 – 10 ppb Chl*a* (summer) • Transparency greater than or equal to 1.5 meters (summer)	Mesotrophic
If one or more of the following exist: • Total phosphorus greater than or equal to 0.02 ppm TP (winter mean) • Chlorophyll *a* greater than 5 – 10 ppb Chl*a* (summer) • Transparency less than 1.5 meters (summer) • Excessive macrophyte populations or sedimentation impairing use	Eutrophic

6.4 Fish Consumption Designated Use Assessment

Fish consumption designated use assessments are based on the presence of fish consumption advisories or bans. The data collection, risk assessment and the issuance of fish consumption advisories and bans are overseen by the New Jersey Interagency Toxics in Biota Committee (ITBC). Through the ITBC, a joint effort between the Department and the NJ Department of Health and Senior Services research projects are coordinated to monitor levels of contaminants in commercially and recreationally harvested fish, shellfish and crustacean species. Edible portions of individual animals are tested for one or more bioaccumulative chemicals (e.g., PCB's, chlorinated pesticides, dioxins, and mercury). These data are evaluated for development of consumption advisories and bans as appropriate to protect human health.

Data Requirements Specific to Fish Consumption Designated Use

In addition to the requirements provided in Section 3 (General Data Requirements), the Department followed the USEPA's "Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories – Volume II Risk Assessment and Fish Consumption Limits" (USEPA 2000) for establishing PCB advisories. For mercury consumption advisories, the ITBC used health risk-based mercury guidelines established by the NJDEP (NJDEP, 1994) which follow closely guidelines recommended by the Year 2000 National Research Council report - *Toxicological Effects of*

Methylmercury. For dioxin, New Jersey currently uses an FDA advisory opinion issued in 1981[2] (see FDA. 1981 and FDA. 1983).

Table 6.10: Fish Consumption Designated Use Assessment Method

Assessment	Result
No fish restrictions or bans in effect	Full Attainment
"Restricted Consumption" of fish in effect (restricted consumption defined as limits on the number of meals or size of meals consumed per unit time for one or more fish species); or a fishing ban is in effect for a sub-population that could be at potentially greater risk for one or more fish species or included on 1998 Impaired Waterbodies List and no new data available.	Non Attainment
"No consumption", or fishing ban in effect for general population for one or more fish species; or commercial fishing ban in effect.	Non Attainment
Fish tissue data not available	Unassessed
Statewide advisory based on extrapolated data	Insufficient Data

6.5 Shellfish Harvesting Designated Use Assessment

Shellfish harvesting designated use is applicable in all waters classified as SC and SE 1 in the SWQS. Shellfish harvesting classifications are based on the National Shellfish Sanitation Program (NSSP) requirements **(**NOAA, 1997**).** This program is overseen by the federal Food and Drug Administration to ensure the safe harvest and sale of shellfish.

Data Requirements for Shellfish Harvesting Designated Use Assessment

In addition to the general data requirements provided in the Quality Assurance section, the following are specific data requirements for assessment of shellfish harvesting designated use attainment as outlined in Table 6.11 below.

[2] For dioxin, New Jersey currently uses an FDA advisory opinion issued in 1981 that is based upon the following tissue concentrations:

50 parts per trillion (ppt)	Do not eat.
25-50 ppt	One meal per month,
<25 ppt	Unlimited consumption.

Table 6.11: Data Requirements for Assessment of Shellfish Harvesting Designated Use Attainment	
Data Considerations	**Data Requirements**
Sampling Methods	All sampling methods and harvesting classifications are conducted in accordance with the NSSP Manual (NOAA, 1997)
Data Age	Most recent 5 years of readily available data
Sampling frequency	At least 15 samples collected, as specified by NSSP Manual
Spatial Extent	Shellfish harvesting classifications are available for all SC and SE1 waters

Shellfish Harvesting Designated Use Assessment Method

The adopted shellfish harvesting classifications are included in the NJ SWQS by reference in N.J.A.C. 7:9B-1.12(g). Based on sampling data and assessment procedures in the NSSP manual, waters are classified for unrestricted harvest, special restricted, seasonal or prohibited. Prohibited areas are further classified into waters where shellfish harvest is prohibited due to poor water quality or administrative closures.

Administrative closures are established in areas around potential pollution sources, such as sewage outfalls and marinas. These areas are closed as a preventive measure to protect shellfish from contamination in areas immediately adjacent to the 15 sewage outfalls in the ocean and from an emergency such as a sewage bypass or a break in an outfall pipe. In marinas, prohibited areas are established to protect human health from contamination from boat wastes and runoff. Where closings are based on land use (i.e. marinas, STP outfalls etc.) and there is insufficient water quality data to assess attainment, these areas are identified as not assessed. Where closings are based on land use but there is sufficient data to assess attainment, these areas will be assessed. This assessment methodology (Table 6.12) is consistent with the USEPA's guidance on the use of shellfish classifications in 303(d) decisions which states that waters classified "Prohibited" due to administrative closures should not be classified as impaired if data are not available to document an impairment. (USEPA, 2000).

Table 6.12: Shellfish Harvesting Designated Use Assessment Method		
Shellfish Harvesting Designated Use Assessment	**NSSP Classification**	**Result**
Geometric mean of total coliform was less than or equal to 70 MPN per 100 milliliters (ml) and the estimated 90th percentile was less than 330 MPN per 100 ml	Approved	Full Attainment
Geometric mean of total coliform was greater than 70 MPN per 100 ml but less than or equal to 700 MPN per 100 ml and the estimated 90th percentile was less than 3,300 MPN per 100 ml	Special Restricted or Seasonal	Non Attainment
Geometric mean of total coliform exceeded 700 MPN per 100 ml and the estimated 90th percentile was greater than 3,300 MPN per 100 ml	Prohibited	Non Attainment
Administrative Closure with insufficient data for assessment	Prohibited	Insufficient Data
Administrative Closure with sufficient data and geometric mean of total coliform was less than or equal to 70 MPN per 100 ml and the estimated 90th percentile was less than 330 MPN per 100 ml	Prohibited	Full Attainment
Notes: MPN: most probable number (of total coliform bacteria) *Approved* waters are harvestable without restriction. *Seasonal* waters that are open seasonally typically opened in the winter. *Specially Restricted* shellfish require additional treatment (relay or depuration) prior to harvest. *Prohibited* waters that are closed to the harvesting of shellfish.		

6.6 Drinking Water Supply Designated Use Assessment Method

Drinking water designated use that fully meets SWQS is defined as waters that are potable after conventional filtration treatment and disinfection, and do not have consistent removal issues for chemical constituents. Drinking water designated uses apply to surface waters classified as Pinelands (PL), Freshwater Category 2 (FW2), and DRBC Zones 2 and 3. It is important to note that many waterbodies do not have drinking water intakes due to stream size and other considerations.

Data Requirements for Drinking Water Supply Designated Use Assessment

Human health based water quality criteria protect human health exposure to carcinogens and noncarginogenic toxics through the consumption of drinking water. Chemicals addressed through numeric human health criteria include metals, organics, and nitrate. Assessment methods based on numeric surface water criteria are described in Section 4.0. In addition to the numeric SWQS criteria, the Department uses monitoring data from treated or finished water supplies to determine compliance with the Safe Drinking Water Act's National Primary Drinking Water Regulations (NPDWRs or primary standards) and water supply use restrictions. Pollutants monitored for the protection of human health under the primary standards include volatile organic compounds, semi-volatile organic compounds, inorganic constituents, salinity, radioactive constituents, and disinfection by-products. Use restrictions include closure, contamination based drinking water supply

advisories, more than conventional treatment requirements and increased monitoring requirements due to confirmed detection of one or more pollutants.

Drinking Water Designated Use Assessment Method
The assessment of nitrate, as an indicator for drinking water designated use, follows the assessment method for conventional water quality parameters explained in Section 4.1. The other indicators, metals and organics, follow the assessment method for toxic water quality parameters explained in Section 4.3 and are based on the human health criteria.

The Department's Bureau of Safe Drinking Water summarizes Safe Drinking Water Violations annually. The Drinking Water Designated Use assessment method uses the data provided in these reports. Only those violations which can be attributed to surface water sources are considered. Violations for copper and lead which could be attributed to the collection system are not used for assessing source water unless the violations occur in the ambient waters. This assessment method is explained in Table 6.13 below.

Table 6.13: Drinking Water Designated Use Assessment Method

Safe Drinking Water Actions	Assessment
Closure	Non Attainment
Surface water quality is such that more than conventional treatment is required	Non Attainment
Contamination based drinking water supply advisories	Insufficient Data
Increased monitoring requirements due to confirmed detection of one or more pollutants	Insufficient Data

6.7 Industrial Water Supply Designated Use Assessment Method
Industrial water supply designated use assessment was piloted in the 2000 New Jersey Water Quality Inventory Report to waters used for processing or cooling. The Department has selected total suspended solids (TSS) and pH, a measure of acidity, as indicators for industrial water supply use.

Data Requirements for Industrial Water Supply Designated Use Assessment
The specific data requirements for assessment of industrial water designated use are described in Section 3: General Data Requirements and in Section 4.1 entitled "Conventional Parameters".

Industrial Water Supply Designated Use Assessment Method
Industrial designated uses were met if 10% or less of samples exceeded applicable criteria for pH or TSS. The assessment methodology for industrial water supply designated use is summarized in Table 6.14.

Table 6.14: Industrial Water Supply Designated Use Assessment Method	
Industrial Water Supply Designated Use Assessment	**Assessment**
Water Quality Assessment for 8 or More Samples	
10% or less of samples exceeded applicable criteria for pH or TSS	Full Attainment
Threatened Waters: Less than 10% of samples exceeded applicable criteria for pH or TSS, but degrading WQ trends indicate that more than 10% of samples are likely to exceed the criteria within 2 years	Non Attainment
More than 10% of samples exceeded applicable criteria for pH or TSS and at least two (2) samples exceed applicable SWQS, or termination as an industrial water supply	Non Attainment
More than 10% of samples exceed applicable criteria for pH or TSS, however, the only one (1) sample is exceeding criteria (out of only 8 or 9 samples)	Insufficient Data
Water Quality Assessment for 4-7 Samples	**Assessment**
All samples met applicable criteria for pH or TSS	Full Attainment
Two (2) or more samples exceeded applicable criteria for pH or TSS or termination of an industrial water supply	Non Attainment
One (1) sample exceeded applicable criteria for pH or TSS or fewer than 4 samples are available for analysis	Insufficient Data

6.8 Agricultural Water Supply Designated Use Assessment Method

Agricultural uses of surface water include irrigation and livestock farming. Agricultural designated uses are referenced in the SWQS policies.

Data Requirements for Agricultural Water Supply Designated Use Assessment

The specific data requirements for assessment of agricultural water supply designated use are described in Section 3: General Data Requirements and in Section 4.1 Conventional Parameters.

Agricultural Water Supply Designated Use Assessment Method

This assessment (see Table 6.15) applies to waters classified as FW2 and PL in the NJ SWQS. Waters classified as FW1, tidal (saline) and DRBC waters are not included. Although the SWQS are applicable to agriculture, numeric criteria specific to agricultural designated use are not included. The water quality suitable for agriculture is normally less stringent than that needed to protect aquatic life and human health. In order to evaluate water supplies that support agriculture in New Jersey, guidelines are referenced from the U.S. Department of Interior Natural Resources Conservation and other states (Follet, 1999 and Bauder, 1998). These guidelines are used to evaluate whether water supplies support common agricultural uses such as irrigation and livestock raising.

For the assessment, total dissolved solids (TDS) and salinity were selected as indicators of agricultural use. Salinity was chosen due to its adverse and immediate detrimental effects on all

agricultural practices. TDS has similar negative effects and also indicates possible contamination from runoff. The more stringent of the recommended standards for irrigation and livestock is applied in the assessment as the acceptable level to fully support agricultural use. Acceptable levels for total dissolved solids and salinity were established as at or below 2,000 mg/l (Follet, 1999). If TDS or salinity data are not available, specific conductance is used as a surrogate with a specific conductance of 3,000 us/cm approximately equivalent to TDS and salinity levels of 2,000 mg/l (United Nations, 1985). Toxics are also a primary concern for agricultural uses, however, the state's criteria for toxics apply to human health and aquatic life protection which are more stringent than the criteria needed for agricultural use. Several other states have established criteria for agricultural uses and further research will be done to evaluate the feasibility of applying their criteria to our state water quality for agricultural uses.

