



Great Bay Watershed, New Hampshire

Great Bay Total Nitrogen General Permit

Overview

The Great Bay watershed, located in the states of Maine and New Hampshire, is composed of an inland estuary with a network of tidal rivers, inland bays, and coastal harbors. Great Bay estuary has been listed as an estuary of national significance under EPA’s National Estuary Program (NEP) and is a critical resource in New Hampshire. In past years, Great Bay has experienced significant water quality issues related to high loads of total nitrogen in the watershed, including low dissolved oxygen, algae blooms, and declining eelgrass habitats and oyster communities. Since the 1990s, eelgrass communities in Great Bay have declined by 50 percent, while oyster and clam communities have declined by over 90 percent. Sources of nitrogen to the watershed include discharges from wastewater treatment facilities (WWTFs) and significant loads from various nonpoint sources and stormwater point sources.

In November 2020, EPA issued a watershed-based general permit for discharges of nitrogen from WWTFs with the goal of restoring water quality to support designated uses in Great Bay. The discharge of pollutants other than nitrogen from the WWTFs is authorized by their individual NPDES permits. EPA determined that a watershed approach would be more expeditious and effective than individual permit issuances. This approach allows EPA to address total nitrogen impacts

Watershed

Great Bay, New Hampshire

Key Water Quality Concerns

Total Nitrogen

Stakeholder Involvement Techniques

- Early engagement with various regulators and stakeholders to determine the regulatory pathway most likely to expedite restoration
- Meetings with coalitions of potential municipal permittees and other stakeholders
- Stakeholder meetings to describe the scientific basis for the permit
- Public hearing at a local venue
- Public comment period for draft permit review

Case Study Issues of Interest

Type of Point Sources



Publicly Owned Treatment Works Discharges

Type of Watershed-Based Permit or Approach



Multisource Watershed-Based Permit

Highlighted Approach(es)



Implementation of Total Maximum Daily Loads (TMDLs) or Other Watershed Pollutant Reduction Goals



Coordinated Watershed Monitoring

and evaluate receiving water responses on a systemwide, holistic level. The goal of the watershed approach is to achieve a gross reduction in total nitrogen from multiple sources at roughly the same time.

This case study focuses on EPA's General National Pollutant Discharge Elimination System (NPDES) Watershed Permit for Total Nitrogen Discharges in Great Bay for Wastewater Treatment Facilities in New Hampshire (General Permit—NHG58A000) and the adaptive management approach implemented in the permit.

Background

The Piscataqua Region Estuaries Partnership collects, compiles, and analyzes monitoring data from the Great Bay estuary to produce State of Our Estuary reports every five years. These reports include the status of the estuary's environmental conditions, environmental trends, and overall environmental health indicators. The environmental indicators relating to excessive levels of nutrients in the Great Bay estuary include dissolved oxygen, total nitrogen, and eelgrass.

To confront the challenge of controlling or accounting for discharges into the Great Bay watershed, which is dominated by nonpoint source nitrogen loading, EPA chose to implement a watershed-based permitting approach including adaptive management to increase monitoring

The Great Bay Total Nitrogen General Permit defines total nitrogen as the sum of the concentrations of total Kjeldahl nitrogen and nitrate plus nitrite nitrogen expressed as milligrams of nitrogen per liter. The permit includes seasonal load limits for total nitrogen (in units of average pounds per day). Compliance with the effluent limits is determined using rolling seasonal average loads.

and data collection throughout the watershed. EPA translated narrative water quality criteria to establish numeric water quality-based effluent limitations in the permit. EPA evaluated the scientific literature and identified a range of possible nitrogen thresholds. EPA chose the least stringent threshold within the "critical range" as a reasonable next step in an adaptive management approach. The Agency may establish a lower threshold in the future if the system does not fully recover once the initial threshold is achieved. This adaptive management process reduces uncertainty, builds knowledge, and improves management over time in a goal-oriented and structured process. One objective of EPA's adaptive management permitting approach is to give the municipalities flexibility in achieving the most cost-effective nitrogen reductions that will maximize the benefit to water quality throughout Great Bay as expeditiously as possible.

