

Briefing on New Jersey Water Quality

Executive Summary

This document synthesizes key information regarding water quality in New Jersey, detailing the environmental context, the comprehensive regulatory framework, and the impact of land use on pollutant levels. Due to its status as the most densely populated state with significant industrial activity, New Jersey's numerous water bodies face substantial pollution pressures.

To manage and protect these resources, the state employs the Surface Water Quality Standards (SWQS), N.J.A.C. 7:9B. This regulatory framework establishes designated uses for all surface waters—such as drinking water supply, recreation, and aquatic life support—and implements a tiered classification system to ensure their protection. Waters are categorized into "Outstanding National Resource Waters," "Category One" waters of exceptional significance, and "Category Two" waters. These are further classified based on water type (freshwater, saline), specific ecological characteristics (e.g., trout-supporting), and geographic location (e.g., Pinelands).

For each classification, the SWQS sets specific, legally enforceable criteria for a wide range of pollutants, including bacteria, dissolved oxygen, nutrients like phosphorus, pH, temperature, and toxic substances. Analysis of pollutant sources reveals that land use is a primary driver of water quality degradation. Stormwater runoff from developed areas, such as commercial, residential, and industrial lands, contributes significantly higher loads of suspended solids, nitrogen, and phosphorus compared to forested or open spaces. This direct link between land use and pollutant loading underscores the challenges in maintaining and restoring the quality of New Jersey's surface waters.

New Jersey's Water Environment and Regulatory Framework

Environmental Context

New Jersey possesses a diverse water system that includes numerous rivers, lakes, reservoirs, and estuaries. As the most densely populated state in the United States, situated between the major metropolitan areas of New York City and Philadelphia, its water resources are under significant pressure from dense residential development and numerous industries. Consequently, New Jersey is ranked among the most polluted states in the nation.

Surface Water Quality Standards (SWQS) - N.J.A.C. 7:9B

The primary regulation governing the state's water quality is the Surface Water Quality Standards (SWQS), N.J.A.C. 7:9B, titled "Protecting, Maintaining, and Restoring New Jersey

Surface Waters.” The purpose of the SWQS is to establish the necessary policies, stream classifications, and criteria to protect the quality of New Jersey's surface waters.

Key functions of the SWQS include:

- **Establishing Designated Uses:** The standards assign designated uses (e.g., drinking water supply, recreation, fish consumption) to the state's surface waters.
- **Classifying Surface Waters:** Waters are classified based on their designated uses (e.g., FW1, FW2-TP, SE1).
- **Setting Water Quality Criteria:** For each classification, specific criteria are set to protect the designated uses.
- **Implementing Protection Policies:** The SWQS contain various policies for protecting water quality, covering antidegradation, nutrients, mixing zones, and general technical guidance.
- **Regulating Discharges:** The standards include procedures for establishing and modifying water quality-based effluent limitations for New Jersey Pollutant Discharge Elimination System (NJPDES) point sources.

Water Body Classifications

Designated Uses of Surface Waters

Designated uses encompass both existing and potential uses that each type of surface water can support. All freshwaters in New Jersey, for instance, are designated for potable water supply use after conventional treatment. The primary designated uses established under the SWQS are:

- Public potable water supply
- Recreation (primary and secondary contact)
- Fish consumption
- Shellfish harvesting
- Maintenance, migration, and propagation of fish
- Agricultural and industrial water supplies
- Any other reasonable uses

Surface Water Protection Categories

New Jersey's surface waters are classified into three overarching categories to implement antidegradation policies:

1. **Outstanding National Resource Waters:** These are high-quality waters that constitute an outstanding national resource. Examples include waters within National or State Parks, Wildlife Refuges, and waters of exceptional recreational or ecological significance.
2. **Category One Waters:** These waters are designated for protection from any measurable changes in water quality. This designation is based on their exceptional ecological,

recreational, water supply, or fisheries significance, which protects their aesthetic value (color, clarity) and ecological integrity (habitat, water quality, biological functions).

3. **Category Two Waters:** This category includes all waters not designated as Outstanding National Resource Waters or Category One.

Specific Water Classifications

Surface waters are further classified based on type (fresh or saline) and designated use.