Note: Crops and livestock may be negatively affected by numerous non-water factors such as type of livestock, crop tolerance, soil type, drainage, irrigation methods and management. Therefore exceedances of these guidelines does not necessarily impair uses for agriculture. On the other hand, concentrations below these limits may restrict agricultural use in certain circumstances. Therefore, the designated use assessment of "non attainment" is applied only when a water supply no longer supports existing agricultural uses.

Table 6.15: Agricultural Designated Use Assessment Method for Rivers and Streams

Assessment	Result
Water Quality Assessment for 8 or More Samples	
TDS greater than 2000 mg/l or Salinity greater than 2000 mg/l in 10 % or less of samples	Full Attainment
Threatened Waters: Meets full support but degrading water quality trends indicate full support will not be attained in 2 years	Non Attainment
TDS greater than 2000 mg/l or Salinity greater than 2000 mg/l in more than 10% of samples and at least two (2) samples exceed applicable SWQS	Non Attainment
Termination of use, due to water quality, as an agricultural supply.	Non Attainment
TDS greater than 2000 mg/l or Salinity greater than 2000 mg/l in more than 10% of samples , however, only one (1) sample exceeds applicable SWQS	Insufficient Data
Water Quality Assessment for 4-7 Samples	
TDS less than 2000 mg/l or Salinity less than 2000 mg/l in all samples	Full Attainment
TDS greater than 2000 mg/l or Salinity greater than 2000 mg/l in two (2) or more samples	Non Attainment
TDS greater than 2000 mg/l or Salinity greater than 2000 mg/l in one (1) sample or fewer than 4 samples	Insufficient Data

7.0 Spatial Extent of Assessments

Spatial extent is a representation of a waterbody associated with a sampling site. For example, the sampling station, 01403300, is located on the Raritan River at Queens Bridge in Bound Brook. The spatial extent for this site is calculated as 5 miles upstream and 4 miles downstream of the sampling site on the Raritan River. This stretch of river represents the assessment results from the sampling site; in other words, spatial extent is associating a single sampling point to a waterbody such as river stretches and applying the assessment results to this waterbody. With this technique, the Department has the capability to apply assessment data to many uses including the ability to observe which waterbodies in the state meet designated uses, do not meet designated uses, or have insufficient data to make an assessment

The USEPA recommends that assessment results should be coded to waterbody segments using either Reach File 3 (RF3), the new National Hydrography Database (NHD), or polygon coverages depicting large waterbodies such as lakes and estuary waters. RF3 and NHD contain segment codes that provide a waterbody address and segment length for streams, lakeshores and coastlines. Lakes, estuary, and ocean waters are depicted as polygon areas using coverages created by the Department and also provide waterbody names and area sizes. The Department is currently using RF3 for hydrography but is in the process of transitioning to NHD.

7.1 Spatial Extent Method for Streams.

The Department and the USGS developed this spatial extent method for benthic macroinvertebrate assessments, conventional water quality parameters, and toxics assessments for all streams in the state. The goal of this spatial extent method is to maximize the use of monitoring data without overestimating the geographical extent the data represents.

Estimation of spatial extent is based on hydrology using the widely accepted Strahler stream order system. Strahler defines headwaters with no tributaries as a "1st order stream". A "2nd order stream" is formed when two 1st order streams converge. Stream order changes when two or more streams with the same stream order converge. Two 2nd order streams converge to create a 3rd order stream. Stream order does not change if a lower order stream converges with a higher order stream. If 2nd or 3rd order streams converge with a 4th order stream, the 4th order stream continues until it converges with a 4th order or higher stream. Strahler stream order is depicted in Figure 4.

Generally, Strahler stream order increases with flow and watershed size and indicates when flow from incoming tributaries is likely to be significant enough to change water quality. Strahler stream order, size of the watershed draining to the monitoring site, land use/land cover, impoundments, and station type (for stations in the redesigned ASMN) were used to determine the upstream and downstream extent of monitoring. The different types of spatial assessment for waterbodies are explained below:

- Monitored Waters: are reaches immediately adjacent to the monitoring site and will be used in assessment for sublists 1 through 5 given the higher degree of confidence in the assessment results. (These waters directly represent monitoring site data assessment results.)
- Estimated waters*:* are extrapolated from monitored waters based on land use. Estimated waters, given the lower degree of confidence, will, when coupled with monitored waters, be placed on the Sublist as determined by the monitored waters.
- Unassessed waters: are waters that can not be evaluated with available data.

7.1.1 Spatial Extent of Chemical and Toxic Assessments

The following method was developed to estimate spatial extent of the Ambient Stream Monitoring Network (ASMN). The redesigned ASMN includes 4 monitoring station types selected for a specific purpose: 1) background, 2) land use indicator, 3) watershed integrator, and 4) Statewide status. This spatial assessment is tailored to each type of monitoring station type. See Appendix IV for description of network and station types.

This method is used to estimate the spatial extent of stations sampling conventional water quality parameters and toxics. The spatial extent of monitoring sites considers: 1) stream order of the reach on which the monitoring site is located; 2) presence of impoundments greater than 50 acres; and 3) surrounding land use/land cover. The maximum length of any stream reach is 25 miles based on the USEPA guidance.

The Strahler stream order of the tributaries to the monitored reach and the size of the tributary watersheds are considered to estimate the upstream and downstream spatial extent. In general, the spatial extent is terminated at the confluence of a tributary that is one stream order lower than the monitoring site, equal to, or a higher stream order than the monitoring site. Lakes greater than 50 acres may have significantly different water quality above and below the lake, therefore, the spatial assessment type changes from monitored to estimated at these waterbodies.

Water quality in streams within a dominant land use watershed is considered to be similar to the monitoring station, providing an opportunity to assess longer stream reaches per monitoring station. If one land use is present in 50% or more of the watershed, then that land use is considered dominant. If no single land use accounts for 50% of the watershed the land use is considered mixed. Land use/land cover (LU/LC) is estimated using 1995-97 data grouped into urban, agricultural, and undeveloped (forest plus wetlands). Because changes in water quality may be associated with changes in land use, LU/LC is used (as necessary) to shorten long reaches. For example, the spatial extent of assessment for the Musconetcong River is shortened because land use changes from undeveloped land in the upper portion of the watershed to agricultural in the lower portion.

The general method to estimate spatial extent of assessment for conventional water quality parameters and toxics is described below. The spatial extent of sampling sites from monitoring networks other than the NJDEP/USGS ASMN are estimated using the same method for statewide status sites.

<u>All Stations on a 3rd Order or Smaller River</u>: *Upstream* of the monitoring site, all streams are classified as monitored i.e. mainstem and tributaries in the watershed. *Downstream*, the spatial extent continues along the mainstem to the next 2nd order or larger stream, or an impoundment of at least 50 acres. (See Figure 5.)

NOTE: Criteria for determining spatial extent varies for each station type when applied to 4th order and larger streams. The following describes the spatial extent method for each type of station. Background Stations are not located on 4th order or larger rivers and therefore not discussed.

<u>Land Use Indicator Station on a 4th Order or Larger River</u>:

A. <u>Dominant Land Use</u>: If the watershed draining to Land Use Indicator (LUI) station has one dominant land use: *Upstream* of the monitoring site, the spatial extent of the assessment continues along the entire mainstem. The mainstem is classified as monitored and tributaries are estimated.

Downstream, the monitored spatial extent continues along the mainstem until there is a confluence with a tributary that is one stream order smaller, equal to, or larger than the mainstem stream, or an impoundment of at least 50 acres. See Figure 6.

B. Mixed Land Use: If the watershed draining to the LUI station has mixed land use: *Upstream* of the monitoring site, the entire mainstem is monitored but tributaries are not assessed. *Downstream,* the monitored spatial extent continues along the mainstem until there is a confluence with a tributary that is one stream order smaller, equal to, or larger than the mainstem stream, or an impoundment of at least 50 acres.

Watershed Integrator Station on a 4th Order or Larger River: These stations are located at the outlets of large watersheds and have mixed land use. *Upstream* of the monitoring site, the mainstem is classified as monitored until there is a confluence with a tributary that is one stream order smaller, equal to, or larger than the mainstem stream, or an impoundment of at least 50 acres. The spatial extent is classified as estimated from this point until there is a confluence with a tributary that is two stream orders smaller or larger than the mainstem stream, or an impoundment of at least 50 acres. *Downstream* of the monitoring site, the monitored spatial extent continues along the mainstem until there is a confluence with a tributary that is one stream order smaller, equal to, or larger than the mainstem stream, or an impoundment of at least 50 acres. Tributaries to the monitored and estimated reach are not assessed.

Statewide Status Stations on a 4th Order or Larger River:

A. Dominant Land Use: If the watershed draining to the Statewide Status station has one dominant land use: *Upstream* of the monitoring site, the entire mainstem is classified as monitored. *Downstream* the monitored spatial extent continues along the mainstem until there is a confluence with a tributary that is one stream order smaller, equal to, or larger than the mainstem stream, or an impoundment of at least 50 acres. Tributaries are not assessed.
B. Mixed Land Use: If the watershed draining to the monitoring site has mixed land use: *Upstream* of the monitoring site, the mainstem is classified as monitored until there is a confluence with a tributary that is one stream order smaller, equal to, or larger than the mainstem, or an impoundment of at least 50 acres. *Downstream* of the monitoring site, the monitored spatial extent continues along the mainstem until there is a confluence with a tributary that is one stream order smaller, equal to, or larger, than the mainstem stream, or an impoundment of at least 50 acres. Tributaries are not assessed. See Figure 7.

7.1.2 Spatial Extent of Aquatic Life Assessments (benthic macroinvertebrates)

The Ambient Biological Monitoring Network (AMNET) is the primary data source of benthic macroinvertebrate data in the state. Since local factors are likely to have a significant influence on aquatic biology, the spatial extent for each of these monitoring sites is limited in range. However the 800(+) stations in this network provide for excellent overall spatial coverage of the state.

Spatial extent of AMNET monitoring-sites considers the stream order of the reach on which the monitoring site is located; the presence of lakes greater than 25 acres; and if needed, land use/land cover information. Given the significance of local influences, tributaries are not assessed except in small watersheds (i.e., watersheds of 2nd order or smaller streams). The close proximity of AMNET stations (typically 3 to 5 miles apart) also provides an opportunity to assess stream segments between monitoring sites that have the same assessment result. The method for estimating spatial extent of AMNET stations is described below:

- Monitoring Site on a 2nd Order Stream or Smaller: *Upstream* of the monitoring site, all streams are monitored (i.e. mainstem and tributaries in the watershed). *Downstream*, the spatial extent continues along the mainstem to the next 2nd order or larger stream, or an impoundment of at least 25 acres.

- Monitoring Site on 3rd Order River: *Upstream and downstream* of the monitoring site, the spatial extent continues along the mainstem until there is a confluence with a 2nd order or larger stream, or an impoundment of at least 25 acres (tributaries are not assessed).

- Monitoring Site on 4th Order River: *Upstream and downstream* of the monitoring site, the spatial extent continues along the mainstem until there is a confluence with a 3rd order or larger stream, or an impoundment of at least 25 acres (tributaries are not assessed).

- Monitoring Site on 5th Order or Larger River: *Upstream and downstream* of the monitoring site, the spatial extent continues along the mainstem until there is a confluence with a tributary that is two stream orders smaller or larger than the mainstem stream, or an impoundment of at least 25 acres. This mainstem is classified as monitored and the tributaries to this reach are not assessed. Thus, if the monitoring site is located on a 5th order stream, the spatial extent continues upstream and downstream to the confluences with a 3rd order or larger stream.

- Estimated River Assessments: Assessments for estimated rivers were used for the following two scenarios which are shown on Figure 8. If two adjacent monitored reaches had the same assessment result and similar land uses, then the assessment was extended to close small gaps. If two or more monitored reaches with the same assessment result joined at a confluence and had similar land uses, then the assessment was extended below the confluence to the next tributary.

