Connecticut's Second Generation Nitrogen Strategy
Long Island Sound
2017-2022

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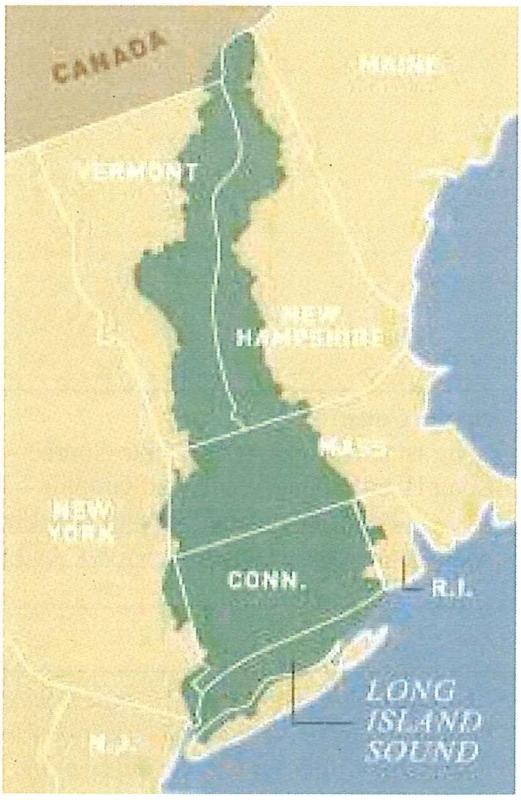

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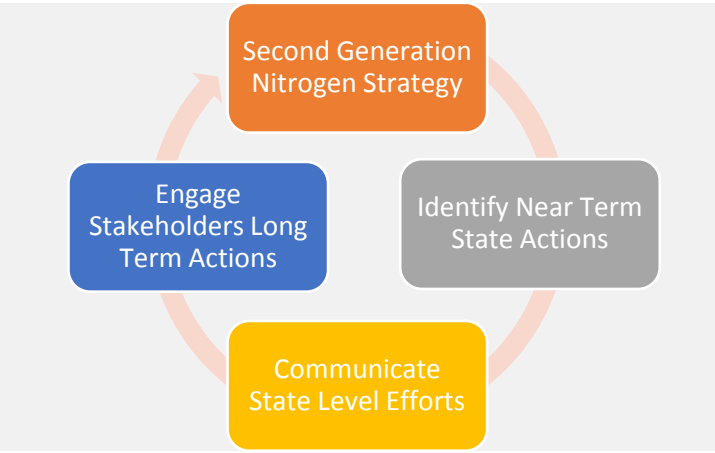
Long Island Sound Aerial Photo Source – UCONN https://lis.research.cuconn.edu/
Long Island Sound Watershed Graphic – Long Island Sound Study Website
http://longislandsoundstudy.net/our-vision-and-plan/clean-waters-and-healthy-watersheds/long-island-sound-watershed-projects/

Purpose

The Connecticut Department of Energy and Environmental Protection's (CT DEEP's) Second Generation Nitrogen Strategy is a plan to engage existing programs, implementation projects, and specific studies within the overall objective to reduce nitrogen loading to Long Island Sound (LIS) and embayments located in the State of Connecticut. This document serves the following purposes:

1. Identify early actions that can be implemented within the near term (5-6 years) and describe those actions.
2. Communicate Connecticut's efforts to address nitrogen loading beyond the Total Maximum Daily Load for Long Island Sound.
3. Engage stakeholder participation in the development of long term implementation actions.



Background

LIS and the nearshore embayments provide a multitude of resources to both residents and visitors to Connecticut. For example, coastal habitats (such as tidal wetlands) alleviate storm surge and help to protect shoreline resources and property; eelgrass beds and shallow water habitats provide spawning and nursery grounds for both commercially and recreationally significant fish and shellfish; embayments and offshore waters are frequently used for fishing, swimming, boating, and water sports. The waters of LIS and its embayments support an abundance of marine life, as well as a variety of habitats.

Although LIS provides a host of resources for human use, consumption, and enjoyment, it is threatened by pollutants due to human activities. For instance, the use of septic systems to treat wastewater in many coastal locations results in an excessive amount of nitrogen and other pollutants carried to LIS through the groundwater, as well as direct discharge to shallow tidal waters. Another way that pollutants are transported to LIS is through rivers and streams. As rainfall travels over concrete and paved surfaces, nitrogen, oil and grease, sediment, metals, lawn care chemicals (fertilizers and pesticides), and other contaminants are carried to stormdrains that discharge to local waterways and eventually, LIS. These sources are typically referred to as nonpoint, meaning that the pollution comes from diffuse locations; not a direct pipe, such as industrial dischargers or wastewater treatment plants. Industrial dischargers and wastewater treatment plants are referred to as point sources.

Although nitrogen is necessary for plant life to thrive, too much nitrogen results in a process called eutrophication due to excessive plant growth (Figure 1). Conditions are rendered undesirable to both humans and aquatic life by eutrophication. Clarity of the water is reduced and nuisance and harmful algae interfere with swimming, boating and water sports. Furthermore, harmful algae may be detrimental to the health of humans as well as other animals (including pets). As demonstrated in Figure 1, when excess plant growth dies, it sinks to the bottom and decays through a process that uses up oxygen in the water. If too much oxygen is used up, marine life cannot survive. In addition to eutrophication issues, tidal wetland plants are also damaged by too much nitrogen. Thus reducing the function of this resource to protect coastal properties. Table 1 indicates the direct impact of eutrophication on human life, land animals, and aquatic life.

