



NITROGEN REMOVAL INITIATIVES

By: Kristen L. Miller, Associate Analyst

NITROGEN AND HYPOXIA

Hypoxia occurs when there is a low level of dissolved oxygen in the water. In Long Island Sound ("the Sound"), it is mainly caused by nitrogen enrichment.

Nitrogen is a naturally occurring nutrient, but excessive levels of nitrogen come from many human sources such as wastewater discharge and runoff.

Nitrogen increases algae growth, and when algae decays, it consumes oxygen. Marine organisms need oxygen to survive. When oxygen levels fall to a certain point, the organisms become stressed and may die.

Hypoxia occurs in the Sound when dissolved oxygen falls below a concentration of 3 mg/L.

The Department of Energy and Environmental Protection (DEEP) monitors water quality, including dissolved oxygen levels, in the Sound on a year-round basis. Results from the monitoring are available on DEEP's [website](#).

ISSUES

What are the primary sources of nitrogen in Long Island Sound ("the Sound")? What steps is Connecticut taking to reduce the amount of nitrogen entering the Sound? Is the state collaborating with New York or Rhode Island on nitrogen reduction efforts?

SUMMARY

Nitrogen in the Sound comes from many natural and human sources. The primary human sources are wastewater treatment plants. Other human sources include urban and agricultural runoff and atmospheric deposition. Excess nitrogen causes reduced oxygen levels, which negatively affect aquatic life ("hypoxia," see sidebox).

Connecticut is engaged in many initiatives to reduce the amount of nitrogen entering the Sound, several in collaboration with New York.

Connecticut and New York participate in the Long Island Sound Study (LISS), a bi-state partnership with the federal Environmental Protection Agency (EPA), which investigates water quality in the Sound. In 1994, LISS developed a conservation and management plan to protect and improve water quality. The plan identifies hypoxia as a priority concern. LISS is currently updating the plan.

LISS also helped Connecticut and New York develop a goal of reducing the nitrogen from human sources in the Sound by 58.5% by 2014. The goal was included in a federally-approved Total Maximum Daily Load (TMDL) agreement between the states to reduce nitrogen in the Sound.

According to the Department of Energy and Environmental Protection (DEEP), Connecticut complied with the TMDL goal in 2013. It met the goal by (1) requiring wastewater treatment plants to operate under general permits that gradually reduce the nitrogen discharged and (2) operating a nitrogen credit exchange program.

Connecticut's other nitrogen reduction efforts include (1) collaborating with the Sound's upper watershed states, (2) designating the Sound as a "No Discharge Area" for vessel sewage, and (3) operating programs to control nonpoint source pollution (e.g., runoff).

According to DEEP, Connecticut and Rhode Island do not similarly collaborate on nitrogen reduction in the Sound, since Rhode Island has little effect on the Sound's water quality. (Hypoxia is a condition occurring primarily in the Sound's western half.)

NITROGEN SOURCES

Nitrogen occurs naturally in the Sound, but human activities increase the Sound's nitrogen content, resulting in unhealthy conditions for aquatic life.

According to DEEP's Director of Planning in the Bureau of Water Protection and Land Reuse, the main human sources of nitrogen in the Sound are wastewater treatment plants. DEEP's website also identifies the following sources: industry discharges, urban stormwater and agricultural runoff, and atmospheric deposition (pollutant transfer from the air to the earth's surface through such things as rain or snow).

Nitrogen is found in human and animal waste discharged from wastewater treatment plants; fertilizers used in farming and lawn care; and exhaust from cars, power plants, and other combustion sources.

Wastewater treatment and industrial plants are called pollution "point sources" because they discharge pollutants from a single point, such as a discharge pipe. The treatment plants account for most of the nitrogen discharged from point sources.

“Nonpoint sources” are sources which cannot be traced to a single point of origin. They include naturally occurring nitrogen, runoff, and atmospheric deposition. The largest cause of nonpoint source nitrogen is urban runoff.