7.2 Spatial Extent Method for Lakes

Lakes are assessed as one waterbody and are not subdivided. Each waterbody is identified by a unique name and assigned one assessment result. If several sites are sampled in a lake with individual evaluation results, the assessment result for the lake is the aggregation of all of the sampled site results. For example, there may be several lake beaches with some assessment results being 'Full Attainment' and others "Non Attainment." The final assessment for the lake would be partially supporting recreational lake beaches which is a "Non Attainment" result.

7.3 Spatial Extent Method for Estuary Waters

Estuary waters include all tidal waters except ocean areas and tidal rivers. Spatial extent for ocean waters is explained in Section 7.4, and tidal rivers use the same spatial extent method for streams, Section 7.1. The spatial extent for estuarine waters is based largely on identifying waterbodies and patterns of sample site results. First, the estuaries are identified by unique names to identify separate waterbodies (e.g., Great Bay, Barnegat Bay, Raritan Bay, Little Egg Harbor, etc.). These waterbodies are then subdivided into smaller areas by patterns of sample site results. For biological, recreational, and conventional spatial extents, the monitored estuarine waters are delineated by identifying regional patterns through clusters of sites that are either in full attainment or non-attainment. Open waterbodies with isolated sites in violation are not assigned spatial extents. Instead the cluster of sites that most accurately represents the water quality pattern will be assigned the spatial extent of the waterbody. For example, a bay has 10 sampling sites located throughout the waterbody. If only two sites are not attaining and the remaining sites are attaining then the regional pattern in the bay is fully attaining. Isolated sites are defined as one or two sites surrounded by sites

with different assessments that isolate the site or small pocket of sites. These isolated sites will not be assigned their own spatial extent Instead the waterbody will represent the assessment results from the majority of the sampling sites (See Figure 2). If clusters of similar assessment results are identified then each cluster is assigned a spatial extent (See Figure 3). The assessment and delineation of shellfish waters determined by water quality is performed by the Department's Bureau of Marine Water Monitoring.

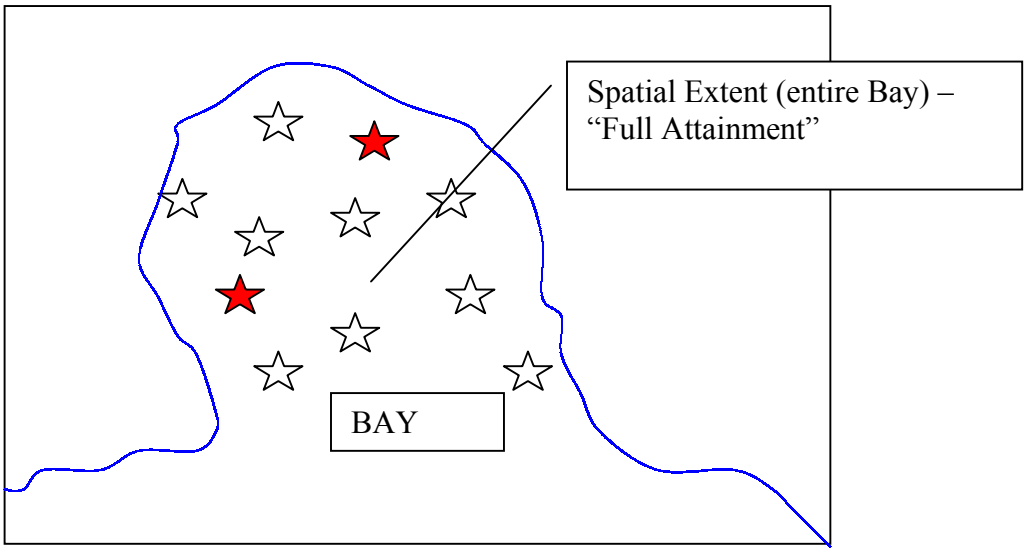


Figure 2. Spatial extent is the entire bay with a "Full Attainment" result. Dark stars are sampling sites with "Non Attainment" results, Open stars have "Full Attainment" results.

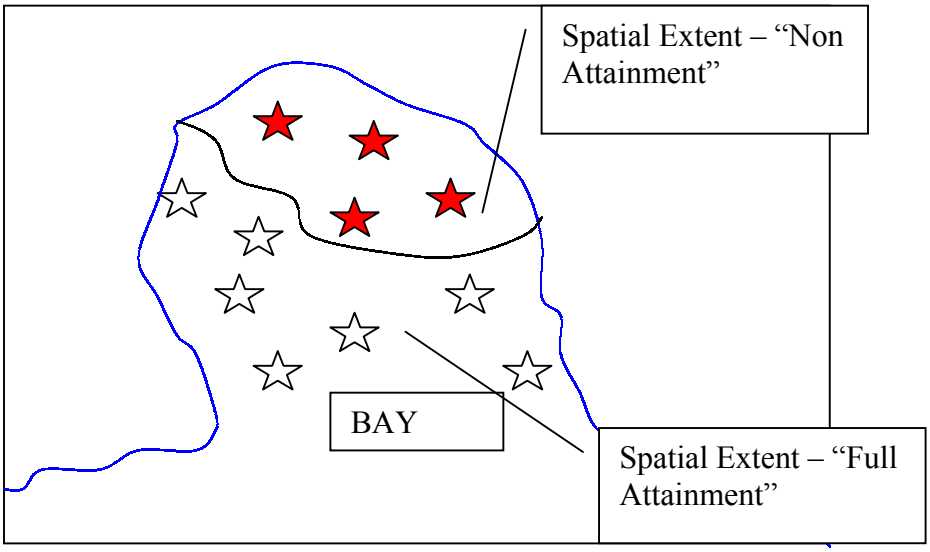


Figure 3. Clusters of sampling sites have different assessments. Bay divided into two spatial extents.
Dark stars are sampling sites with "Non Attainment" results, Open stars have "Full Attainment" results.

7.4 Spatial Extent Method for Ocean Waters

New Jersey jurisdictional waters extend from the shoreline to 3 nautical miles off the coast and from the tip of Sandy Hook to Cape May Point. Spatial extent of assessment is developed in 2 phases. First the USEPA helicopter transects subdivide the ocean waters so that each USEPA monitoring site is assigned a quadrant with each site centrally located. These quadrants cover all the near ocean waters.

The second phase overlies the monitoring sites maintained by the Department which are usually located around ocean outfall pipes and large bay inlets. Portions of the original quadrants, explained above, closest to the coast are then subdivided into near-shore regions characterized by Department sites and far-shore regions characterized by the USEPA sites. If the USEPA site indicates non-attainment then the entire quadrant is assigned non-attainment. If the USEPA site indicates full attainment but the Department's data indicates non-attainment then the miles for non-attainment should be assigned to the polygon characterized by the Department's site only. The reason for this lies in that the USEPA network focuses on benthic anoxia which is very extensive along the NJ coast at certain times of the year. The Department's sites in contrast, characterize surface anoxia, which appears to be much less extensive spatially.

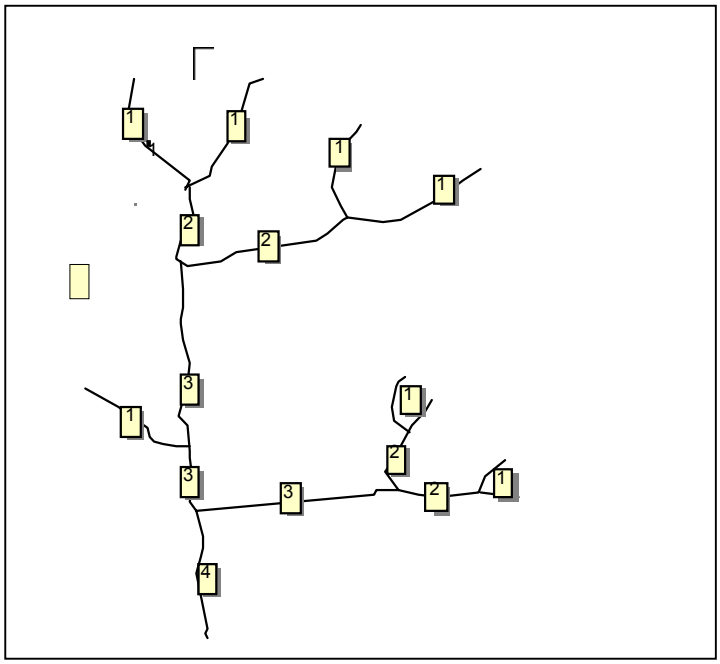


Figure 4. Strahler Stream Order. (Boxes indicate stream order).

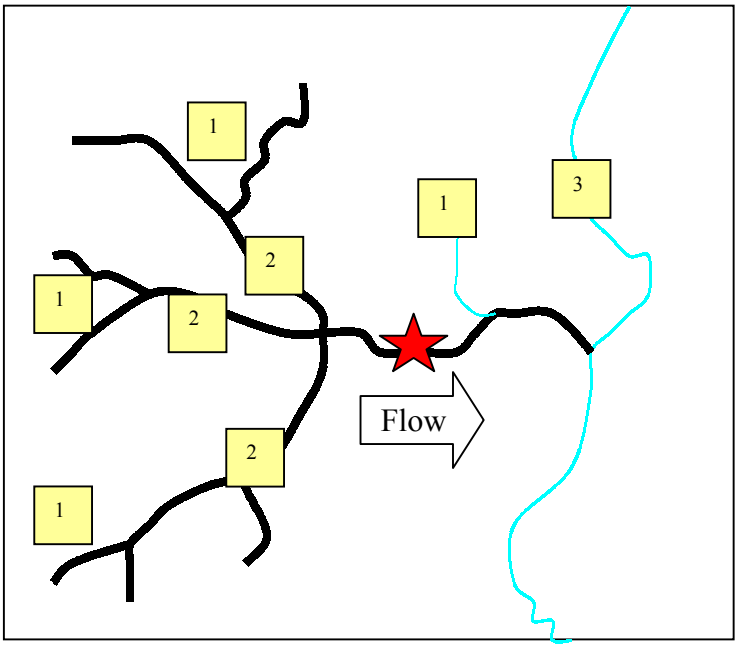
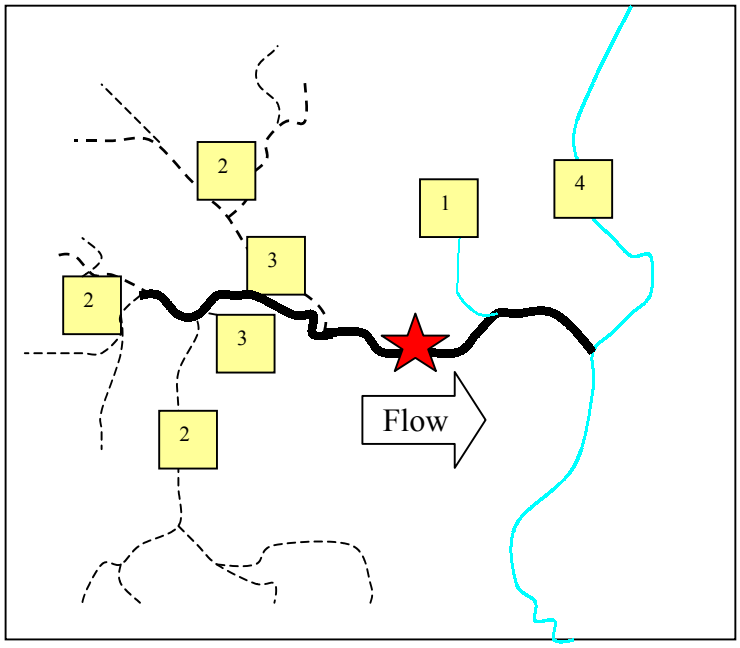


Figure 5. Spatial extent of a chemical monitoring site located on a 3rd order stream.
Dark rivers are monitored while lighter rivers are not monitored.



Boxes indicate stream order.
Star represents sampling station.

Figure 6. Spatial extent of a monitoring site (land use indicator in dominant land use) located on a 4th order stream. Heavy dark lines are monitored, dashed dark lines estimated, and light lines are not monitored. Boxes indicate steam order, Star represents sampling station.