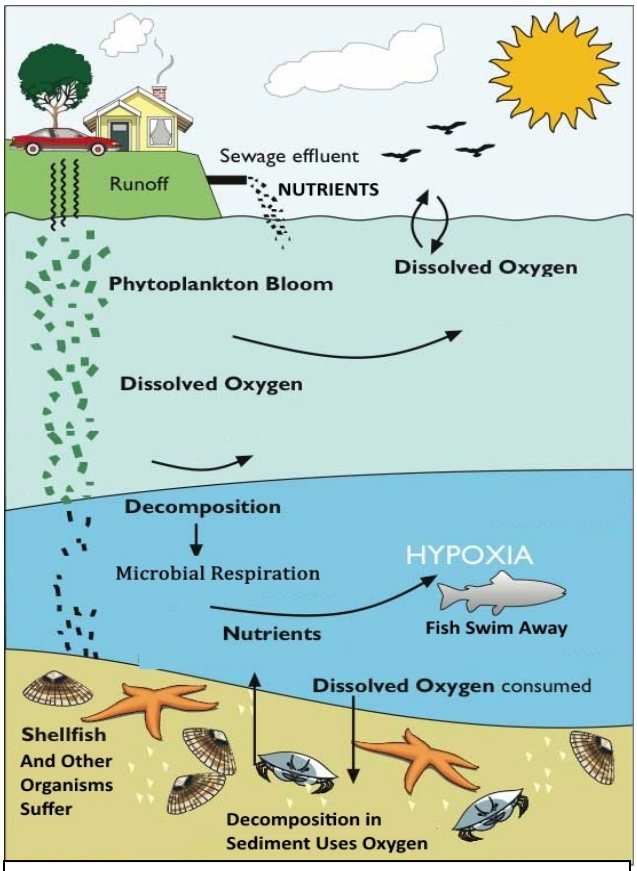


Figure 1 - Graphic of Nutrient (nitrogen) Transport and Fate in Seawater. Source: National Coastal Condition Report IV, EPA-B42-R-10-003 (April 2012), modified.

Table 1. Impact of Eutrophication on human, land, and aquatic life.

Eutrophic Condition	Humans	Land animals	Aquatic life
Reduced clarity	X		X
Harmful algae blooms	X	X	X
Low dissolved oxygen			X
Nuisance algae growth	X	X	X
Decreased tidal wetlands	X		X
Decreased eelgrass			X

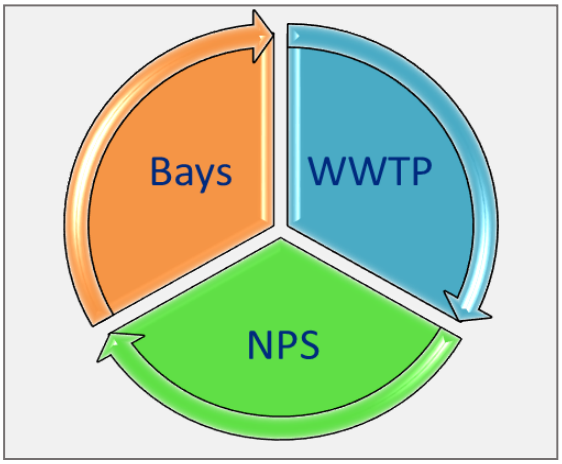
Low dissolved oxygen (hypoxia) has been documented to occur during the summer months in LIS. As a result, the states of Connecticut and New York, and the Federal Environmental Protection Agency (EPA) adopted a Total Maximum Daily Load (TMDL) for nitrogen in 2000. To reduce nitrogen to the levels necessary to improve dissolved oxygen concentrations and meet water quality standards, the TMDL established a 58.5 percent nitrogen reduction target from the early 1990s baseline levels to be attained by 2014 (later adjusted to 2017). This percent reduction when applied to Connecticut sources equaled a 63.5 percent reduction from wastewater treatment plants (WWTPs) and a 10 percent reduction to nonpoint sources and stormwater. The cumulative

nitrogen load from Connecticut's WWTPs has met the TMDL target reduction for point sources since 2012.

In 2015, EPA released a new Nitrogen Reduction Strategy for LIS which is intended to advance implementation of the TMDL; increase the spatial area subject to nitrogen reductions; and address a variety of eutrophication issues (Table 1). The approach addresses three watershed groups of LIS: coastal watersheds (embayments), large riverine watersheds (Housatonic River, Connecticut River, and Thames River), and Western Long Island Sound (offshore). EPA's strategy involves the use endpoint parameters to develop ecologically based nitrogen endpoints for each of these groups. DEEP, along with NYDEC and select members of the academic and non-profit community serve on the technical stakeholder group.

Subsequently, DEEP formalized this new nitrogen reduction plan, named the Second Generation Nitrogen Strategy, as it follows initial efforts specified in the LIS TMDL aimed at reducing nitrogen in order to achieve dissolved oxygen concentrations in offshore Long Island Sound.

Second Generation Nitrogen Strategy



The Second Generation Strategy combines existing efforts with new initiatives under one plan. It engages nitrogen reduction efforts in three main focus areas: wastewater treatment plants, nonpoint sources and stormwater, and embayments. Near term actions that can be taken at the state level to enhance nutrient reduction efforts are proposed for each of the three focus areas (Table 2).

Motivating factors for the focus areas include:

- Additional upgrades at wastewater treatment plants can be made that would be less expensive than other methods to reduce nitrogen loads.
- Nonpoint source loads of nitrogen seem to be increasing.
- Embayments provide resources, such as critical habitats, and could benefit from a more holistic assessment process. Sources of nitrogen, such as septic systems, may be disproportionately affecting local water quality in Connecticut's embayments.

Wastewater Treatment Plants

It is important to note that the nitrogen reduction target from point sources (i.e. WWTPs) as specified in the TMDL for LIS was meet in 2012. However, additional reductions will create a safety net in the event that nitrogen removal efficiency is decreased at WWTPs. Nitrogen removal at WWTPs is influenced by weather conditions. Cold and wet weather tends to reduce the level of removal, while warm and dry weather acts to improve nitrogen reduction performance. Although temperatures in Connecticut have increased (which is positive for nitrogen removal at WWTPs), rainfall amounts in Connecticut has also increased and is anticipated to continue to increase in the coming years. Because of this, technology upgrades taken at additional WWTPs will help to ensure that the TMDL reduction target will continue to be meet when weather conditions are not favorable. In addition, this next step effort to remove nitrogen at WWTPs beyond the TMDL continues to be a cost effective approach. For example, the initial removal of 16,381 equalized pounds of nitrogen from Connecticut's WWTPs was achieved at a total cost of $720M (scaled to 2019 dollars) or $44k per pound removed. The estimated cost to remove an additional 566 equalized pounds of nitrogen is $97M or $171k per pound removed. Further nitrogen reductions from Connecticut WWTPs beyond this point would be prohibitively expensive. It is estimated that an additional 378 equalized pounds could be removed for a price of $116M or $307k per pound removed.