Permit Strategy

The watershed-based permit establishes total nitrogen effluent limitations, monitoring requirements, reporting requirements, and standard conditions for 13 eligible WWTFs in New Hampshire's portion of the Great Bay watershed. The discharge of pollutants other than nitrogen from these facilities continues to be authorized by their individual NPDES permits.

Coverage under this permit is optional, allowing the municipalities to choose between controlling nitrogen discharges through the adaptive approach of the general permit or through nitrogen limits in their individual permits. Individual permit limits for total nitrogen are expected to result in upgrades at the POTWs to the limit of technology (*i.e.*, limits of 3.0 mg/L). The individual permit limit option would not include the flexibilities associated with the systemwide adaptive management approach in the general permit. The general permit establishes effluent load limitations for total nitrogen for 11 of 13 eligible POTWs. One objective of the load limits established for the POTWs is

that limited investments would be necessary for facility upgrades in the short-term, with potential investments only occurring if flows increase (based on growth) and the facility must treat nitrogen to a lower concentration to meet the load limit at higher flows. This tradeoff allows municipalities to plan for immediate and ongoing investments in nonpoint source and stormwater point source nitrogen reductions, while planning for and incorporating investments at the POTWs, if necessary, in the future. Although not required by the permit, EPA anticipates that communities will invest in nonpoint source controls to achieve the nitrogen reductions necessary to meet water quality standards.

Permit Highlights

Adaptive Management Framework Voluntary Submittal

Part 3 of the watershed-based permit gives permittees the opportunity to participate in adaptive management in collaboration with EPA; the New Hampshire Department of Environmental Services (NHDES); and public, private, and commercial stakeholders. Elements of the adaptive management framework include ambient monitoring, pollution tracking, source reduction planning, and review of permit issues. If permittees elect to participate in the collaboration, they must submit a detailed proposal to EPA within 180 days following the permit effective date including the following information:

- The approach the permittee will use to monitor the ambient water quality in the Great Bay estuary to determine progress and trends.
- The method(s) the permittee will use to track reductions and additions of total nitrogen over the permit term.
- An outline/plan for overall source reductions of total nitrogen over the permit term.
- A process for evaluating any significant scientific or procedural issues relating to the permit (e.g., appropriate thresholds), including detailed milestones, culminating in submission of a report to EPA for inclusion in the administrative record for the permit renewal.
- A proposed timeline for completing a total maximum daily load (TMDL) for total nitrogen in Great Bay and for submitting it to EPA for approval.

Permittees have the option of submitting their proposals individually or jointly with other permittees.

Ten of the 12 municipalities (representing 11 WWTFs) have submitted voluntary adaptive management plans and are currently implementing the plans in collaboration with EPA and NHDES.

Permit Components

Coverage under the general permit is only available to the 13 WWTFs located in New Hampshire that discharge to Class B waters in the Great Bay watershed. These facilities have the option of applying for coverage under the general permit or complying with facility-specific nitrogen limits in their individual NPDES permits. Facilities maintain coverage under their individual permits for all other parameters. To obtain coverage under the general permit, facilities must complete a notice of intent and submit it to EPA within 60 days following the permit effective date. Upon receiving approval from EPA, a facility is subject to the conditions of the general permit.

New Hampshire's surface waters are divided into two classes. Class A waters are of the highest quality, and Class B waters are of the second highest quality. Each class must attain and maintain specified water quality standards (see [New Hampshire Revised Statute Annotated 485-A:8, I, II and III](#)).

Effluent Limitations

The permit establishes seasonal load limits for total nitrogen from April 1 through October 31 for 11 WWTFs. The two remaining WWTFs are subject to seasonal monitoring and reporting requirements for the first 24 months of the permit term. After the 24-month period, effluent limits equivalent to the average monthly load (in pounds per day) from the initial 14 growing season months (i.e., all months between April 1 and October 31) will become effective for these facilities.

New Hampshire's water quality standards lack numeric nutrient criteria for Class B waters, but include numeric dissolved oxygen criteria and narrative criteria for nutrients and biological and aquatic community integrity. In the absence of numeric criteria, EPA translated the relevant narrative criteria into a numeric threshold based on several scientific studies that evaluated nitrogen loading rates necessary to protect estuarine environments. Effluent limits were established for the WWTFs consistent with the numeric threshold. Due to uncertainties in the selection of the threshold, EPA may establish a more stringent threshold in the future if the system does not fully recover once the threshold is achieved. See the permit [fact sheet](#) (pp. 21-24) for the rationale for EPA's approach for translating the narrative criterion.