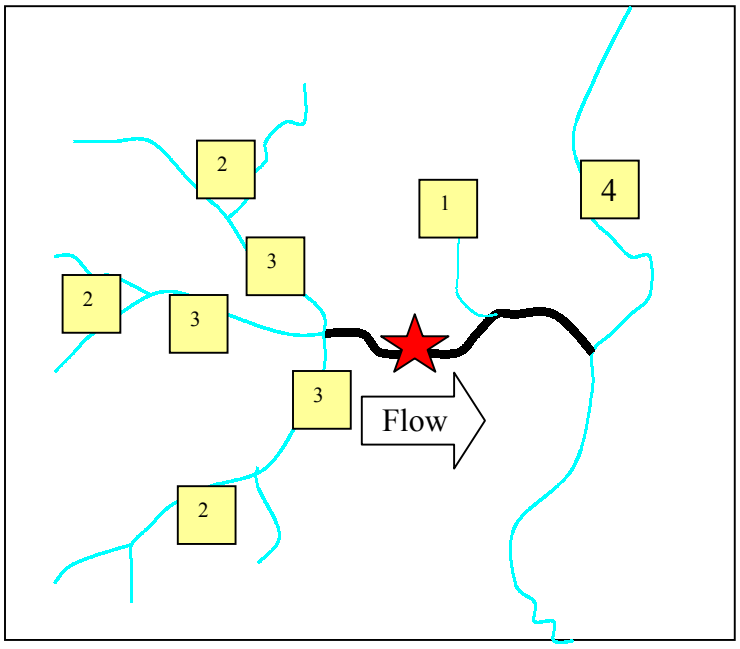


Figure 7. Spatial extent of a monitoring site (statewide status in mixed land use) located on a 4th order stream. Dark rivers are monitored while lighter rivers are not monitored. Boxes indicate stream order. Star represents sampling station.

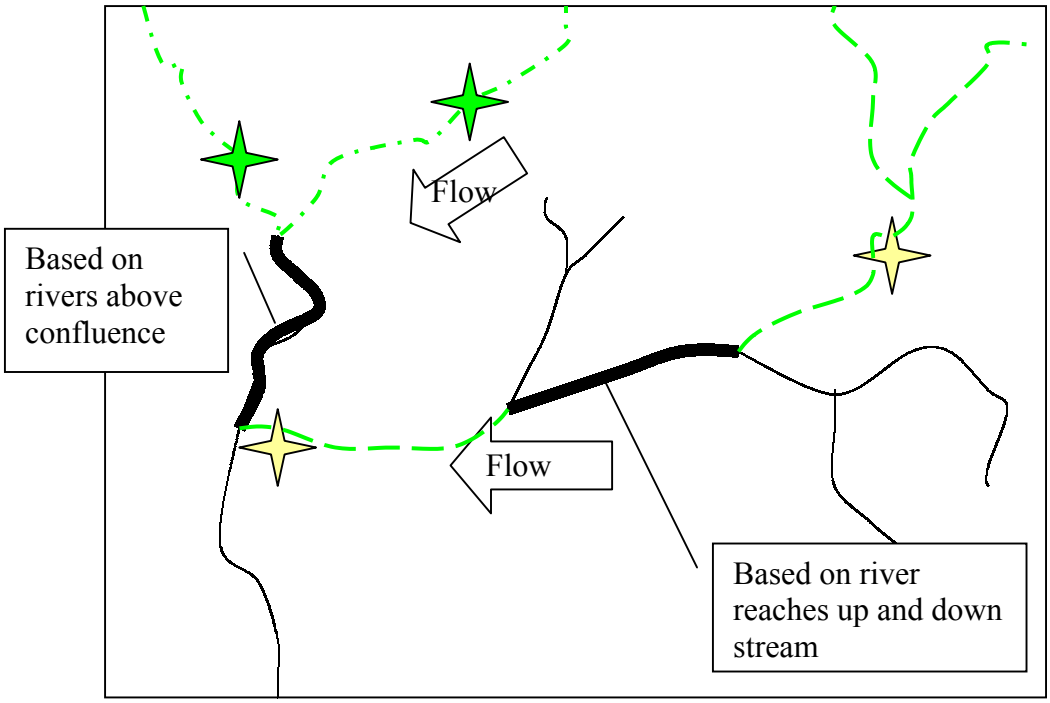


Figure 8. Example of estimated river reach based on biological monitoring sites. Large, dark lines represent estimated river reaches. Stars represent biological monitoring sites with dark stars = "Full Attainment" and light stars = "Non Attainment." Dashed lines represent monitored river reaches. Small, dark lines represent non assessed river reaches.

8.0 Integrated Listing Guidance Method

The USEPA Guidance for developing Integrated Reports (USEPA 2001, USEPA 2003) of water quality and listings of impaired water segments recommends placing the assessment results into one of five specific categories. The USEPA's Guidance defines the five categories in which a waterbody may be placed. Briefly, those categories are:

Category 1: Attaining a water quality standard and no use is threatened.
Category 2: Attaining some of the designated uses; no use is threatened; and insufficient or no data and information is available to determine if the remaining uses are attained or threatened.
Category 3: Insufficient or no data and information to determine if any designated use is attained.
Category 4: Impaired or threatened for one or more designated uses but does not require the development of a TMDL. (Three Categories).

A. TMDL has been completed.
B. Other enforceable pollution control requirements are reasonably expected to result in the attainment of the water quality standard in the near future.
C. Impairment is not caused by a pollutant.

Category 5: The water quality standard is not attained. The waterbody is impaired or threatened for one or more designated uses by a pollutant(s), and requires a TMDL.

8.1 Integrated Listing Methodology

The Department had considered using the USEPA's categories as outlined in the guidance. (Note: The Department has chosen to use the term "sublist" rather than "category" when referring to the 5 parts of the Integrated List to eliminate confusion between the Category 1 of the Integrated List and Category 1 waters under Surface Water Quality Standards (SWQS)). This would have listed each waterbody only once according to the waterbody's worst assessment. As noted in the Introduction, under the USEPA guidance, a waterbody can be included in only one of the 5 sublists (i.e., the sublist that conveys the highest degree of impairment) as a result of the integrated assessment. Thus, if a waterbody meets all applicable surface water quality standards except fecal coliform, the waterbody would be included only in Sublist 5 - *"Water quality standard is not attained and a TMDL is required"* - until the fecal coliform TMDL is completed, even though all other water quality standards are met. Since this approach may result in an overly negative view of water quality, the Department has chosen to develop the Integrated List by waterbody/parameter combinations, not just by waterbody. This will enable the Department to present each parameter for each waterbody in the appropriate sublist. This results in the possibility of a waterbody being placed on multiple sublists. This also has resulted in the elimination of sublist 2 since a waterbody/parameter is placed either on sublist 1 (full attainment) or sublist 3(insufficient data).

The Integrated Listing Method provided in Table 8.1 describes how the results of the individual assessments described in Sections 4.0 and 5.0 will be integrated to determine the listing assignment for each waterbody/parameter combination. The following are important considerations associated with the Integrated Listing Method:

- Assessment of Waterbodies on Sublist 5 of the Previous Integrated List: Waterbodies included on Sublist 5 of the previous Intergrated List are re-evaluated using all existing and readily available data that meets the data requirements specified in this Methods Document. If new data are available, the waterbody is reassessed using the methods described in Section 4, 5, 6 and 7 and placed in the appropriate sublist. If no new data are available and the integrated assessment methods does not justify moving it to an alternate sublist, the

waterbody will continue to be assessed as "non-attainment" and remain on sublist 5 as required by 40 CFR 130.7 and N.J.A.C. 7:15-6.

- Waterbodies classified as "non attainment" due to impairment or threat of impairment by one or more pollutants may be reclassified to another sublist without completing a TMDL if additional data and information indicating this classification was inappropriate becomes available by the next listing cycle.
- Results of studies conducted to further evaluate relationships between designated use attainment, policies, and applicable criteria may be used to develop site-specific or watershed-specific criteria, clarify designated uses or reclassify waterbodies to another sublist without completing a TMDL. For example, studies to evaluate relationships between designated uses, nutrient policies and total phosphorus criteria are anticipated in some waterbodies that do not meet the numerical criterion.
- The USEPA guidance (USEPA, 2001) requires a TMDL only when the cause of the impairment is a pollutant (see Sublist 5). If the impairment is caused by pollution and not a pollutant, the waterbody will be placed in Sublist 4. Pollutant is defined in the CWA as "spoil, solid waste, incinerator residue, sewerage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal, and agricultural waste discharged into water". Pollution is defined as "the man-made or man-induced alteration of the chemical, physical, and radiological integrity of a waterbody". The definition of "pollutant" in the CWA includes a number of listed materials and categories of materials. The alteration of water flow and aquatic habitat are not among the items specifically identified as a pollutant, and also does not correspond with any of the general categories of pollutants, such as industrial and agricultural wastes. In addition, the USEPA, in its comments on Idaho's 303(d) list, agreed that the alteration of flow and habitat are not pollutants. Therefore, New Jersey will not identify these as pollutants or list waterbodies that are impaired solely as a result of flow or habitat alteration. Although flow and habitat alterations may not be appropriate for TMDL calculations, they are still important factors affecting water quality and should be addressed appropriately under other water quality programs.

Table8.1: Integrated Listing Method		
Assessment	**Integrated Assessment**	**Sublist**
Full Attainment	SWQS criteria or designated use assessment is complete and results for the assessment indicated Full Attainment.	**Sublist 1:** Attaining SWQS
Insufficient Data	Results of SWQS criteria and designated use assessments indicated "Insufficient Data"	**Sublist 3:** Insufficient or no data and information to determine if designated use or SWQ criteria is attained.
Non Attainment	SWQS criteria or designated use assessment is complete and results for the assessment indicated Non-Attainment or threatened for a pollutant.	**Sublist 4a**: TMDL adopted in New Jersey Register and approved by the USEPA **Sublist 5:** The water quality standard or designated use is not attained or is threatened and requires a TMDL
Non Attainment	Non Attainment due to pollutants, other enforceable strategies being used to restore attainment status.(i.e. watershed management, non-point source controls, lake restoration plan, permitting, enforcement, finance, site remediation and other relevant water quality improvement projects)	**Sublist 4b:** Document water quality improvement strategies and expected time frame of SWQS attainment
Non Attainment	Non Attainment due to pollution, including impoundments, flow alterations, habitat degradation or the cause is unknown	**Sublist 4c**: The cause of impairment could reasonably be determined and was attributed solely to pollution.
Non Attainment	The cause of impairment (pollution/pollutant) could not reasonably be determined.	**Sublist 5**: Additional studies will be done to determine the cause of impairment.

8.2 Determining Causes and Sources of Impairment

In making 305(b) water quality/use support assessments, the primary focus is the evaluation of existing data and information. Some of that information may include knowledge of conditions known or likely to cause impairment. Many times, however, ambient data, especially biological data, may indicate an impairment but the cause and source are unknown. In other cases, monitoring staff may have knowledge of particular discharges or land use conditions that could potentially cause impairment, but do not have the specific information or resources to conduct a thorough investigative study to verify causes and sources. Therefore, for the vast majority of impaired waters listed in the Integrated Report, the causes and sources indicated are the best estimations of staff. Once a waterbody or segment is designated for TMDL development, however, a more thorough investigative study will be conducted to determine possible causes and sources of impairment. These investigations may include more intensive ambient water quality sampling, aquatic toxicity studies, sediment or fish tissue analysis and/or dilution calculations of known discharges. In some cases the determination of causes and sources may not be possible

8.3 Delisting

For waters listed on previous 303(d) Lists, there are several possible scenarios that may result in a waterbody being removed from a 303(d) list (Sublist 5). Some scenarios that could result in the removal of a waterbody from sublist 5 follow:

1. A determination is made that the waterbody is meeting water quality standards (i.e., no TMDL is required). For example:
   - **A.** An error was made in the initial listing causing an erroneous listing;
   - **B.** New Information: More recent and/or more accurate data which meets the QA/QC requirements identified in Section 3.2 of this Methods Document demonstrates that a designated use or SWQ criterion is being met for the waterbody (with or without a TMDL). See additional information regarding metals data in Section 8.3 below;
   - **C.** Revisions to the SWQS may cause a waterbody to come into compliance with standards or no water quality standard exists.

