New Jersey Department of Environmental Protection
Water Monitoring and Standards
Bureau of Water Quality Standards and Assessment

Draft 2010 Overview of Water Quality Conditions

"Water is the spring of life. It nurtures our bodies. It sustains our most precious natural resources." [1]

Introduction

This document presents a draft overview of the water quality conditions in New Jersey, as presented in the 2010 Integrated Water Quality Monitoring and Assessment Report. This draft overview is intended to provide information to assist with the public participation review of the draft 2010 List of Water Quality Limited Waters ("303(d) List") and the draft 2010 two-year schedule for development of total maximum daily loads (TMDLs) for waters on the 2010 303(d) List considered to be a high priority for TMDLs. Components of this summary will be included in the final 2010 Integrated Water Quality Monitoring and Assessment Report (Integrated Report) after the public participation process has concluded. The statistics presented in this summary are subject to change based upon comments received.

Introduction: What is an "Integrated Assessment"?

The federal Clean Water Act mandates that states submit biennial reports to the U.S. Environmental Protection Agency (USEPA) describing the quality of their waters. The biennial "305(b) Report" must include the status of principal waters in terms of overall water quality and support of designated uses, as well as strategies to maintain and improve water quality. The 305(b) reports are used by Congress and USEPA to establish program priorities and funding for federal and state water resource management programs. The biennial List of Water Quality Limited Waters or "303(d) List" identifies waters that are not supporting designated uses because they do not meet surface water quality standards despite the implementation of technology-based effluent limits. States must prioritize waters on the 303(d) List of Water Quality Limited Waters for Total Maximum Daily Load (TMDL) analyses and identify those high priority waters for which they anticipate establishing TMDLs in the next two years. New Jersey's 2010 Integrated Water Quality Monitoring and Assessment Report satisfies the reporting and public participation requirements of both Sections 303(d) and 305(b) of the federal Clean Water Act.

[1] NJDEP. 2007. *NJDEP Priorities and Action Plan.* "Clean and Plentiful Waters", p.18. New Jersey Department of Environmental Protection. January 2007

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

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

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

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

Water quality monitoring data used for the 2010 Integrated Assessment was generally collected between January 1, 2004 and December 31, 2008, and was used to identify high quality waters that are fully supporting applicable designated uses, lower quality waters that are not supporting designated uses, and waters for which insufficient information is available to assess water quality. The Integrated Assessment also identifies causes and sources of water quality problems so that appropriate strategies may be implemented by the State to maintain high quality waters,

improve lower water quality waters, and gather sufficient information to assess all waters of the State. The information provided in the Integrated Assessment is used by Congress, USEPA, and the State of New Jersey to establish program priorities and funding for federal and State water resource management programs for maintaining and restoring water quality, including the development of Total Maximum Daily Loads (TMDLs) for waters that do not meet surface water quality standards despite the implementation of technology-based effluent limits, as identified on the List of Water Quality Limited Waters (303(d) List).

The Results: What Does The Data Tell Us?

Monitoring of chemical constituents in the water column provides an accurate "snapshot" of conditions at the time of sampling but may fail to detect acute pollution events, such as runoff from heavy rain; non-chemical pollution, such as habitat alteration; and nonpoint source pollution. Because of the limitations of chemical monitoring, the Department supplements it with biological monitoring and evaluates data generated by both monitoring networks over a long period of time to detect water quality trends that may not be apparent by evaluating only chemical data over five-year periods.

Chemical and biological monitoring data collected between 2004 through 2008 were used to generate the Draft 2010 Status of Designated Uses by Subwatershed Report (Status Report)[2] and the Draft 2010 303(d) List of Water Quality Limited Waters (303(d) List). The Status Report contains the use assessment results for all waters of the State, grouped into 960 assessment units[3]. When assessing each designated use, the Department determines whether the use is fully supported, not supported, or not assessed. Use assessments results are as follows:

- **Drinking Water Supply:** Almost half (49%) of waters designated for the drinking water supply use fully support the use; a slight (1%) increase over 2008. Twenty-three percent did not support the use and 29% of waters designated for this use were not assessed. It should be noted that all New Jersey freshwater streams and lakes are designated for potential use as drinking water supply; however, most of the waters that do not support this use do not contain potable water intakes and are not used for drinking water purposes.
- **Recreation:** Seventeen percent of State waters fully support the recreation designated use, a slight (2%) decrease from 2008. Forty-three percent did not support the use and 40% were not assessed. TMDLs have been completed for most (80%) of the waters that did not support recreational uses because of pathogens (fecal coliform/*E. coli/Enterococcus*). It should be noted that the recreational use applies to all waters throughout the State and that the assessment of ocean bathing beaches, where most recreation occurs, are fully swimmable.