- **Freshwaters (FW):**
 - **FW1:** These are non-degradation waters set aside for posterity due to their unique ecological significance and are not subject to any man-made wastewater discharges.
 - **FW2:** This classification applies to all other freshwaters (except Pinelands waters). FW2 waters are sub-classified by their ability to support trout, which require cooler temperatures:
 - **FW2-TP:** Trout Production waters.
 - **FW2-TM:** Trout Maintenance waters.
 - **FW2-NT:** Non-Trout waters.
- **Saline Waters (SE/SC):**
 - **SE (Saline Estuarine):** These waters are sub-classified based on their ability to support recreation, shellfish harvesting, and warm-water fish species.
 - **SE1, SE2, SE3**
 - **SC (Saline Coastal):** This classification applies to coastal waters.
- **Pinelands Waters (PL):** This classification applies to waters within the Pinelands Protection and Preservation areas, which can be fresh or saline, unless they are otherwise classified as FW1.

Some coastal waters have **dual classifications** (e.g., FW2-NT/SE1) to reflect the transition from freshwater to saline water as they drain toward an estuary or the ocean.

General Surface Water Quality Criteria (N.J.A.C. 7:9B-1.14(d))

The SWQS establish specific criteria for various substances, expressed as maximum concentrations unless otherwise noted, for FW2, SE, and SC waters.

Substance	Criteria	Classifications
1. Bacterial Quality		
Shellfish Harvesting	Shall not exceed the standard for approved shellfish waters as established by the National Shellfish Sanitation Program.	Shellfish Waters
Primary Contact Recreation	Enterococci: Geometric mean $\leq 30/100$ ml (90-day period) and Statistical Threshold Value $\leq 110/100$ ml (not $>10\%$ excursion).	SE1, SC
	E. coli: Geometric mean $\leq 100/100$ ml (90-day period) and Statistical Threshold Value $\leq 320/100$ ml (not $>10\%$ excursion).	All FW2
Secondary Contact Recreation	Fecal coliform: Geometric mean $\leq 770/100$ ml.	SE2
	Fecal coliform: Geometric mean $\leq 1500/100$ ml.	SE3
2. Dissolved Oxygen (mg/L)	Not less than 7.0 at any time.	FW2-TP
	24-hour average not less than 6.0; not less than 5.0 at any time.	FW2-TM
	24-hour average not less than 5.0; not less than 4.0 at any time.	FW2-NT, SE1
	Not less than 4.0 at any time.	Tidal FW2-NT tributaries to Delaware River (Rancocas Cr. to Big Timber Cr.)
	Not less than 5.0 at any time.	SC
	Not less than 4.0 at any time.	SE2
	Not less than 3.0 at any time.	SE3
3. Floating, Colloidal, Settleable Solids; Petroleum Hydrocarbons; Oils & Grease	None noticeable in the water or deposited on the shore that is detrimental to biota or renders waters unsuitable for designated uses.	All Classifications
4. Nutrients	Shall not be allowed in concentrations that render waters unsuitable for designated uses due to nuisance algal densities, excessive	All Classifications

	vegetation, diurnal fluctuations in DO or pH, or other indicators of impairment.	
	Phosphorus (Total P): ≤ 0.1 mg/L in any non-tidal stream.	FW2
	Phosphorus (Total P): ≤ 0.05 mg/L in any lake, pond, reservoir, or tributary at the point it enters such bodies of water.	FW2
5. pH (Standard Units)	6.5 - 8.5	Certain FW2 waters, All SE
	4.5 - 7.5	Certain FW2 waters
	Natural pH conditions shall prevail.	SC
6. Radioactivity	Prevailing regulations adopted by the U.S. EPA shall apply.	All Classifications
7. Solids, Suspended (Non-filterable residue)	≤ 25.0 mg/L	FW2-TP, FW2-TM
	≤ 40.0 mg/L	FW2-NT
	None which would render the water unsuitable for the designated uses.	All SE, SC
8. Solids, Total Dissolved (Filterable Residue)	No increase in background that adversely affects aquatic biota. No increase that interferes with designated uses, or 500 mg/L, whichever is more stringent.	FW2
	None which would render the water unsuitable for the designated uses.	All SE
9. Sulfate	≤ 250 mg/L	FW2
10. Taste and Odor	None offensive to humans or which would produce offensive taste/odors in water supplies or biota used for consumption.	All Classifications
11. Temperature (°C)	Daily max $\leq 22^{\circ}\text{C}$; rolling 7-day average of daily max $\leq 19^{\circ}\text{C}$.	FW2-TP
	Daily max $\leq 25^{\circ}\text{C}$; rolling 7-day average of daily max $\leq 23^{\circ}\text{C}$.	FW2-TM
	Daily max $\leq 31^{\circ}\text{C}$; rolling 7-day average of daily max $\leq 28^{\circ}\text{C}$.	FW2-NT
	No thermal alterations causing temperatures to exceed 29.4°C (85°F) summer seasonal average.	SE
	No thermal alterations causing temperatures to exceed 26.7°C (80°F) summer seasonal average.	SC
12. Toxic Substances	Various narrative criteria protecting against effects on humans, aquatic life, drinking	All Classifications

	water standards, chronic/acute toxicity, and bioaccumulation.	
13. Turbidity (NTU)	Max 30-day average of 15 NTU; max of 50 NTU at any time.	FW2, SE3
	Max 30-day average of 10 NTU; max of 30 NTU at any time.	SE1, SE2
	Levels shall not exceed 10.0 NTU.	SC