Effluent Limitations

Wastewater Treatment Facility	Rolling Seasonal Average Total Nitrogen Effluent Limitation (lbs/day)*
Rochester	198
Portsmouth	248
Dover	167
Exeter	106
Durham	59
Somersworth	92
Pease ITP	93
Newmarket	30
Epping	43
Newington	15
Rollinsford	Report
Newfields	16
Milton	Report

*The reported rolling seasonal average value must be calculated as the arithmetic mean of the monthly average load (in lbs/day) for the reporting month and the monthly average loads (in lbs/day) of the previous six months from April 1 through October 31 of each year (i.e., rolling seven-month average).

Permittees may request an increase of their permitted load after successfully completing septic system or private sewer system tie-in projects, as described in Part 2.2 of the permit. Rolling seasonal average load limits established in the permit were calculated based on the design flow of the facilities from 2012 through 2016.

Monitoring and Reporting Requirements

General permit holders are required to conduct weekly discharge monitoring to determine compliance with rolling seasonal average total nitrogen effluent limitations. Permit holders must calculate and report monthly average monitoring results for total nitrogen, total Kjeldahl nitrogen, and nitrate plus nitrite nitrogen no later than the 15th day of the month following the completed reporting period.

Permit Effectiveness

Environmental Benefits

The watershed-based permit has resulted in a significant focus on implementing best management practices in the largest urban communities around the estuary. In the first year alone, the communities funded over \$20 million in projects to improve stormwater quality and optimize wastewater treatment. The permit directly incentivized the Dover City Council to authorize the creation of a stormwater utility—the first in New Hampshire.

Because the permit was only recently issued, environmental benefits have not yet been quantified. However, the watershed-based and adaptive management approaches in the permit will allow for the Great Bay watershed to be evaluated systemwide. EPA believes this approach will result in gross reduction of total nitrogen from multiple sources in the watershed at roughly the same time, improving water quality and restoring designated uses for the watershed. Restoration of eelgrass communities will also have a significant effect on the watershed by improving habitats for local wildlife.

Benefits to the Permittee

The permit was developed to provide the permittees with several different tools for achieving compliance. EPA established seasonal load limits for the WWTFs so that limited investments would be necessary for short-term facility upgrades, in contrast with higher investments needed to comply with more stringent nitrogen limits that would be required in the facilities' individual permits without the flexibilities of the systemwide, adaptive management approach. Under the general permit, potential investments would only occur in the long term if flows increase significantly, requiring the facility to treat nitrogen to a lower concentration to continue to meet their seasonal load limit at higher flows. This allows municipalities to plan for alternative, voluntary source reduction investments (which may include nonpoint source and stormwater point source nitrogen reductions) while planning any necessary future investments at the WWTFs. This provides facilities with a more flexible approach than solely employing treatment upgrades at the WWTF.

Benefits to the Permitting Authority

The watershed-based permit is a more streamlined and efficient permitting approach for EPA to reduce total nitrogen loads in Great Bay. Following years of delays and litigation from traditional individual permitting approaches, the watershed-based permit has resulted in stakeholders working together to achieve the necessary nutrient reductions.

Lessons Learned

Michael Cobb, the EPA Region 10 permit writer, and Ted Diers, the administrator of NHDES's Watershed Management Bureau, shared their "lessons learned" during development of the watershed-based permit. They identified balancing the needs of diverse stakeholders and building trust among stakeholders as the most challenging parts of developing the watershed-based permit.

According to Mr. Cobb, facilitating discussions among stakeholders in advance helped EPA and stakeholders work through their differences. EPA included the author of a scientific paper used to support the nutrient target in several early meetings with permittees and environmental groups to describe the science underlying the nutrient target. These meetings allowed stakeholders to ask questions and gain a better understanding of the scientific basis of the permit. Additionally, EPA conducted a public hearing at a local venue during the public comment period. The hearing was well

attended and provided an opportunity for a variety of stakeholders to submit comments and listen to comments from other stakeholders.