2. Reassessment of available information or data: Waterbody listed on previous 303d list is based on data, which is insufficient to meet current data quality requirements. Some examples:
   - **A.** New Macro-Invertebrate Protocol: Macroinvertebrate data had been collected under conditions not calibrated to reference conditions specified in the sampling protocol. See Section 6.1 and Table 6.5 for detailed information
   - **B.** Criterion not measurable.
   - **C.** Sufficient data not available (i.e. frequency, number of samples or QA/QC requirements not met.
3. TMDL has been completed. A waterbody will be removed from Sublist 5 and placed in Sublist 4a once a TMDL, which is expected to result in full attainment of the SWQS, has been developed and approved by the USEPA.
4. Other enforceable pollution control requirements are reasonably expected to result in the attainment of the water quality standard in the near future. These requirements must be specifically applicable to the particular water quality problem. This includes the installation of new control equipment or elimination of discharges.
5. Impairment is not caused by a pollutant.
6. New spatial extent – When sufficient data warrants, waterbodies previously listed on a large scale may be broken down into smaller assessment units and placed in other sublists, if appropriate. Waterbodies listed based on CWA Section 304(l) and previously identified by RF1 segments will be identified by the station causing the original listing when station information is available.
7. Natural causes - Waters that exceed standards but drain wilderness or similar areas and it can be documented that there are no human contributions to the standard exceedance.

Delisting Protocol for Metals (in non-tidal waters)

An Interagency 303d Technical Workgroup including representatives from the Department, the USEPA Region II and the USGS were tasked with developing a water quality assessment procedure for metals. This workgroup developed a procedure using New Jersey's Whippany River Watershed in a pilot project as per the USEPA Region II and the Department's Memorandum of Agreement

(MOA) for TMDL development (March 13, 2000). This procedure is outlined in Appendix 2. This metals procedure will be applied in assessing the results from the previous NJ Impaired Waterbodies List and current data.

Data Requirements for the Delisting of Metals (in non-tidal waters)
In addition to the requirements provided in Section 3 (General Data Requirements) the following specific data requirements noted in Table 8.2 will be required for the assessment of metals.

Table 8.2: Data Requirements for Delisting of Metals (non-tidal waters)

Data Consideration	Data Requirements
Minimum Sampling Frequency	At least 4 samples
Data Age	The most recent 5 years of readily available data
Flow Considerations	Three (3) stable base flow samples and one (1) elevated flow sample recommended; Direct flow measurement preferred for base flow samples, USGS should calculate flows from nearby stations as needed. See Notes below.
Metal Fraction	Total recoverable (TR) and dissolved fraction (DF) as needed for comparison to SWQS; Lab filter for DF preferred.
Spatial Extent of Assessment	Determined using the method for Statewide Status Stations described in Section 6.1.2: Spatial Extent of Ambient Stream Monitoring Network Stations

Notes:
Stable Base flow: flows that are above SWQS design flows, below long term daily median flow and less than 30% change from the previous day.
Elevated flow: flows that are 10% or more above long term daily median flow.

Table 8.3: Metals (non-tidal waters) Assessment Method	
Water Quality Assessment Method for Delisting Metals (non-tidal waters)	**Assessment**
Applicable criterion is met in 3 stable base flow samples and 1 elevated flow sample, with or without application of waterbody specific DF/TR ratios; or excursions are due to natural conditions (See notes)	Full Attainment
Applicable criterion is measurable and not met in any one sample of a data set consisting of at least 3 stable base flow and 1 elevated flow samples.	Non-Attainment
One or more of the following applies: • Applicable criterion is not measurable; • Data from at least 3 stable base flow and 1 elevated flow data are not available; • TR data from the ASMN exceeds an applicable dissolved criterion; • Elevated concentrations approaching or above the criterion occurred in field or laboratory blanks	Insufficient Data
Notes: **Stable Base flow:** flows that are above SWQS design flows, below long term daily median flow and less than 30% change from the previous day. **Elevated flow:** flows that are 10% or more above long term daily median flow.	

Delisting Protocol for Phosphorus

The New Jersey Surface Water Quality Standards (SWQS) include both numeric and narrative water quality criteria for Total Phosphorus (N.J.A.C. 7:9B-1.14(c)). In FW2 freshwater lakes and streams, the SWQS state:

a) Lakes: Phosphorus as Total P shall not exceed 0.05 (mg/L) in any lake, pond or reservoir, or in a tributary at the point where it enters such bodies or water, except where watershed or site-specific criteria are developed pursuant to N.J.A.C. 7:9B-1.5(g)3.
b) Streams: Except as necessary to satisfy the more stringent criteria in the paragraph above or where watershed or site-specific criteria are developed pursuant to N.J.A.C. 7:9B-1.5(g)3, phosphorus as total P shall not exceed 0.1 (mg/L) in any stream, unless it can be demonstrated that total P is not a limiting nutrient and will not otherwise render the waters unsuitable for the designated uses.

In addition, at N.J.A.C. 7:9B-1.5(g)2, the SWQS state:

- Except as due to natural conditions, nutrients shall not be allowed in concentrations that cause objectionable algal densities, nuisance aquatic vegetation, abnormal diurnal fluctuations in dissolved oxygen or pH, changes to the composition of aquatic ecosystems, or otherwise render the waters unsuitable for the designated uses.

The Department has provided technical guidance for conducting evaluations concerning total phosphorus in the "Technical Manual for Phosphorus Evaluations For NJPDES Discharge to Surface Water Permits", dated March 2003. This document is available on the web at http://www.state.nj.us/dep/dwq/techmans/phostcml.pdf. These analyses are in accordance with the allowable demonstrations provided for in the Surface Water Quality Standards (SWQS) at N.J.A.C. 7:9(B)-1.14(c) to demonstrate whether or not TP is the limiting nutrient and whether or not TP otherwise renders the waters unsuitable for the designated uses. The results of these evaluations will be used to determine the applicability of the TP SWQS criteria.

In order to successfully demonstrate that the 0.1 mg/L phosphorus criterion does not apply, it must be demonstrated that phosphorus is not the limiting nutrient AND the designated uses would not otherwise be impaired. In this regard, the two tables below summarize the standards that must be met:

Table 8.4 USE IMPAIRMENTS DETERMINATION TRIGGERS

NUTRIENT PARAMETERS	IMPAIRMENT TRIGGERS
Diurnal Dissolved Oxygen	Applicable DO conditions
Periphyton Concentration (Chl a)	> 150 mg/m^2 Seasonal Mean > 200 mg/m^2 Individual Sample
Phytoplankton Concentration (Chl a)	>24 µg/l Seasonal Mean > 32 µg/l 2 week mean

Table 8.5 LIMITING NUTRIENT DETERMINATION TRIGGERS

IF [DRP] $\geq$ 0.05 mg/l

OR TIN/DRP $\leq$ 5

THEN phosphorus can be excluded as the limiting nutrient

(where DRP=Dissolved reactive Phosphorus and TIN=Total Inorganic Nitrogen)

9.0 Method to Rank and Prioritize Impaired Waterbodies

Section 303(d) of the Federal Clean Water Act requires states to rank and prioritize impaired waterbodies (i.e., waterbodies in Sublist 5). The goal of priority ranking is to focus available resources on the right waterbodies at the right time, in the most effective and efficient manner, while taking into account environmental, social and political factors. The Department will prioritize and rank individual listings identified in Sublist 5 dependent upon the following factors:

- Parameter of concern
- TMDL complexity
- Status of parameter with respect to actively produced or legacy
- Additional data and information collection needs
- Sources of the pollutants
- Severity of the impairment or threatened impairment
- Spatial extent of impairment
- Designated uses of the waterbodies
- Efficiencies of grouping TMDLs for waterbodies located in the same watershed or for the same parameter of concern
- Efficiencies related to leveraging water quality studies triggered by NPDES permit renewals.
- Status of TMDL currently under development
- Timing of TMDLs for shared waters
- General watershed management activities (e.g. 319 grant activities and watershed management planning)
- Other ongoing control actions that will result in the attainment of SWQS (e.g. site remediation activities)
- Existence of endangered and sensitive aquatic species
- Recreational, economic, cultural, historic and aesthetic importance
- Degree of public interest and support for particular waterbodies.

Parameters of concern will also be a basis for prioritization and ranking. Parameters that relate directly to human health issues rank “high”, while more conventional water quality parameters rank “medium” and aquatic life considerations rank “low”. Table 9.1 below lists the parameters of concern and their relative ranking.

Table 9.1: Criteria for Ranking Waterbodies by Pollutants of Concern

Pollutant of Concern	Priority	Reason for Priority
Fecal Coliform in streams	High	Direct human health issues.
Metals, Toxics and Organics	High	Direct human health issue. Important aquatic life issue.
Nitrate	High	Direct human health issue.
Phosphorous, pH, Dissolved Oxygen, temperature, total dissolved solids, total suspended solids, unionized ammonia	Medium	No direct human health issue but may have indirect effect on human health. Important aquatic life issue.
Fecal Coliform in lakes	Low	Either associated with bathing beaches, at which there are extensive controls in place (monitoring/beach closings) or at non-bathing beaches were recreational activities are more controllable than in streams.
Listings for Shellfish	Low	Managed by NSSP classifications.
Macoinvertebrates, Eutrophic Lakes, Aquatic Life	Low	Not directly related to human health issues, but are of environmental importance.

10.0 Method for Developing the Monitoring and Assessment Plan

The Integrated Report guidance (USEPA 2002) states that the States should include: 1) description of additional monitoring that may be needed to determine water quality standard attainment status and, if necessary, to support development of TMDLs for each pollutant/waterbody combination; and 2) schedule for additional monitoring planned for waterbodies.

Consistent with Section 106(e)(1) of the CWA, the Integrated Report will include a comprehensive Monitoring and Assessment Plan that describes the state's approach to obtaining data and information necessary to characterize the attainment status of all assessment units. Elements of this strategy include: a description of the sampling approach (i.e. rotating basin, fixed and probabilistic station array), a list of the parameters to be collected (i.e. physical, chemical, and biological), an approach to assess the data with respect to SWQS and spatial extent. The Integrated Report will include a schedule (both long term and annually) for collecting data and information for basic assessments and for TMDLs.

It is neither necessary nor practical to conduct site-specific monitoring of all waters to support comprehensive assessments. Various approaches will be employed to prioritize and target collection of new water quality data, assess data from available sources, and use advanced assessment tools such as spatial statistics, probabilistic monitoring and modeling to estimate water quality. Assessment of data is an important component of the Monitoring and Assessment Plan. Assessments may include the following:

- Comparing site-specific data to applicable SWQS;
- Estimating the spatial extent of monitoring;
- Conducting trends analyses or other statistical methods to evaluate changes in water quality over time and predict future water quality changes (i.e., threats to water quality);
- Identifying causes of impairment, particularly biological impairment; and
- Estimating the effectiveness of water quality improvement strategies (i.e., pollutant load reductions, flow alterations, TMDL implementation).

The schedule associated with the monitoring and assessment plan will consider the following priorities:

- TMDL planning and development;
- Identifying causes of impairment for waterbodies on Sublist 5;
- Identifying waterbodies that may be impaired by pollutants and require TMDLs;
- Monitoring and assessments for waterbodies that currently have no data or insufficient data. (Monitoring and assessments may be prioritized based on existing uses (potable supply, recreational contact, aquatic life)); and
- Continuing routine monitoring for waterbodies that are currently assessed.

It is important to recognize that monitoring and assessing each waterbody will require significant effort and can only be accomplished over the long term. Several strategies will be key to accomplishing this goal including:

- Using advanced statistical techniques to evaluate water quality in waterbodies that are not sampled based on probabilistic sampling;
- Exchanging and using data and assessments from other programs within the Department and from watershed partners;

- Expanding ongoing and planned monitoring and assessments to address data limitations identified for waterbodies on Sublist 3.