Nonpoint Sources and Stormwater

Nitrogen from nonpoint sources has likely increased simultaneously with growth in development and changes in rainfall patterns. Nonpoint sources addressed in this focus area include both regulated and nonregulated stormwater, and fertilizers from residential, commercial, and agricultural uses. Implementation actions under this category are applicable statewide. Although,

this category is typically more costly to reduce nitrogen than point sources, non-regrettable, low-cost actions have been proposed for this focus area.

Embayments

Embayments are tidal waters adjacent to the shoreline but distinct from offshore LIS as they are recessed into the land. Embayments are the primary area where the public interacts and enjoys LIS. The study completed by Vaudrey in 2016, indicated that Connecticut's embayments may be suffering from eutrophication caused by excessive nutrient loading. Because embayments provide critical habitats that support both ecosystem functions (fish and shellfish habitat, nursery, and foraging areas) and human uses (fishing, shell fishing, swimming, boating), they are a priority for further study, and restoration as necessary.

Table 2. Second Generation Nitrogen Strategy Goals, Objectives, and Implementation Actions.

Wastewater Treatment Plants	
Goal: To reduce the nitrogen load from point source wastewater discharges statewide.	
Objectives	Implementation Actions
Improve wastewater management infrastructure **statewide**	Plan for additional nitrogen reductions, approximately 3%, at 6-8 wastewater treatment plants
	Pursue opportunities (through permits and/or funding) to incentivize denitrification at wastewater treatment plants that have not become project facilities under the trading program
	Continue to operate the nitrogen trading program to meet and exceed 2000 Total Maximum Daily Load reductions
	Continue to reduce combined sewer overflows

Table 2 (continued)

Non-Point Sources and Stormwater	
Goal: Mitigate Stormwater and NPS nitrogen loads **statewide** and where possible.	
Objectives	Implementation Actions
Reduce the stormwater load of nitrogen through regulatory enhancements	Implement the 2015 enhanced Municipal Separate Storm Sewer System (MS4) general permit which now includes 121 out of 169 municipalities in CT. The area of coverage increased by about 6% over the last permit cycle. The 2015 permit includes additional nitrogen controls, impervious cover and retrofit requirements, and considerations for low impact development
	Finalize the Department of Transportation general permit which will be similar to the enhanced MS4 general permit
	Contract with the Center for Land Use Education and Research to provide outreach and technical assistance for MS4 stormwater planning and management
Increased monitoring and focused watershed studies to model nutrient transformation and delivery to embayments and support local watershed based planning efforts	Update the state-wide model of nutrient and sediment loads from rivers using data from an enhanced surface water monitoring program.
Improve management and handling of fertilizers, Increased public awareness	Include regional nitrogen guidelines for fertilizer use and application in outreach campaigns
Assess and mitigate nitrogen loads from agricultural activities	Continue to coordinate with Natural Resources Conservation District to review and comment on nutrient management plans as well as efforts undertaken in National Water Quality Initiative watersheds
	Pursue issuance of the Concentrated Animal Feeding Operations (CAFO) general permit
	Participate in the Regional Conservation Partnership Programs managed by the National Resources Conservation District when appropriate.
Align 319 projects with watershed priorities	Prioritize nitrogen reduction projects in the 319 request for proposals to increase watershed implementation projects

Table 2 (continued)

Embayments and Coastal Watersheds	
Goal: Reduce the nitrogen load that results in eutrophication of embayments.	
Objectives	Implementation Actions
Increased monitoring and focused studies to better understand the impacts of nutrients and establish reduction or protection targets.	Conduct a pilot monitoring study to develop sampling methods to advance volunteer monitoring efforts
	Prioritize embayments through the Integrated Water Resources Management Process.
	Develop and implement a focused plan of study to collect data and information for input to coupled biogeochemical estuarine models for select priority embayments.
	As a result of the focused studies, develop Total Maximum Daily Load plans or other action plans that identify the source categories (i.e. point source, regulated and non-regulated stormwater, fertilizers) and necessary reductions to minimize impacts to ecological and human uses caused by nitrogen loading and eutrophication.
	Participate in a special study of the Niantic River Estuary to model nitrogen effects and develop loading targets
Outreach and short term management measures	Contract with the Center for Land Use Education and Research to provide education and outreach materials regarding nitrogen sources within Connecticut's coastal boundary
Assess the nitrogen load from septic systems in coastal areas and implement site specific management approaches to reduce those loads	Continue coastal sewer plans and decentralized projects (i.e., Old Saybrook, Westbrook, Clinton, Old Lyme)
	Incentivize the evaluation of wastewater management needs to reduce nitrogen pollution and implementation of centralized or decentralized management approaches through State Clean Water Fund assistance
	Develop and implement a special study on the impacts of nutrients discharged from septic systems on coastal embayments
	Update sewer service area mapping
	Include considerations of climate change impacts (e.g., sea level rise, increased precipitation, increased erosion potential) on studies relative to septic systems located in vulnerable areas of the State

Status of Nitrogen Loading to Long Island Sound

> *In Connecticut, nitrogen loads from wastewater treatment plant have been significantly reduced but nonpoint source loads have increased and now represent the largest source of nitrogen to Long Island Sound.*

In response to the LIS TMDL, efforts taken at wastewater treatment plants throughout Connecticut have resulted in a 63.5% reduction of nitrogen loading to LIS. The reductions were facilitated through the use of a nitrogen credit trading program, enabled by the state legislature in 2001. Figure 2 shows the decline in the monthly average nitrogen load discharged by seventy-nine wastewater treatment plants in Connecticut.