For Mr. Diers, overcoming mistrust among the various parties was a significant hurdle after more than a decade of disagreement and legal challenges over nutrient management in the watershed. Working through mistrust to get to a resolution took some give and take from all parties. The three main strategies that built trust were 1) being open to flexible approaches, 2) creating a mediation environment that encouraged open communication, and 3) working toward a positive solution that everyone could believe in. When asked what could have been differently to resolve this challenge, Mr. Diers suggested that having more open dialogue earlier in the process and entering the safety of the mediation environment (or nondisclosure types of agreements) at an earlier stage could have helped.

Both Mr. Cobb and Mr. Diers believe this watershed-based permitting approach could be used to achieve environmental goals in other watersheds that receive significant stormwater and nonpoint source nutrient loads and where reductions from publicly owned treatment works alone will not achieve water quality standards. Mr. Diers also suggested that candidate watersheds would lack a TMDL and trading opportunities and would have multiple parties involved, elements that are difficult to deal with in traditional NPDES regulations and permitting approaches. If the approach were to be applied in another watershed, he recommends that the permitting authority:

- Create an inclusive environment with opportunities to speak freely.
- Establish opportunities for nontraditional approaches.
- Build in alternative pollution reduction strategies.
- Recognize that changes will take time and incremental progress is acceptable.
- Create opportunities for stakeholders to share science and help form the monitoring and research questions.

Resources

City of Dover. No date. *Nitrogen and the Great Bay*. <https://www.dover.nh.gov/government/city-operations/community-services/wastewater/nitrogen/>.

U.S. Environmental Protection Agency (EPA). January 2020. *EPA Draft Permit Will Significantly Reduce Nitrogen Discharges, Improve Health of Great Bay*. <https://www.epa.gov/newsreleases/epa-draft-permit-will-significantly-reduce-nitrogen-discharges-improve-health-great-bay>.

EPA. No date. *Draft Fact Sheet: National Pollutant Discharge Elimination System (NPDES) Great Bay Total Nitrogen General Permit for Wastewater Treatment Facilities in New Hampshire*. <https://www3.epa.gov/region1/npdes/gbtn/gbtn-draft-gp-fs.pdf>.

EPA. National Pollutant Discharge Elimination System (NPDES) Great Bay Total Nitrogen General Permit for Wastewater Treatment Facilities in New Hampshire. Effective February 1, 2021. <https://www3.epa.gov/region1/npdes/gbtn/nhg58a000-gbtn-gp.pdf>.

EPA. No date. *Response to Comments: Issuance of NPDES Permit No. NHG58A000 Great Bay Total Nitrogen General Permit for Wastewater Treatment Facilities in New Hampshire*. <https://www3.epa.gov/region1/npdes/gbtn/nhg58a000-gbtn-gp-rtc.pdf>.

Great Bay Municipal Coalition. No date. *Great Bay Municipal Coalition Adaptive Management Plan*. <https://www.dover.nh.gov/Assets/government/city-operations/community-services/image/b4AMP%20Summary.pdf>.

New Hampshire Revised Statutes Annotated (RSA). No date. *RSA Section 485-A:8 Classification of Waters*. <http://www.gencourt.state.nh.us/rsa/html/l/485-a/485-a-8.htm>.

Roseen, Robert M. May 2020. *Feasibility Analysis for EPA's Draft Great Bay Total Nitrogen General Permit in Dover, Durham, Epping, Exeter, Milton, Newfields, Newington, Portsmouth, Rochester, Rollinsford, Somersworth NH and Berwick, Kittery, North Berwick and South Berwick ME*. <https://scholars.unh.edu/prep/444/>.

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Permit Information:

Permit:
<https://www3.epa.gov/region1/npdes/gbtn/nhg58a000-gbtn-gp.pdf>

Draft fact sheet:
<https://www3.epa.gov/region1/npdes/gbtn/nhg58a000-gbtn-gp-draft-permit-fs.pdf>

Pollutants of Concern in Watershed:

Excessive nitrogen, low dissolved oxygen (DO), and chlorophyll-a

Pollutants Addressed in Permit:

Total nitrogen

Permit Issued:

November 24, 2020