[2] Formerly referred to as the "Integrated List of Waters", "Statewide Water Quality Inventory Report" or "305(b) Report"

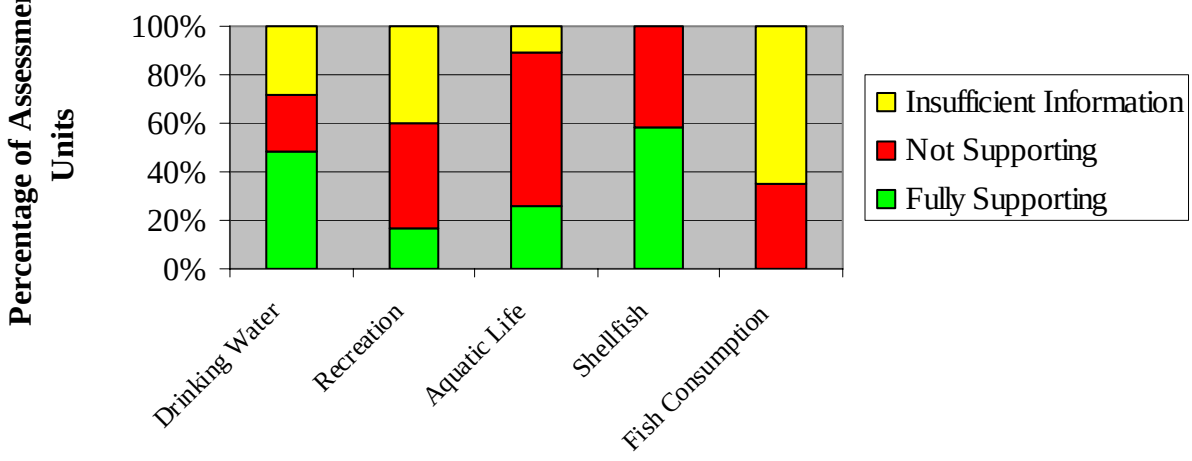
[3] New Jersey's waters are grouped for assessment purposes into hydrologically connected assessment units, which are based on United States Geological Survey (USGS) 14-digit Hydrologic Unit Code (HUC) boundaries. HUCs are geographic areas representing part or all of a surface drainage basin or distinct hydrologic feature as delineated by USGS in cooperation with the National Resources Conservation Service (NRCS).

- **Aquatic Life:** Over 25% of State waters fully support the aquatic life designated use; a slight (2%) increase over 2008. Sixty-three percent of waters did not support this use and 11% of waters designated for this use were not assessed.

- **Shellfish Harvest for Consumption:** Currently, 58% of waters designated for shellfish harvest for consumption fully support the use, a small (6%) decrease from 2008. Forty-two percent of designated waters did not support this use; however, approximately 90% of shellfish waters are classified as harvestable. This is because federal requirements for shellfish classification provide three categories of harvestable shellfish: "approved (with no restrictions), seasonal harvest, and special restrictions. All three of these categories are considered "harvestable" but under federal water quality assessment guidelines, only shellfish waters approved without restriction ("approved") are considered to fully support the designated use. Approved waters comprise 80% of classified shellfish waters. TMDLs have been developed for most (75%) of waters that do not support the shellfish harvest for consumption use.

- **Fish Consumption:** None of the waters assessed for fish consumption fully support the use, the same as in 2008.Thirty-five percent of waters designated for this use did not support the use, and 65% were not assessed. While the Department used fish tissue data where available, most of the State's waters were assessed based on fish consumption advisories. Consumption advisories may restrict the amount and/or the type of fish consumed and there may be different advisories for high-risk populations and the general public. The Department issues both statewide and waterbody-specific advisories for the general population and for high-risk groups including infants, children, pregnant or nursing mothers, and women of childbearing supported because health advisories will continue to be issued limiting consumption of fish contaminated by legacy pollutants such as mercury and PCBs.