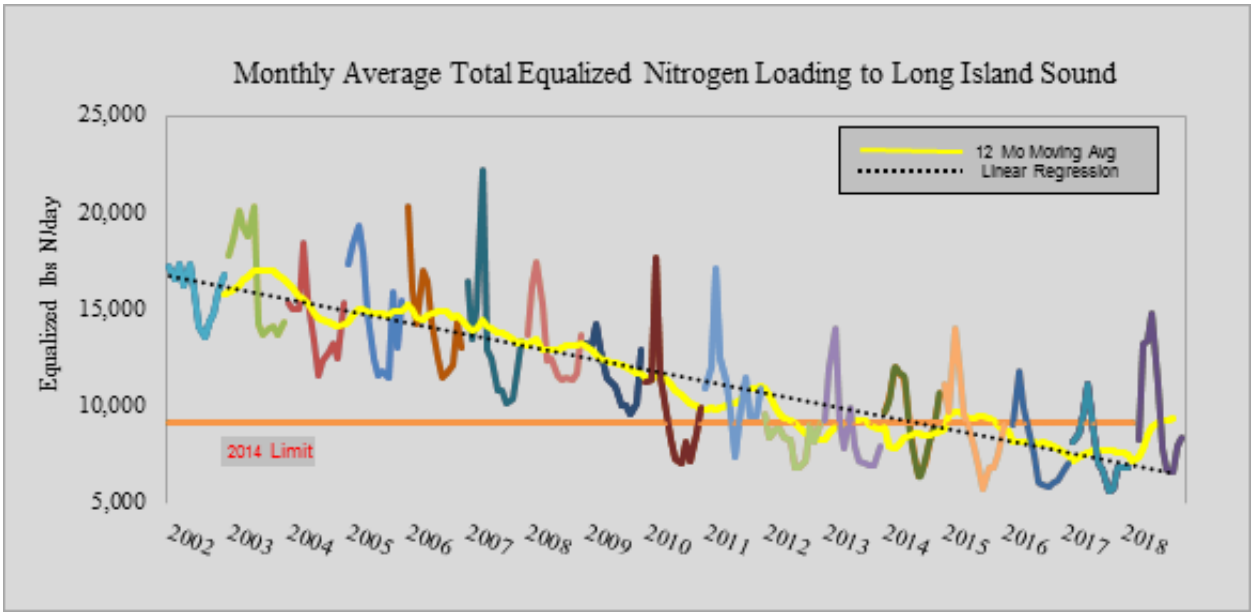
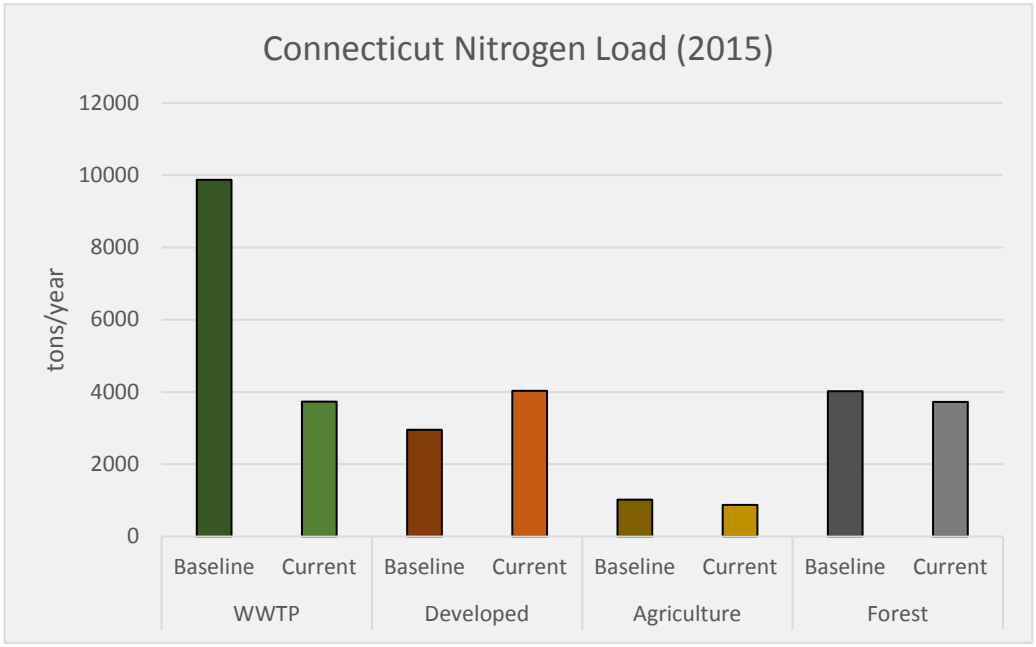