11.0 Public Participation

The Integrated Report will combine the non-regulatory Water Quality Inventory Report (305b) aspects with the more regulation-driven aspects of the Impaired Waterbodies (303d) listing procedures (i.e., only the latter triggers TMDL development). The public participation requirements of these programs are different. In general, sublist 5 of the Integrated List is considered reporting under Section 303(d) for Impaired Waterbodies and the remaining sublists (1 through 4) are considered reporting under Section 305(b) for Water Quality Inventory. Therefore, regulatory requirements identified in this section (regarding public participation, the USEPA approval and adoption of the Impaired Waterbodies List) apply only to sublist 5 waters. The Department is required under 40 CFR 130.7(b)(6) to provide a description of the methodology used to develop the list as part of the 303(d) List. This Methods Document lays out the framework for assessing data and determining which of the sublists the waterbody will be assigned to (and will be provided with the Integrated List). The entire Integrated List (Sublists 1 through 5) will be provided during the public process for informational purposes only.

Request for Data
The Department will invite the submittal of data and information for use in developing the Integrated Report. The public notice of the request for data will be published in the New Jersey Register and on the Department's website. The time period for submitting data will be specified in the public notice and will be a minimum of six months. Data submitted after the specified period will be considered in the development of subsequent Integrated Reports.

Public Notice
The Department will publish notice of the availability of the Integrated Water Quality Monitoring and Assessment Methods and Draft Integrated List in the New Jersey Register, on the Department Website, and in newspapers of general circulation throughout the State. Adjacent states, federal and interstate agencies shall also be notified, as necessary.
The public notice shall include the following:

- A summary of listed waterbody segments and relative parameters;
- A description of the procedures for comment on the proposed Sublist 5; and
- The name, address and website of the office in the Department from which the proposed Integrated List may be obtained and to which comments may be submitted.

Comment Period
The comment period on a proposed Sublist 5 (303(d)) List shall be a minimum of 30 days.

Public Hearings
Within 30 days of the publication of the notice, interested persons may submit a written request to extend the comment period for up to 30 days. If the Department determines that there are significant environmental issues or that there is a significant degree of public interest, the comment period shall be extended. If granted, notice of an extension of the comment period shall be published promptly on the Department Website.

Final Action

After the close of the public comment period, the Commissioner shall render a decision on Sublist 5 [303(d) List], which will be the final agency action. The Commissioner may:

1. Adopt Sublist 5 as proposed;
2. Adopt Sublist 5 with changes which do not significantly change the public notice regarding the proposed List; or:
3. Re-propose all or portions of Sublist 5.

When the commissioner has adopted Sublist 5, the Department will public notice the adopted list in the New Jersey Register and submit the adopted list to the USEPA for approval in accordance with 40 CFR 130.7.

Availability of Final Documents

The Integrated Report, which will include the Integrated List, monitoring needs, and schedules, TMDL needs and schedules, as well a, any other information usually included in the 305(b) Report, will be submitted to the USEPA as required by Section 305(b) of the Clean Water Act. The Department will post the availability of the Integrated Report on its web page at that time.

APPENDICES

Appendix I: Principal Water Monitoring Programs Overseen By NJDEP And Other Governmental Organizations That Provided Data And Assessments For The 2004 Integrated Report

Appendix II: USEPA–USGS–NJDEP Interagency Workgroup Assessment and Listing Methodology for Aquatic Life in Freshwater Streams

Appendix III: NJDEP-USGS Ambient Stream Monitoring Network (ASMN)

Appendix IV: List of Acronyms and Abbreviations

References

Appendix I

Principal Water Monitoring Programs Overseen By NJDEP And Other Governmental Organizations That Provided Data And Assessments For The 2004 Integrated Report

NJDEP-USGS Cooperative Ambient Stream Monitoring Network (ASMN): The New Jersey Department of Environmental Protection (NJDEP) and the United States Geological Survey (USGS) have cooperatively operated the Ambient Stream Monitoring Network since the 1970's. The data from this network have been used to identify status and trends for conventional water quality parameters, metals and recreational designated uses (fecal coliform) in freshwater, non-tidal streams as well as sediment quality.

A Quality Assurance Project Plan was developed and approved each year for the NJDEP-USGS Cooperative Ambient Stream Monitoring Network (ASMN).

In 1996 and 1997, the ASMN included 81 stations located outside of regulatory mixing zone in well mixed, non-tidal areas. Sites were located using GPS. Conventional water quality samples were collected 5 times per year; metals were collected 2 times per year at about 2/3 of the stations on a rotating basis. Samples were collected using cross-sectional, depth-integrated sample collection techniques. Beginning in 1995, modified Clean Methods sampling techniques were implemented to improve metals data quality. Concurrent measurement of stream discharge was also collected. USGS report on water quality trends was used to assess threats to water quality (USGS, 1999a).

Redesigned Ambient Stream Monitoring Network: Although the previous network was sufficient to assess general status and trends, changes were needed to provide data for water quality indicators and watershed management. The new network, which was designed by a NJDEP and USGS interagency committee, has been operating since October 1997. By using several different types of monitoring stations, the Redesigned Ambient Stream Monitoring Network is designed to answer several important questions about surface water quality.

Reference Stations: To characterize water quality in undeveloped areas, 6 reference stations have been established in the 4 physiographic regions of the state. Data from these stations will be used to evaluate degradation in developed areas and to provide additional data to support surface water quality standards.

Land Use Indicator Stations: To characterize the effects of the 2 dominant land uses in each of 20 watershed management areas (WMA), 40 land use indicator stations were selected. Drainage area, and percent of urban, agricultural, and forest from the most recent Land Use/ Land Cover data were used to select these stations. Many Land Use Indicator stations are also monitored in the Benthic Macroinvertebrate (AMNET) Monitoring Network. These data will provide insight into the biological effects of chemical pollutants, and the effects of nonpoint sources from dominant land uses on chemical and biological water quality.

Statewide Status Stations: To provide a strong statistical basis for estimating statewide water quality indicators, 40 status stations are selected. Two statewide status stations per WMA were randomly selected from the set of ~800 Benthic Macroinvertebrate Network stations to provide a probabilistic monitoring component. From 1998 to 2000 these status stations were monitored for 1 year after which 40 new stations are randomly selected to increase spatial coverage. Beginning in 2001, the status stations are monitored for 2 years before 40 new stations are randomly selected. These stations provide site-specific data at an increasing number of locations and can identify emerging issues.

Watershed Integrator Stations: Watershed integrator stations were located at the outlet of each WMA and at the outlets of larger watersheds within WMAs. The 23 watershed integrator stations will be used to characterize downstream water quality and will be assessed together with data from Coastal and Estuarine Water Quality Monitoring Network to evaluate pollutant transport to back bays.

Watershed Reconnaissance: Resources to conduct watershed reconnaissance sampling are available each year to address data needs. Watershed reconnaissance sampling has recently been used to monitor diurnal DO at a subset of ASMN stations.

Parameters: Bacteria were monitored 5 times within 30-days as recommended in the NJSWQS. Conventional water quality parameters (i.e., dissolved oxygen, nutrients, solids, and pH) were monitored at all stations seasonally, 4 times per year. Diurnal DO data were collected at a subset of ASMN stations. Flow is continuously monitored or instantaneous discharge measurements were collected during seasonal monitoring at all stations except Statewide Status stations. Monitoring at the 6 reference stations and 40 statewide status stations included one sample event per year for total recoverable metals, pesticides and volatile organic chemicals.

For both the ASMN and Redesigned ASMN, conventional water quality samples were sent to the New Jersey Department of Health and Senior Services (NJDHSS) NJ state certified laboratory; metals samples were analyzed for total recoverable (TR) metals at the USGS National Laboratory in Denver. Samples were analyzed using USEPA approved methods or equivalent USGS methods.

Data were managed in USGS's National Water Information System (NWIS) and USEPA's Storage and Retrieval (STORET) database. Raw data collected between 1/96 and 12/2000 were reported by USGS in Water Year Reports. (USGS, 1997, 1998, 1999, 2000, 2001). Electronic data are available to be downloaded from NWIS at www.usgs.gov\nwis or USEPA's STORET database at www.epa.gov/owow/STORET.

303d Evaluation Monitoring: The 303d Evaluation Monitoring, also called 303d Reconnaissance Monitoring was initiated in 1998 to provide high quality, current data regarding concentrations of total recoverable and dissolved metals in waterbodies included on the 1998 303d List for metals.

A Quality Assurance Project Plan was developed and approved. Locational data were obtained using Global Positioning System (GPS). Sites were sampled three times during stable baseflow, often for 3 consecutive days; all sites in a WMA were sampled on the same day. Total recoverable (TR) and dissolved fraction (DF) metals samples were collected using modified Clean Methods techniques. Bottom sediment samples were also collected. USGS determined when stable baseflow conditions existed and collected flow measurements on day 2 of sampling. Samples were analyzed at the New Jersey Department of Health and Senior Services (NJDHSS) NJ State certified laboratory using EPA approved methods.

Data were reviewed by NJDEP and are being entered into USEPA's Storage and Retrieval System (STORET) available at www.epa.gov/owow/STORET and are published in Preliminary Data Reports on 303d Reconnaissance Monitoring for each Watershed Management Area.

USGS National Ambient Water Quality Assessment (NAWQA): NAWQA is a water quality monitoring and assessment program carried out by the USGS designed to support national and regional needs and decisions related to water quality management and policy. The final report from the Long Island New Jersey National Ambient Water Quality Assessment (NAWQA) program was used to evaluate conventionals in freshwater non-tidal streams (USGS, 2000).

Marine and Estuarine Monitoring Program: NJDEP's Marine and Estuarine Monitoring Program was used to assess SWQS attainment, aquatic life and recreational designated uses. This monitoring network included 200 stations in tidal rivers, back bays, estuaries and inlets that were monitored quarterly for dissolved oxygen, ammonia-nitrogen, nitrate-nitrite, organic nitrogen, ortho-phosphate, chlorophyll a, Secchi depth, salinity, temperature, pH, suspended solids, fecal and enterococcus bacteria. The stations were a subset of the National Shellfish Sanitation Program stations. Data is available from the Marine Monitoring Program. Their website is http://www.state.nj.us/dep/watershedmgt/bmw/reports.htm

Ambient Biological Monitoring Network (AMNET): Aquatic life designated uses in rivers were assessed using NJDEP's Ambient Biological Monitoring Network (AMNET). This network monitored benthic macroinvertebrate organisms, including crustacean, larval insects, snails and worms, which are ubiquitous throughout the state's streams and an important component of the aquatic food web. Over 800 AMNET stations located in freshwater, non-tidal streams were sampled on a 5-year rotating schedule. Round 1 sampling was completed in the mid-1990s. Round 2 sampling conducted between 1997 and 2001 was used for this 2002 New Jersey Integrated Report. Round 3 is currently underway.

Benthic macroinvertebrate communities were examined using USEPA's Rapid Bioassessment Protocols - Level II (see EPA, 1989; NJDEP, 1992). Communities were examined for pollution tolerant and intolerant forms and the results were used to compute the New Jersey Impairment Score (NJIS). NJIS scores were used to assess aquatic life designated uses as follows: **full attainment** (non-impaired; NJIS: 24-30), **non-attainment** (moderately impaired; NJIS: 9-21 and severely impaired; NJIS: 0-6). Round 2 and 3 sampling included a qualitative assessment of stream habitat quality, which was used to compute a Habitat Assessment Score. The habitat condition provide insight into factors that contribute to biological impairment.

AMNET monitoring results are being entered into USEPA's Storage and Retrieval System (STORET) available at www.epa.gov/owow/STORET; reports are published by NJDEP's Water Monitoring Management Program (www.state.nj.us/dep/watershedmgt/bfbm)

Warmwater Fisheries Populations: Aquatic life designated use assessment in lakes was based on assessments of lake fisheries performed by the Division of Fish and Wildlife. Lakes were selected for assessment based on the Warmwater Fisheries Management Plan, which provides primary guidance for Warmwater fisheries management in New Jersey (NJDEP, 1998c).

Fish populations were sampled using electrofishing (spring or fall), shoreline seining (summer to assess fish reproduction), and/or gillnetting (fall). Conventional water quality parameters such as dissolved oxygen; pH and nutrients are recorded during the summer months when the water columns are most stratified. Fish population data were assessed by experienced fishery biologists to determine the actual or potential recreational value as a fishery and used to recommend strategies to maintain or enhance the resource.