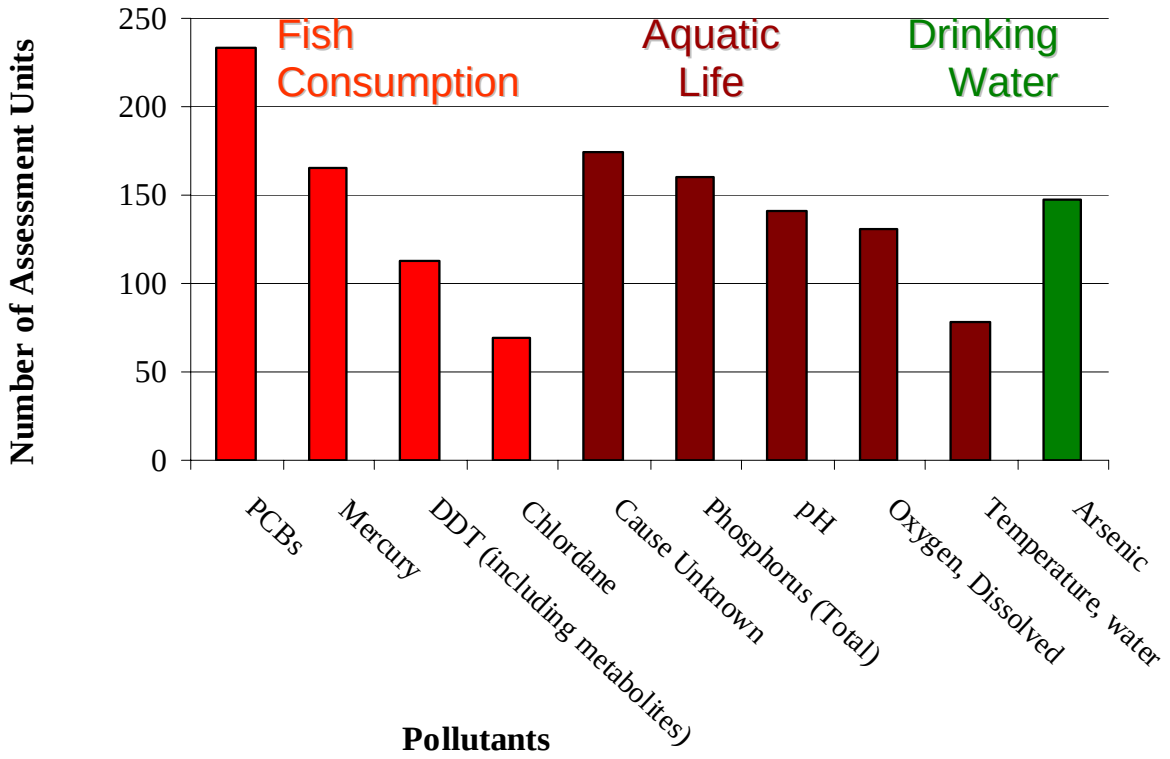
Figure 1: Draft Use Assessment Results 2010



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

The 2010 303(d) List identifies 38 pollutants causing water quality impairment in one or more assessment units, of which 174 are attributed to "cause unknown" for a total of 1,848 listings. In comparison, the 2008 303(d) List, adjusted for direct comparison of pollutants, identified 39 pollutants causing water quality impairment in one or more assessment units, resulting in 2,030 assessment unit/pollutant combinations, 189 of which were attributed to "cause unknown".

Figure 2: Draft Top Ten Pollutants on The 2010 303(d) List



The top ten pollutants identified on the 2010 303(d) List are responsible for over 75% of the total listings, as shown in Figure 2. Most of the top ten pollutants are associated with the fish

consumption use (PCBs, mercury, DDT and metabolites, and chlordane). Ninety-eight assessment units listed for mercury on the 2008 303(d) were delisted in 2010 because the Department adopted a statewide TMDL for mercury in 2009. Ten of these assessment units are being delisted because the level of mercury in fish tissue meets the water quality target established in the TMDL. The other top ten pollutants ("cause unknown," total phosphorus, dissolved oxygen, pH, and temperature) are associated with aquatic life uses. The only top ten pollutant associated with the drinking water supply use is arsenic.