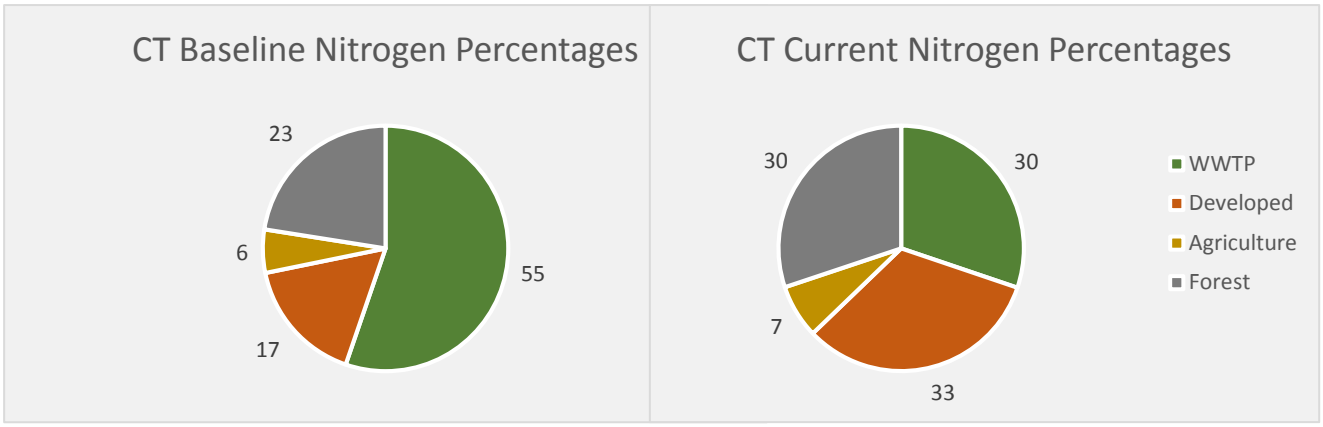
Figure 2 - Connecticut WWTP Nitrogen Loading to LIS.

In 2013, the LIS TMDL workgroup undertook a review of regulatory and non-regulatory programs in an effort to assess the adequacy of current stormwater and nonpoint source nitrogen control efforts implemented to achieve the TMDL for dissolved oxygen. The workgroup consisted of representatives from the states of Connecticut, New York, Massachusetts, Vermont, and New Hampshire, as well as Region 1 and Long Island Sound Study of the Environmental Protection Agency, and the New England Interstate Water Pollution Control Commission (NEIWPCC). NEIWPCC synthesized the state reports to create a summary of watershed wide trends. In general, nitrogen from wastewater treatment loads, atmospheric deposition, and agricultural activities has decreased. However, nitrogen from urban stormwater, septic systems, and fertilizer use have likely increased.

In 2015, CT DEEP conducted a comparison of nitrogen load estimates from the TMDL baseline to current calculations. Figure 3a demonstrates the decrease in WWTP, agricultural, and forest loads, with a simultaneous increase in the stormwater nitrogen load (identified as “developed” in the graphics). It is important to note that the current total nitrogen load does not exceed the TMDL baseline load. The TMDL baseline nitrogen load from WWTPs previously made up the

majority of the load at 55% (Figure 3b). That nitrogen load has been reduced to 30% due to upgrades at WWTPs. Conversely, the nitrogen load from stormwater has increased from 17% (baseline) to 33% (current) as shown in the graphics. Therefore, nonpoint sources of nitrogen from stormwater, agriculture, and forest runoff, now account for a majority (70%) of Connecticut's nitrogen load to LIS. This shift in the largest source of nitrogen is one of the motivating factors behind Connecticut's Second Generation Nitrogen Strategy.





Figures 3a & 3b - Comparison between Baseline (~1990) and Current (2009 Landuse & 2015 WWTP data) Nitrogen loading conditions.

Hypoxia Trends in Offshore Long Island Sound

Nitrogen reductions at WWTPs have weakened the occurrence of hypoxia in Long Island Sound.

Hypoxia (dissolved oxygen concentrations less than 3.0 mg/L) has been documented to occur during the summer months in LIS. Years of research, monitoring and modeling have identified nitrogen loading as a significant cause of decreased dissolved oxygen levels. In a process called eutrophication, excessive discharges of nutrients such as nitrogen fuel the growth of algae. The algae and planktonic animals that feed on algae die, settle to the bottom of the Sound, and decay, using up oxygen in the process.

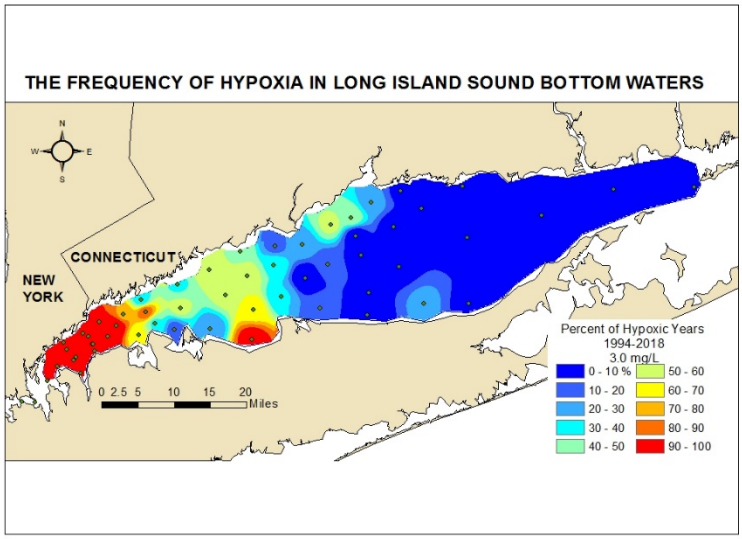


Figure 4 - Frequency of Hypoxia in Long Island Sound Bottom Water (1994-2016).

Hypoxia in LIS typically occurs during the summer between July and September. The Long Island Sound Study tracks the frequency and area of hypoxia, as well as several other indicators (Longislandsoundstudy.net). Measures of the frequency and area of hypoxia in LIS using routine monitoring data are discussed in this document. Figure 4 illustrates the frequency and locations that hypoxia typically occurs in LIS. Hypoxia is most prevalent in the narrows and western LIS. Specifically, the area west of a line from Stratford, CT to Port Jefferson, NY. Figure 5 plots the maximum area of hypoxic water in LIS since 1991. Despite inter-annual variability, the area of hypoxic waters appears to be decreasing. EPA estimates a 40% reduction in the five year rolling average area of hypoxia across the Sound, compared to pre-TMDL levels (EPA 2015). As shown in Figure 2, reductions have been made in nitrogen discharges from wastewater treatment plants which have resulted in achieving the LIS TMDL. It is important to note that although hypoxia is caused by excess nitrogen loading, other climatic factors do influence the area and duration of hypoxia in LIS. These factors include wind speed and direction, water temperature, and the amount of rainfall.