Although the Bureau of Freshwater Fisheries is principally concerned with the recreational value of the fisheries, the assessments were based on the diversity of fish species, not only species of recreational value. Many sport fish are carnivores that depend upon an abundant and diverse forage base to support their populations. Hence, although many of these lakes are stocked, assessment results are not affected by the stocking. Individual lake assessment reports are available from the Bureau of Freshwater Fisheries by calling (908) 236-2118.

New Jersey Pinelands Commission: The Commission provided biological and chemical/physical data for streams, rivers and impoundments within the Mullica River (Zampella, R.A., et al. 2001) and Rancocas Creek (Zampella, R.A., et al. 2003) watersheds. These data are the result of the Commission's long-term environmental monitoring program designed to evaluate the consequences of the Comprehensive Management Plan for the Pinelands National Reserve. The Commission may be reached at http://www.state.nj.us/pinelands/.

Clean Lakes Program: The Clean Lakes Program was used to assess aesthetic quality of public lakes. This program was designed by USEPA to facilitate identification and remediation of eutrophic public lakes. Between 1977 and 1992, public lakes with recreational use impairments were identified by lake associations, municipalities or other entities; studies were conducted to characterize water quality and as funding was available, remediation projects were conducted. Also during the 1980's and early 1990's, NJDEP collected water quality data on a number of public lakes. The trophic status of lakes was assessed using USEPA Clean Lakes Program Guidance Manual based on total phosphorus, Secchi disk transparency and chlorophyll *a* levels (USEPA 1980). Individual Clean Lake Reports are available by calling (609) 292-0427.

USEPA Helicopter Monitoring Program: The USEPA Helicopter Monitoring Program was used to assess aquatic life and recreational designated use attainment in ocean waters. USEPA-Region 2 monitors water quality in the ocean at a series of 10 transects that extend eastward from Sandy Hook to Cape May with samples taken at 1, 3, 5, 7, and 9 mile points along each transect. This assessment was based on data collected at the 1 and 3 mile stations, which were located within New Jersey's 3-mile jurisdiction. Samples collected eight to ten times during the summer

between 1996 and 2001 were used for this Integrated Report. Parameters included dissolved oxygen and fecal coliform.

The aquatic life assessment for ocean waters was based on dissolved oxygen (DO) data collected in the USEPA Helicopter Monitoring Program. USEPA-Region 2 has found over many years of monitoring that surface DO levels are consistently acceptable (DO is at or above 5mg/l). Therefore, DO monitoring at the surface was discontinued and NJDEP assumed that surface DO is at or above 5mg/l. Current DO assessments are based on DO recorded one meter above the ocean bottom.

Fish Consumption Advisories: The presence of fish consumption advisories and bans was used to evaluate fish consumption designated use. In 1976, monitoring of fish and shellfish tissue for contaminants of concern to human health was initiated. Sampling locations were chosen to include areas where known or suspected sources of persistent bioaccumulative toxics (PBTs) might be found (e.g., PCBs, dioxin, pesticides, and mercury). These included freshwater, estuarine and marine areas important to both recreational and commercial fisheries. Data were collected primarily through research projects targeted at species and drainages where contamination was found. The Interagency Toxics in Biota Committee, with representatives from NJDEP and NJDHSS, oversees the issuance of fish consumption advisories and bans as needed to protect human health. Sampling locations and advisories are routinely listed at the NJDEP Website (i.e., www.state.nj.us/dep/fgw) and in the New Jersey Fish and Wildlife Digests.

National Shellfish Sanitation Program: National Shellfish Sanitation Program was used to assess shellfish consumption designated use. Shellfish harvesting areas are classified in accordance with the National Shellfish Sanitation Program (NSSP) through monitoring total and fecal coliform bacteria in water and shellfish at over 2,500 sites between 5 and 12 times per year and conducting sanitary surveys to identify potential pollution sources. www.state.nj.us/dep/watershedmgt/bmw/reports.htm

Cooperative Coastal Monitoring Program: The Cooperative Coastal Monitoring Program (CCMP) was used to assess recreational designated use attainment at ocean and bay bathing beaches. A Quality Assurance Project Plan is developed and approved each year prior to the start of sampling. This monitoring program is cooperatively operated by NJDEP, the New Jersey Department of Health and Senior Services (NJDHSS) and local health agencies. Ocean and bay bathing beaches are monitored weekly, with over 6000 samples collected each summer between Memorial Day and Labor Day at 179 ocean beaches and 139 bay beaches. Results are used to open and close bathing beaches to protect public health.

Lake Bathing Beach Data: The Lake Bathing Beach monitoring program was used to assess recreational designated use attainment at lake bathing beaches. The NJDHSS oversees monitoring by local health agencies at about 360 lake beaches in New Jersey. Fecal coliform data (not closure records) were provided to NJDEP for use in Lake Beach assessments. Approximately 180 of 360 beaches have been located on GIS. Lack of GIS locations precluded assessments of the remaining lakes; efforts are underway to locate these lake beaches.

2002 Integrated List Sublist 5 (303d): Waterbodies on Sublist 5 of the Integrated List of Waterbodies t were placed on one of 5 sublists based on new data and assessments; or were retained on Sublist 5 in the 2004 Integrated Report if no new data were available to update the previous assessments.

Nonpoint Source Assessment (319): The most recent Nonpoint Source Assessment was incorporated into the 2000 New Jersey Water Quality Inventory Report.

Local water quality data and information: NJDEP solicited local water quality data and information through a notice published in the New Jersey Register on February 3, 2003, and NJDEP Website. Data were accepted by NJDEP for a period of 6 months and were required to be accompanied by an approved Quality Assurance Project Plan, accurate monitoring sites locations, electronic data format, citeable report and contact information. Data that met these conditions were received from the following entities:

Monmouth County Health Department Benthic Macroinvertebrate data and ambient chemical data was collected to: support watershed initiatives; track water quality trends; obtain water quality and habitat data which could be correlated with erodible soils and land uses; and, coordinate the collection of biological data with ambient stream chemical and bacteriological monitoring. Macroinvertebrate samples were collected from Fall of 1999 through Fall of 2000. Ambient water chemistry was collected four times a year, during the months of March, June, October, and December from 1996 through 2000. Parameters included: pH, fecal coliform, TSS, phosphorus, and ammonia. Macroinvertebrate and water chemistry data are available from the Monmouth County Health Department's website at http://www.visitmonmouth.com/health/environmental/water/water.htm.

Pequannock River Coalition Diurnal temperature data were collected at 12 stations in the Pequannock River watershed during the summers of 2000 and 2001. Data is available from the Coalition at P.O. Box 392, Newfoundland, New Jersey 07435. (973-492-3212)

Hudson Regional Health Commission: The purpose of this data collection was to obtain baseline data for fecal coliform and to identify conditions which might influence concentrations such as tides, rainfall or temperature. The sampling sites were selected to represent sites publicly accessible with some recreational usage (kayaking, jet skis) Water samples were collected weekly from June 20, 2001 till October 30th for a total of 18 samples per site. One of the four sites had to be relocated after the 9/11 incident. Data are available from the Commission at 595 County Avenue, Secaucus, NJ 07094

Interstate Environmental Commission – The Commission provided fecal coliform and dissolved oxygen data for the shared waters of the NY-NJ Harbor complex. Fecal Coliform data were collected twice a week for 5 weeks (1997-2001). Information on these data can be obtained from the Commission at 311 West 43rd Street, Suite 201, New York, NY 1036. http://www.iec-nynjct.org/reports.htm

Delaware River Basin Commission has the 305(b) Report responsibility for the Delaware River mainstem and estuary. The Department incorporated the Commission's Assessments into the

Integrated Report. DRBC's 305 (b) Report can be found on their web page at http://www.state.nj.us/drbc

Water quality management plans Water *Quality Management Plans* were used to identify waters where TMDLs have been completed.

Superfund and RCRA – The Department considered data from contaminated sites in several specific instances. Five (5) waterbodies were added to the 1998 Impaired Waterbodies List as remanded by USEPA due to pollutants from contaminated sites (Federal Register Vol. 66, Number 195, Tuesday October 9, 2001). The 303d Evaluation Monitoring identified lead contamination in the Rancocas River due to activities at Fort Dix; remediation is underway. Superfund and RCRA data are not computerized and thus are generally not readily available. However, the Department is developing EQUIS database for chemical contaminants at over 8000 contaminated sites in New Jersey. Contaminated sites will be considered in more detail as the EQUIS database is populated.

Appendix II

USEPA – USGS – NJDEP Interagency Workgroup Assessment and Listing Methodology for Aquatic Life in Freshwater Streams

Background:
New Jersey's current Rapid Bioassessment Protocol (RBP) for freshwater streams (NJIS scoring system) was calibrated by EPA Region II. In doing so, EPA sampled between June and September, at sites having drainage areas greater than approximately 5 square miles. In selecting locations, EPA avoided locations under the direct influence of lakes and impoundments and also avoided sites located within the "core" Pinelands region of New Jersey.

NJDEP current 800 site AMNET monitoring program (based on USEPA's calibration) operates by sampling sites once every 5 years; typically 2 sample events per station are now available. Results are used for NJDEP's 305b Aquatic Life assessments and moderately and severely impaired sites were included on 1994, 1996 and 1998 303d Lists.

Some of the 800 sites in the AMNET program are not consistent with the calibration done by USEPA Region II. The Workgroup concluded that there is a lower degree of confidence in aquatic life assessment results from sites that are different from the USEPA calibration.

Goal of Workgroup: to apply the NJIS scoring to locations where it is best suited and to develop either refinements in the NJIS or alternative assessment methods for those sites for which the current scoring is not best suited.

Workgroup Guidelines:
- Ensure that sites on Sublist 5 on the Integrated List have the greatest likelihood of needing a TMDL.
- Ensure that sites having a high probability of not needing a TMDL are not inappropriately listed on Sublist 5, but can be moved to 5 if and when it is decided that a TMDL is appropriate.
- Ensure that unique sites are assessed using appropriate methods, thereby ensuring accurate biological assessments regardless of stream type or location.

Aquatic Life Assessment and Listing Method:
For this protocol, the most recent AMNET assessments are divided into two categories;
- higher level of confidence: conclude that either use is supported or use is not supported (Sublists 1, 2, 4, or 5 as appropriate)
- lower level of confidence: insufficient information to determine use support status (Sublist 3).

1. **Place Pinelands assessments on Sublist 3.** The low pH waters of the NJ Pinelands favor unique biological communities. The "core" Pinelands was not included in the USEPA calibration. Therefore, there is a lower degree of confidence in AMNET assessments for

Pinelands sites. Pinelands sites, regardless of assessment results, would be regarded as representing insufficient information (Sublist 3).

2. Sites outside the Pinelands that are non-impaired are assessed as representing full support in the Integrated List (Sublists 1 or 2). There is a higher level of confidence that non-impaired AMNET sites reflect attainment of aquatic life designated uses.

3. Sites outside the Pinelands that are severely impaired are assessed as representing no support status (Sublist 5). There is a higher level of confidence that severely impaired AMNET sites reflect non-attainment of aquatic life designated uses.

4. Moderately impaired sites that are outside the Pinelands and are <u>not unique sites</u> are assessed as representing no support (Sublist 5). There is a higher level of confidence that moderately impaired AMNET assessments reflect non-attainment of aquatic life designated uses for sites outside the Pinelands that are not unique sites**.**

5. Moderately impaired sites that are outside the Pinelands that are <u>unique sites</u> represent locations where there is currently insufficient data to make an informed assessment of use support (Sublist 3). Unique sites include headwaters, sites under the influence of lake outlets and sites sampled outside the season used by USEPA to calibrate the RBP II protocol for NJ. There is a lower level of confidence that these sites reflect non-attainment of aquatic life designated uses. Additional analyses are needed to ensure that these sites are accurately assessed. If a site is considered unique for any reason it will be placed on Sublist 3.

<u>Unique sites</u>:

Small Stream Size: AMNET assessments derived from sites located on small headwater streams are likely to be affected by the naturally lower community diversity that can occur at these locations. The USEPA calibration used drainage areas of approximately 5 square miles or greater and the Interagency 303d Technical Committee evaluation indicated changes in community structure in sites with drainage areas less than <u>6 square miles</u>.