EFFORTS TO REDUCE NITROGEN

Comprehensive Conservation and Management Plan

LISS, a bi-state partnership between Connecticut and New York created in 1985 with EPA, researches, monitors, and assesses the Sound’s water quality. In 1994, it developed a [Comprehensive Conservation and Management Plan](#) identifying six priority issues for the Sound, including hypoxia, and recommending actions to manage the Sound. LISS uses the plan to help develop strategies for short- and long-term goals.

LISS is updating the plan to address water quality challenges for the next 20 years. Among other things, the [draft update to the plan](#) sets as goals (1) further reducing the Sound’s hypoxia area and (2) maintaining the cap on nitrogen entering the Sound from wastewater treatment facilities.

Furthermore, in 1998 LISS adopted a 58.5% goal for reducing nitrogen entering the Sound from human sources. Connecticut and New York incorporated this goal into their 2001 TMDL agreement for nitrogen reduction in the Sound (as described below).

TMDL Plan

Federal Requirement. The federal Clean Water Act requires states to establish TMDLs for water bodies failing to meet minimum water quality standards. These plans set the maximum amount of pollution that can be discharged without significantly impacting the water bodies’ health. A TMDL must set out (1) where the pollutant of concern is coming from (e.g., point, nonpoint, or natural sources) and (2) where and when reductions will be made to improve water quality.

Goals. In 2001, EPA approved Connecticut and New York’s [TMDL plan](#) to reduce the amount of nitrogen entering the Sound. The states agreed to reduce nitrogen discharges by a combined 58.5% by 2014. The TMDL set reduction goals of 64% for point sources and 10% for nonpoint sources.

Permit and Exchange. To help reach the TMDL’s goals, DEEP (1) issues [general permits](#) that set out annual, gradually declining discharge limits for wastewater treatment plants and (2) operates a Nitrogen Credit Exchange Program for the

plants to create, buy, or sell credits ([CGS §§ 22a-521 et seq.](#)). Each plant may meet its general permit limit by (1) controlling its discharge or (2) buying credits through the exchange program.

DEEP issued the first five-year general permit in 2002, which has been reissued twice. The permits establish the nitrogen discharge cap for each wastewater treatment plant. According to DEEP, the agency intends to reissue the permit in 2015 when the current one expires.

To meet the general permit requirements, municipalities upgrade wastewater treatment plants with nitrogen removal technologies. The Clean Water Fund provides financial aid to municipalities through grants and loans to plan, design, and construct wastewater treatment facilities. It is financed through a combination of federal funds, state general obligation bonds for the grant portion, and state revenue bonds for the loan portion. Nitrogen reduction projects qualify.

Plants failing to meet their general permit discharge caps can purchase nitrogen credits from plants that remove more nitrogen than the general permit requires ("excess credits"). The state, through DEEP and the Nitrogen Credit Advisory Board (NCAB), creates and manages the exchange and sets the credit price each year. The state must buy excess credits. Seventy-nine wastewater treatment plants participate in nitrogen trading.

Reduction Goal Reached. According to DEEP's Director of Planning in the Bureau of Water Protection and Land Reuse, Connecticut complied with the TMDL in 2013. New York has reduced its load by about 30% and should achieve the reduction required by the TMDL by 2017.

Upper Watershed Initiatives

Connecticut works with EPA and New York on collaborating with the Sound's other watershed states (Massachusetts, New Hampshire, and Vermont) to reduce nitrogen from entering the Sound. According to the NCAB's most recent [annual report](#), the watershed states are working toward a five-state TMDL. They also established an "enhanced implementation plan" requiring (1) Connecticut and New York to continue with wastewater treatment plant upgrades, (2) EPA and the upper watershed states to implement a specific wastewater treatment plant permitting strategy, (3) each state to evaluate stormwater and nonpoint source control efforts, and (4) EPA and the states to develop and implement a tracking system to determine whether the TMDL goals are achieved. Efforts to meet these requirements are ongoing.