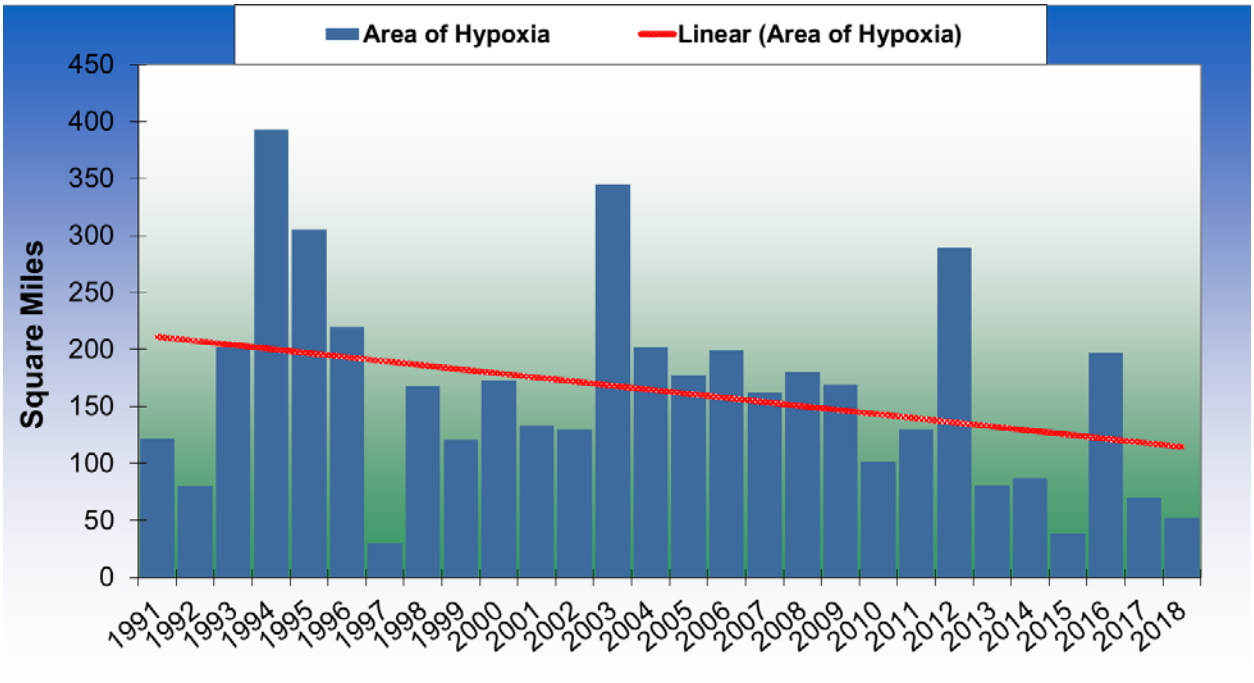


Figure 5 - Long Island Sound Hypoxic Area Trend (1991-2018).

Nitrogen Loading and Embayments

Certain embayments are at high risk of eutrophication from nonpoint sources of nitrogen.

This section summarizes known information relative to nitrogen loading and Connecticut's embayments. Connecticut has a total of 82 embayments, two of which are shared with the States of New York and Rhode Island. Embayments are described as recessed shoreline areas and include harbors, coves, inlets, and bays. They are predominantly where the population engages in water related activities (i.e. swimming, boating, fishing).

In 2012, the Long Island Sound Study funded researchers from the University of Connecticut and Cornell Cooperative Extension to assess the potential for eutrophication to occur in embayments throughout LIS (Vaudrey 2016). This study evaluated the trophic status of embayments using monitoring data, estimated the nitrogen load and sources to embayments using the Nitrogen Loading Model (NLM), and identified 16 embayments in Connecticut where eutrophication is most likely to occur. Sources considered in the NLM include atmospheric deposition (to the watershed and embayment), fertilizer use, sewer, combined sewer overflows, and septic systems. The nitrogen loading to these 16 embayments is shown by source category in Figure 6. In most embayments, nitrogen from septic systems accounts for the majority of the load, followed by fertilizer use.