Downstream of Impoundment: AMNET sites immediately downstream of impoundments are likely to be affected by natural nutrient and temperature changes that occur below the impoundment. The USEPA calibration avoided sites immediately downstream of impoundments. Currently sites within a 450 foot buffer below impoundments are categorized in this group for our purposes here; however, lake effects may occur farther downstream as a function of lake size, stream hydrology and impoundment type, but a conservative approach was taken for this assessment.

Seasonality: AMNET sites sampled between December and March may have artificially lower scores because the invertebrates are smaller and harder to sample in the winter. The USEPA calibration was based on data collected between June and September. USGS has evaluated seasonality effects for the workgroup and as a result the workgroup has established the sampling

season to be April through November (inclusive). Sites sampled between December and March will be regarded as unique.

Appendix III

Integrated Water Quality Monitoring and Assessment Method for Metals (2002)

1. Workgroup Membership

The workgroup members developed the approach for de-listing metals in the Whippany River.

Dore LaPosta, Chief, Monitoring and Assessment Branch, USEPA Region II, Co-chair
Karen Schaffer, Team Lead, Water Assessment Team, DSRT, NJDEP, Co-chair

William Bauersfeld, Chief, Data Unit, US Geological Survey - West Trenton
Kevin Berry, Water Assessment Team, DSRT, NJDEP
Randy Braun, Monitoring and Assessment Branch, USEPA Region II
Richard Coleates, Monitoring and Assessment Branch, USEPA Region II
Jacob Gibs, Water Quality Specialist, US Geological Survey - West Trenton
Nancy Immesberger, Water Assessment Team, DSRT, NJDEP
Helen Rancan, Team Lead, Watershed Modeling Team, DWM, NJDEP
Susan Schulz, Fate and Effects Team, USEPA, Region II
Joel Simpkins, Division of Water Quality, NJDEP
David Stedfast, Assistant District Chief, US Geological Survey - West Trenton
Thomas Vernam, Water Monitoring Management, DWM, NJDEP

2. 1998 Whippany River Metals Listings

The entire Whippany River mainstem was included on the 1996 Impaired Waterbodies List (NJDEP, 1997) based on information contained in Waters Impaired By Toxic Pollutants from Point Sources (NJDEP, 1990) for the following metals: Arsenic (As); Beryllium (Be); Cadmium (Cd); Chromium (Cr); Lead (Pb); Mercury (Hg); Zinc (Zn).

Status with respect to Surface Water Quality Standards was assessed for the 1998 Impaired Waterbodies List using total recoverable data collected in the Ambient Stream Monitoring Network between 1990 and 1997 (NJDEP, 1998), As discussed on pages 14 and A58, results were used to amend the listings for the Whippany River as follows:

Arsenic - retained at Morristown and Pine Brook due to minimum detection limit (MDL) issues for the Human Health (HH) criterion
Beryllium - delisted at Morristown and Pine Brook due to compliance with proposed SWQS criterion
Cadmium - retained at Morristown and Pine Brook due to method detection limit issues for chronic aquatic life (AQLc) criteria
Chromium - delisted at Morristown, retained at Pine Brook due to total recoverable concentrations above dissolved hexavalent chromium (Cr+6) AQL criteria
Copper - listed at Morristown and Pine Brook due to total recoverable concentrations above dissolved AQLc criteria
Lead - retain at Morristown and Pine Brook due to levels above HH and AQLc criteria
Mercury - retained at Morristown and Pine Brook due to MDL issues with AQLc criterion

Zinc - delisted at Morristown and Pine Brook due to compliance with SWQS criteria

3. 2002 303(d) List De-Listing Approach for the Whippany Watershed

3.1 303d Evaluation Monitoring Data

A Work/Quality Assurance Project Plan for 303d Evaluation Monitoring was approved (NJDEP, 2001b). The 304(l) listing did not specify location; Morristown and Pine Brook were used to evaluate this 304(l) listing. Total recoverable and dissolved metals data were collected at these stations under baseflow conditions using modified Clean Techniques during two sampling runs. Criteria were calculated using hardness at the time of sampling. Data and comparisons to criteria are provided in Appendix 1.

3.2 Ambient Stream Monitoring Network Data

A Quality Assurance Work Plan for the Ambient Stream Monitoring Network was approved for each year. Data collected in the Ambient Stream Monitoring Network since 1996 were evaluated to determine if samples were collected under elevated flow conditions. This network collects only total recoverable (TR) data because about 85% of metals samples collected each year are below minimum detection limits (MDL).

Total recoverable samples collected at Morristown and Pine Brook under elevated flow conditions were compared to applicable TR and dissolved fraction (DF) criteria for human health (HH), acute aquatic life (AQLa) and chronic aquatic life (AQLc). Data and comparisons to criteria are provided in Appendix 2.

3.3 2002 303d Recommendations for Whippany Watershed Metals

Results from the evaluation of the 303d Evaluation Monitoring (baseflow) data and Ambient Stream Monitoring Network (elevated flow) data were used to develop 2002 303d Recommendations for Whippany Watershed Metals which are summarized in Appendix 3.

<u>2002 303d Recommendations List for Whippany Watershed Metals</u>

Arsenic - retain at Morristown and Pine Brook due to MDL issues for HH criterion (As HH - 0.017 ug/l as TR; MDL - 1.0 ug/l); conduct low level analyses to address MDL issues.

Cadmium - delist at Pine Brook due to compliance with HH and AQL criteria; retain at Morristown due to MDL issues for AQLc criterion (lowest Cd AQLc - 0.93 ug/l as DF; MDL - 1.0 ug/l); conduct low level analyses to address MDL issues.

Chromium - delist at Pine Brook due to compliance with HH and AQL criteria

Copper - delist the Whippany River at Morristown and Pine Brook due to compliance with AQLa and AQLc criteria

Lead - Delist at Morristown due to compliance with HH and AQL criteria. Retain at Pine Brook due to exceedances of AQLc and HH.

Mercury - delist the Whippany River at Morristown and Pine Brook due to compliance with HH and AQLa; retain due to MDL issues for AQLc (Hg AQLc: 0.012 ug/l as TR, MDL range: 0.1 ug/l to 0.040 ug/l); conduct low level analyses to address MDL issues for AQLc criterion.

4. Statewide Application of the 2002 303(d) List De-Listing Approach for Metals

The approach developed for the Whippany River can be applied statewide for streams listed on the 1998 303d list for metals. The approach is described briefly below and summarized as a flow chart in Appendix 4.

For each listed reach:

Step 1: Compare final 303d Evaluation Data collected under stable baseflow conditions to applicable SWQS criteria. If criteria are met for all samples, proceed to Step 2; if criteria are not met for all samples, retain on the 2002 Impaired Waterbodies List, which will include a management strategy.

Step 2: Determine if Ambient Stream Monitoring Network data collected since 1996 were collected under elevated flow conditions. If elevated flow data are available, proceed to Step 3; if data are not available or were not collected under elevated flow, retain on the 2002 Impaired Waterbodies List and collect new data under elevated flow conditions.

Step 3: Compare Ambient Stream Monitoring Network data collected since 1996 under elevated flow conditions to applicable SWQS criteria. If criteria are met for all samples, pursue delisting in 2002. If criteria are not met for all samples, retain on the 2002 Impaired Waterbodies List and collect new data under elevated flow conditions.

Note: If criteria are below the method detection limit, collect new data under appropriate flow conditions and analyze using low level methods. For hardness dependant criteria, the needed detection limit will vary based on hardness at the time of sampling. The lowest criteria and currently achievable detection limits at the NJDHSS lab are provided in Appendix 5.

NJDEP is exploring the lowest achievable detection limits with the current laboratory (NJDHSS), the USGS-Denver laboratory, used for the Ambient Stream Monitoring Network, or a contract lab. Currently two contract labs have NJDEP certification for low level mercury analyses (MDL 0.001 ug/l). NJDEP is exploring OQA approval to use USGS-Denver Laboratory or, if needed, certification of a contract lab for low level analyses for arsenic, cadmium, copper and lead.

Note: Beryllium (Be) and iron (Fe) will be delisted statewide because there are currently no adopted SWQS criteria for these metals.

Note: Lead exceedances were the most common in the ASMN database, due in large part to comparison of TR data to DF criteria. Therefore, sites which had ASMN (TR) data above the lead criteria were selected for additional sampling. USEPA Region II agreed to sample up to 34 sites for listed metals under elevated flow conditions; samples will be analyzed at the NJDHSS or USGS laboratory. (See Appendix 6).

Appendix IV
List of Acronyms and Abbreviations

AGWQN	Ambient Ground Water Quality Monitoring Network
AMNET	Ambient Biological Network
AQLa	Aquatic Life Acute
AQLc	Aquatic Life Chronic
AU:	Assessment unit.
BMP(s)	Best Management Practice(s)
ASMN	Ambient Stream Monitoring Network
BIOS	Biological System, a component of STORET (see STORET)
C1	Category 1
CALM:	Comprehensive Assessment and Listing Methods
CCMP:	Cooperative Coastal Monitoring Program
CEHA:	County Environmental Health Act
CLP	Clean Lakes Program Phase I diagnostic studies
DF	Dissolved fraction
DFW	Division of Fish and Wildlife
DO	Dissolved Oxygen
DRBC	Delaware River Basin Commission
DRP	Dissolved Reactive Phosphorus
DSRT	Division of Science, Research and Technology
DWQS	Drinking Water Quality Standards
EQUIS	Earthsoft's EQUIS
EWQ	Existing Water Quality (network)
FC	Fecal Coliform (bacteria)
FW	Fresh Water
FW1	Fresh Water Category 1
FW2	Fresh Water Category 2
GIS	Geographic Information System
GW	Groundwater
GWIA	Groundwater Impact Areas
HE	Harbor Estuary Program
HH	Human Health
HUC	Hydrologic Unit Code
IBI	Index of Biotic Integrity
IEC	Interstate Environmental Commission (formerly Interstate Sanitation Commission)
LWQA	Lake Water Quality Assessment Reports
CWA	Federal Clean Water Act
MA1CD10	minimum average 1 day flow with a statistical recurrence interval of 10 years
MA7CD10	minimum average 7 day flow with a statistical recurrence interval of 10 years
MA30CD5	minimum average 30 consecutive day flow with a statistical recurrence interval of 5 years
MCL	Maximum Contaminant Level
MDL	Maximum Detection Limit
MPN	Most Probable Number (of Fecal Coliform bacteria)
NAWQA	National Ambient Water Quality Assessment

NJ	New Jersey
N.J.A.C	New Jersey Administrative Code
NJADN	New Jersey Air Deposition Network
NJDEP	New Jersey Department of Environmental Protection
NJDHSS	New Jersey Department of Health and Senior Services
NJIS	New Jersey Impairment Score
NJPDES	New Jersey Permit Discharge Elimination System
NJLMP	New Jersey Lake Management Program Reports
N.J.S.A.	New Jersey Statutes Annotated
NO_2	Nitrate
NRCS	National Resource Conservation Service
NSSP	National Shellfish Sanitation Program
NY	New York
ODES	Ocean Data Evaluation System
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
P.L.	Public Law (federal)
PPM:	parts per million
PPB	parts per billion
QUAPP	Quality Assurance Project Plan
RF3	River Reach File 3
RPB	Rapid Bioassessment Protocol
SC	Saline coastal
SE	Saline Estuary
SIIA	Sewage Infrastructure Improvement Act
SRP	Site Remediation Program
STORET	Storage and Retrieval, USEPA's water quality database
STP	Sewage Treatment Plant
SWAP	Source Water Assessment Program
SWQS	Surface Water Quality Standards
TCE	tetrachloroethlylene
TIBC	(Interagency) Toxics in Biota Committee
TMDL	total maximum daily load
TIN	Total Inorganic Nitrogen
TP	Total Phosphorus or Trout Maintenance
TR	Total Recoverable
TSS	Total Suspended Solids
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WATSTORE	Water Data Storage and Retrieval System, USGS water quality database
WCE	Water Compliance and Enforcement
WLA	Waste Load Allocation
WMA	Watershed Management Area
WQ	Water Quality
VOC	volatile organic compound
305(b) Report:	Water Quality Inventory Report
303(d) List:	Impaired Waterbodies List

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