No Discharge Area Program

In 2007, EPA approved Connecticut's designation of its coastal waters, from the Rhode Island to the New York state boundaries, as a "No Discharge Area" (NDA). This designation bans vessel sewage from being discharged into the Sound, and it applies to both treated and untreated waste. DEEP's [No Discharge Area Program](#) provides vessel operators with the locations of recreational vessel pump-out facilities and the requirements for installing or upgrading marine sanitation devices. (EPA approved New York's designation for the Sound's waters in New York in 2011, making all of the Sound a NDA.)

Nonpoint Source Reduction

Connecticut maintains two nonpoint source pollution programs, with one specific to coastal areas. Both programs use a "networked" approach to managing nonpoint sources, working with other programs to combat the pollution.

Nonpoint Source Management Program. Connecticut's [program to control nonpoint pollution sources](#) is a network of governmental programs with DEEP as the primary management authority and program coordinator. Some of the strategies the program uses to combat nonpoint pollution include (1) implementing best management practices (BMPs) to control the pollution, (2) improving education and increasing incentives to control the pollution at the municipal level, and (3) requiring stormwater discharge permits.

Coastal Nonpoint Source Pollution Control Program. Federal law requires Connecticut to maintain a [Coastal Nonpoint Source Pollution Control Program](#), which EPA and the National Oceanic and Atmospheric Administration approved in 2013. Administered by the state's Office of Long Island Sound Programs, it addresses five categories of nonpoint source pollution: agriculture, urban sources, marinas and recreational boating, hydromodifications, and wetlands and riparian areas. Its goal is to implement management measures for controlling nonpoint source pollution in coastal waters, primarily focusing on pollutants from urban sources near the Sound.

Similar to the state's general nonpoint source program, the coastal program interconnects existing programs and initiatives that achieve the management measures identified for each source category. For example, measures associated with controlling urban source pollution include (1) using BMPs, (2) restoring degraded habitats, (3) reducing impervious cover, and (4) treating runoff.

HYPERLINKS

DEEP, Connecticut's No Discharge Area Program, <http://www.ct.gov/deep/cwp/view.asp?a=2705&q=323816>, last visited September 23, 2014.

DEEP, General Permit for Nitrogen Discharges, http://www.ct.gov/deep/lib/deep/water/municipal_wastewater/2011_2015_nitrogen_gp.pdf, last visited September 23, 2014.

DEEP, Hypoxia and Monitoring Fact Sheets, http://www.ct.gov/deep/cwp/view.asp?a=2719&q=325568&deepNav_GID=1654, last visited September 29, 2014.

DEEP, Nonpoint Source Pollution Management, http://www.ct.gov/deep/cwp/view.asp?a=2719&q=325588&deepNav_GID=1654%20, last visited September 30, 2014.

DEEP, Overview of Connecticut's Coastal Nonpoint Source Pollution Control Program, <http://www.ct.gov/Deep/cwp/view.asp?a=2705&q=323566>, last visited September 23, 2014.

DEEP, Report of the Nitrogen Credit Advisory Board for the Calendar Year 2012, http://www.ct.gov/deep/lib/deep/water/municipal_wastewater/nitrogen_report_2012.pdf, last visited September 23, 2014.

LISS, Draft Comprehensive Conservation and Management Plan Update, http://longislandsoundstudy.net/wp-content/uploads/2014/09/Draft-LISS-CCMP-final-9_8_14SM_Corrected.pdf, last visited September 23, 2014.

LISS, The Comprehensive Conservation and Management Plan, http://longislandsoundstudy.net/wp-content/uploads/2011/10/management_plan.pdf, last visited September 23, 2014.

New York State Department of Environmental Conservation and DEEP, A Total Maximum Daily Load Analysis to Achieve Water Quality Standards for Dissolved Oxygen in Long Island Sound, http://www.ct.gov/deep/lib/deep/water/lis_water_quality/nitrogen_control_program/tmdl.pdf, last visited September 23, 2014.

KM:ts