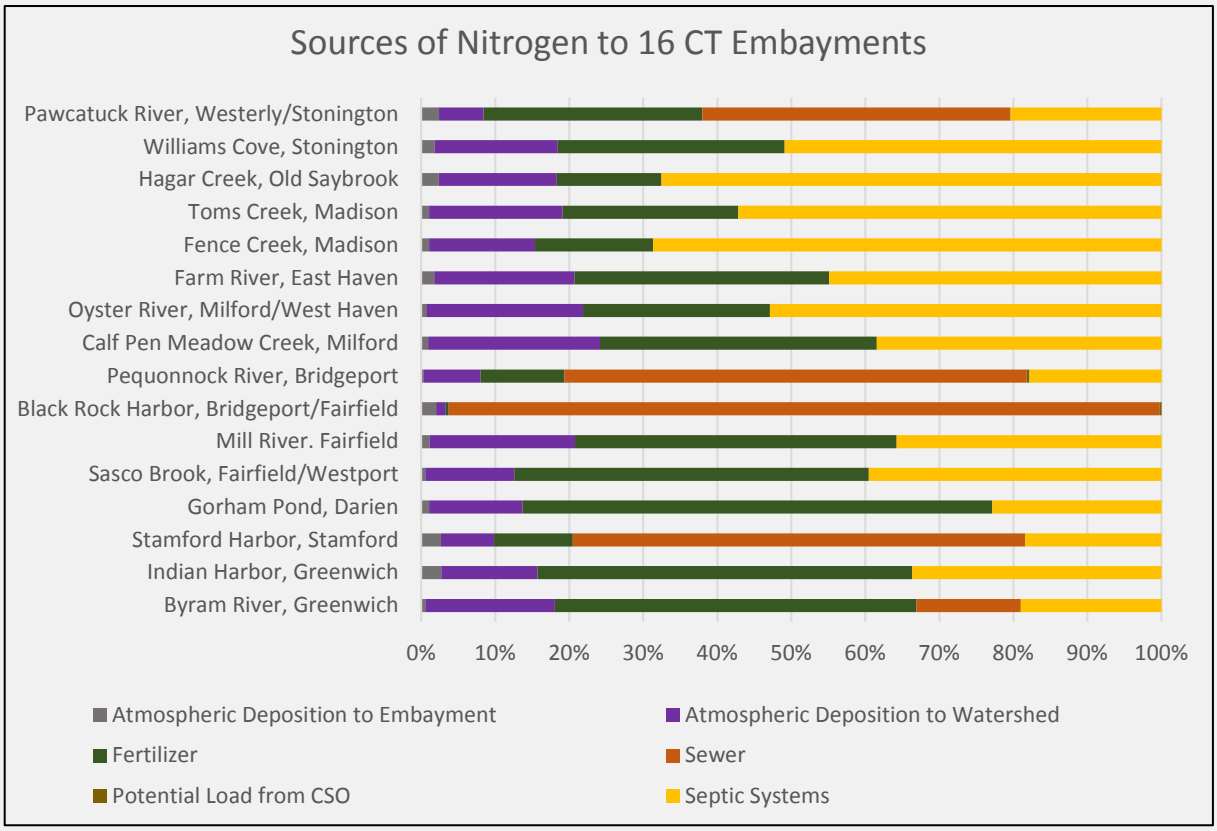


Figure 6. Proportion of sources to Connecticut's 16 Embayments with highest Nitrogen loads (scaled to embayment area).

CT DEEP considered the information from Vaudrey (2016) as well as other factors in a process referred to as Integrated Water Resource Management (IWRM) to prioritize watersheds and embayments for further actions. The IWRM approach used ecological, stressor, and social data and resulted in a list of waterbodies with a high likelihood of restoring water quality. During the selection process many groups within CT DEEP worked together to review ecological conditions, social values, and existing management efforts. Priority data used to select waterbodies for focused efforts included:

- Ecological information showing the health of fish and other aquatic life
- Social values such as fishing, swimming, other recreation, and drinking water sources
- Types and sources of potential pollution such as industrial discharges and sewage treatment plants
- Land use conditions, amount of hard surfaces, and stormwater runoff
- Existing planning efforts within the watershed
- Existing and potential partnerships
- Eutrophication study results for embayments (Vaudrey, 2015)

The final selected watersheds and embayments are shown in Figure 7. Embayments shown in magenta and listed in Table 3 are the focus of the Second Generation Nitrogen Strategy in the "Bays" topic area. Intensive studies are proposed for select priority embayments and action plans will be developed as needed.

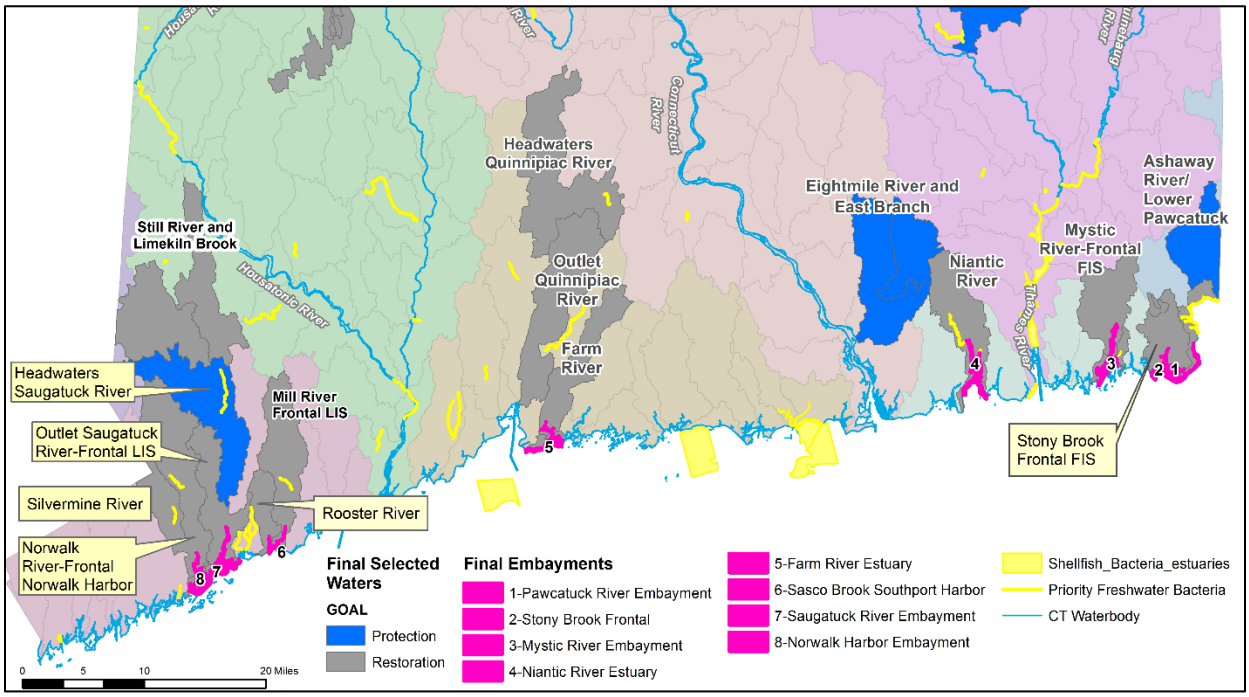


Figure 7 - Final selected embayments highlighted in magenta.

Table 3. List of priority embayments.