Pollutant Sources and Land Use Impact

Pollutant Pathways

Pollutants enter New Jersey's waterways through numerous pathways associated with human activity. A conceptual model of the nitrogen cycle illustrates these sources:

- **Atmospheric Deposition:** Combustion from industry, shipping, and vehicles releases pollutants into the atmosphere, which are then deposited into waterways.
- **Industrial & Municipal Discharges:** Industries and Publicly Owned Treatment Works (POTWs) discharge treated wastewater directly into rivers.
- **Agricultural Runoff:** Fertilizer factories produce materials that, along with animal waste from farms, contribute to surface runoff of nutrients.
- **Urban & Surface Runoff:** Stormwater from urban and residential areas carries a wide array of pollutants into water bodies.
- **Internal & Sub-Surface Pathways:** Pollutants are taken up by plants and algae, released upon death, and stored in sediment through burial and decomposition. They can also enter groundwater and aquifers, eventually draining into surface waters.

Stormwater Runoff and Land Use

Stormwater runoff is a major contributor to water pollution, with pollutant levels varying significantly by land-use type.

Median Event Mean Concentrations (EMCs) by Land Use

Data from the National Urban Runoff Program (1983) shows the median pollutant concentrations in stormwater runoff from different land-use categories.

Pollutant	Residential (Median)	Mixed (Median)	Commercial (Median)	Open/Nonurban (Median)
BOD (mg/L)	10.0	7.8	9.3	-
COD (mg/L)	73	65	57	40
TSS (mg/L)	101	67	69	70

Total Lead (µg/L)	144	114	104	30
Total Copper (µg/L)	33	27	29	-
Total Zinc (µg/L)	135	154	226	195
Total Kjeldahl Nitrogen (µg/L)	1900	1288	1179	965
NO₂-N + NO₃-N (µg/L)	736	558	572	543
Total P (µg/L)	383	263	201	121
Soluble P (µg/L)	143	56	80	26

Average Yearly Pollutant Loading Rates by Land Use

The annual amount of pollution generated per unit of area also varies dramatically with land use. Commercial, urban, and cultivated agricultural lands typically produce the highest pollutant loads.

Table: Annual Loading Rates (kg/ha/yr) *Source: Multiple studies compiled between 1973-1990*

Land Use	BOD ₅	Suspended Solids	Total Nitrogen	Total Phosphorus	Lead	Copper	Zinc
	(kg/ha/yr)	(kg/ha/yr)	(kg/ha/yr)	(kg/ha/yr)	(kg/ha/yr)	(kg/ha/yr)	(kg/ha/yr)
Urban	50	460	8.5	2.0	0.50	0.20	0.40
1-Acre residential	35	420	6.6	1.8	0.30	0.10	0.25
¼-Acre residential	40	450	7.5	1.9	0.40	0.10	0.40
Commercial	87	840	14.5	2.7	0.85	0.24	1.35
Pasture	11.5	343	6.2	0.50	0.10	0.02	0.08
Cultivated	18	450	26.0	1.05	—	—	—
Citrus	15	25	4.0	0.2	—	—	—
Woodland	5	85	3.0	0.10	0.05	0.01	0.03
Wetlands	14	29	4.9	0.40	—	—	—
Golf course	10	150	4.5	0.78	—	—	—
Highway	87	990	13.8	0.7	0.50	0.08	0.47

Table: Annual Loading Rates Used by NJDEP for Planning (lbs/acre/yr) |

Land Cover	TP load (lbs/acre/yr)	TN load (lbs/acre/yr)	TSS load (lbs/acre/yr)
High, Medium Density Residential	1.4	15	140
Low Density, Rural Residential	0.6	5	100
Commercial	2.1	22	200
Industrial	1.5	16	200
Urban, Mixed Urban, Other Urban	1.0	10	120
Agriculture	1.3	10	300
Forest, Water, Wetlands	0.1	3	40
Barrenland/Transitional Area	0.5	5	60