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

An analysis of water quality trends over a longer period of time was conducted in 2010 by the U.S. Geological Survey (USGS) by evaluating key indicator parameters, including: dissolved oxygen (DO), pH, total dissolved solids (TDS), total phosphorus (TP), total organic nitrogen plus ammonia, and dissolved nitrate plus nitrite (nitrate), collected at 70 sampling stations located in various physiographic regions and land use types throughout the State between 1998 and 2007. These chemical constituents were selected for trends analysis because of their role in eutrophication as well as overall water quality. Water bodies affected by eutrophication (i.e., excessive primary production) are characterized by significant algae and weed growth and episodes of low dissolved oxygen. Nitrate is a readily available form of nitrogen taken up by organisms and plants as a nutrient. Phosphorus is also readily used by aquatic plants as a nutrient. Together, these nutrients are principally responsible for the growth rate of aquatic algae and vegetation. Low dissolved oxygen episodes occur when algae die off, and bacteria consume the dissolved oxygen in the process of decomposition. Dissolved oxygen (DO) is necessary for almost all aquatic life; consequently, concentrations of DO in water provide a good indicator of the health of aquatic ecosystems. Under low DO conditions, fish are more susceptible to other pollutants, such as metals and toxics; at very low DO levels, trace metals from sediments are released into the water column. USGS coupled the results of the 1998-2007 trend analysis with results from the 1984-2004 trend analysis to produce a long- term perspective of water quality constituents from the 1980's to the present. The full report is available on the USGS Web site at http://pubs.usgs.gov/sir/2010/5088/.

The 1998 to 2007 trend analysis results show that water quality conditions remained relatively stable (i.e., no trend observed) for all constituents except TDS, nitrate, and TP. TDS and nitrate results over this time period indicate declining conditions, while TP results indicate overall improving conditions - even though TP is still one of the top ten most frequent pollutants on the 2010 303(d) List. If we look at only the aquatic life use, TDS would be in the top ten as well.

TDS is comprised of minerals and other substances dissolved in water. Changes in TDS can affect organisms by altering the flow of water through cell membranes, which can retard growth or even cause death. These changes can make water less fit for other uses. TDS exceedances have been associated with runoff from urban and agricultural areas, including runoff of salt used to control ice on roadways. Discharges from wastewater treatment facilities, including septic systems, can also contribute to increased TDS loadings. These TDS trends represent all types of

land uses (urban, agricultural, mixed, and undeveloped) and physiographic regions. Although dissolved solids come from both point and nonpoint sources, road salting and improper salt storage are major contributors of this constituent.

There has been an effort to reduce the levels of the toxic form of ammonia from wastewater. In doing so, nitrate levels were correspondingly increased as ammonia levels declined (nitrate is a byproduct of ammonia oxidation). The resulting higher instream nitrate concentrations may contribute to eutrophication, along with phosphorus. (It should be noted that the few nitrate listings on the draft 2010 303(d) List are associated with the drinking water use, not aquatic life.)

Phosphorus is often considered the "limiting nutrient" in freshwater, governing the rate of growth of aquatic plants and algae. While both phosphorus and nitrogen are considered "nutrients" that contribute to eutrophication, historically the focus for controlling eutrophication has been on reducing total phosphorus (TP) concentrations rather than nitrogen. Studies demonstrate that the impact of nutrients on water quality is strongly influenced by other environmental factors such as sunlight availability, stream velocity and water clarity, meaning that the same amount of TP can have varying impacts in different waters.[4] Thus, while improving trends in phosphorus conditions may indicate improving water quality over time, some waters remain susceptible to the adverse affects of eutrophication despite decreasing TP concentrations.

The Department developed a nutrient assessment method to evaluate the site-specific impacts that account this variability in phosphorus impacts. In the past, when TP reached a certain concentration in the water, the water was deemed impaired regardless of the actual impact of the nutrient on the designated use. The new method assesses waters impaired for aquatic life use based upon biological monitoring to determine if the impairment was due to nutrients or other causes. Continuous dissolved oxygen monitoring and chlorophyll *a* data are needed to fully assess the nutrient impacts. Only a small number of nutrient assessments were actually conducted for the 2010 Integrated Assessment due to the lack of sufficient data. This resulted in a high number of TP listings using the old assessment method. This also may explain the apparent contradiction in results between the trend analysis, which shows improving phosphorus conditions statewide, and the 2010 303(d) List, which continues to show TP as one of the most common causes of water quality impairment.

Overall, the water quality trend results indicate that, since the 1980's, nutrient levels and DO conditions have significantly improved over time - most likely due to the upgrade and regionalization of wastewater treatment plants that occurred throughout the State in the late 1980's through the early 1990's. More current trend assessments show some stabilizing of conditions throughout the State with some improvements (e.g., TP) and some declines in water quality (e.g., TDS and nitrates).

[4] NJDEP. 2009. *Nutrient Criteria Enhancement Plan*. April 2009. Available at http://www.nj.gov/dep/wms/bwqsa/Nutrient_Criteria_Enhancement_Plan.Final.pdf