Embayments shown in magenta in Figure 7	Details of Priority Embayments
Pawcatuck River Embayment	Pawcatuck River, Wequetequock Cove, Little Narragansett Bay
Stony Brook Frontal	Wequetequock Cove to Stonington Point
Mystic River Embayment	Mystic River, Mystic Harbor, Beebe Cove
Niantic River Estuary	Niantic River
Farm River Estuary	Farm River
Sasco Brook Southport Harbor	Sasco Brook, Mill River, Southport Harbor
Saugatuck River Embayment	Saugatuck River, Compo Beach, Cedar Point, Grays Creek, Canfield Island
Norwalk Harbor Embayment	Norwalk Harbor

EPA's Nitrogen Reduction Strategy

Connecticut's Second Generation Nitrogen Strategy complements EPA priorities.

As mentioned in the introduction, EPA is pursuing additional nitrogen reductions beyond the 2000 TMDL for LIS. These efforts are intended to address three main watershed groups: embayments, large watersheds that drain inland areas, and western LIS watersheds with large, direct discharging WWTPs. This effort was introduced in 2015 and involves the following tasks:

- Address other resource impacts that results from excess nitrogen loading,
- Development of numeric nitrogen endpoints that are protective of designated uses,
- Establish nitrogen reduction targets and allocations where necessary to meet the nitrogen endpoints,
- Continue efforts to increase oxygen in western LIS.

In 2016, a contractor was hired to complete the first phase of the project. This phase included 13 embayments located in both Connecticut and New York, the Connecticut River (large draining watershed), and western LIS. The boundaries of eight of these embayments include all or part of Connecticut's priority embayments. A number of federal, state, academic, and non-profit individuals serve on the Technical Stakeholder Group to this project, including CT DEEP. Deliverables included a literature memo and a number of technical memos specific to certain project tasks. In the draft Subtask F document, EPA's contractor describes an empirical approach based on an evaluation of values from Massachusetts Estuary Program literature, correlation models to develop stressor-response relationships later used to derive nitrogen endpoints for Subtask G. The nitrogen endpoints are intended to be protective of eelgrass and aquatic life. Phase two of the project was initiated in 2018 and extends the approach to 10 additional embayments throughout LIS. Phase two also includes tasks for refining the technical approach, responding to technical comments, collaborating with other nitrogen reduction efforts across LIS, identifying data gaps, and developing nitrogen allocations for 23 embayments located in both Connecticut and New York.

As presented above, CT DEEP prioritized watersheds and embayments for further study and development of action plans, using the Integrated Water Resources Management process. This ensuing effort will be built upon scientifically based methods of study and analysis, as well as consideration of site-specific conditions in order to identify pollutant concentrations and loads consistent with attainment of designated uses, standards and criteria within Connecticut's Water Quality Standards. This holistic approach will yield results that are strongly defensible, garner local stakeholder support, and facilitate the implementation of nutrient reduction efforts. Connecticut's approach builds upon EPA's nitrogen reduction strategy. CT DEEP intends to periodically re-evaluate the priority embayments as studies progress.

Relevant Reports and Publications

The following is a list of reports and publications which are relevant to CT's Second Generation Strategy. Many of these documents are referred to in this Plan. More comprehensive information relative to hypoxia and LIS can be found on DEEP's and the Long Island Sound Study's websites.

Total Maximum Daily Load Analysis to Achieve Water Quality Standards for Dissolved Oxygen in Long Island Sound. This TMDL was adopted by CT, NY, and EPA in 2000 to reduce the total nitrogen load to LIS by 58% of the early 1990s baseline level. The reduction is to be achieved by 2017 in order to attain and maintain WQS for dissolved oxygen. (https://www.ct.gov/deep/cwp/view.asp?a=2719&q=325572&deepNav_GID=1635)

Long Island Sound Prospects for the Urban Sea. In 2013, the LISS announced the availability of the most comprehensive review and synthesis of scientific research for LIS in 35 years. Contributors to the book include scientists, resource managers, and historians who gathered and summarized 1,500 research papers regarding the history and trends of the ecological health of LIS. (http://longislandsoundstudy.net/2014/03/executive-summary-of-long-island-sound-prospects-of-the-urban-sea/)

Evaluation of Stormwater and Nonpoint Source Control Efforts in the Long Island Sound Watershed. Initially prepared with the five watershed states and NEWIPCC in 2013. This document describes programs, policies, and regulations administered by CT to mitigate the nitrogen load to LIS. (http://www.neiwpcc.org/neiwpcc_docs/LIS%20TMDL_CT%20State%20Section.pdf

Comprehensive Conservation and Management Plan. LISS's partners, in 2015, revised the 1994 Comprehensive Conservation and Management Plan to address ongoing and new challenges. The 2015 plan is organized around four themes, each with an overall goal, strategies, and respective actions. The plan sets 20 ambitious, but achievable ecosystem targets for these goals and identifies detailed strategies and actions to drive progress to attain them. (http://longislandsoundstudy.net/2015/09/2015-comprehensive-conservation-and-management-plan/)

Comparative Analysis of Eutrophic Condition and Habitat Status in Connecticut and New York Embayments of Long Island Sound. University of Connecticut researchers estimated the risk of eutrophication, for 116 embayments in the Long Island Sound region. The researchers used computer models to calculate the total watershed nitrogen load and in-estuary dissolved nitrogen concentrations. Models were validated using data collected from sixteen embayments at dawn and slack tide during the summer hypoxia season. (https://vaudrey.lab.uconn.edu/embayment-n-load/)

Integrated Water Resources Management. Using a new enhanced approach to restoring and protecting water quality called Integrated Water Resource Management (IWRM), CTDEEP can better focus state resources and further collaborative efforts with local partners to restore and protect water quality. The use of IWRM by CTDEEP includes longer term goal setting by selecting targeted waters for a six year time period through 2022. Embayments prioritized for further assessment in 2017 include the Pawcatuck River, Little Naragansett Bay, Wequetequock Cove, Quanaduck Cove, Mystic Harbor, Niantic River, Farm River, Sasco Brook/Southport Harbor, Saugatuck River, and Norwalk Harbor.
(https://www.ct.gov/deep/cwp/view.asp?a=2719&Q=580936&deepNav_GID=1654)

Nitrogen Credit Advisory Board Trading Report. CTDEEP established a nitrogen credit trading program as one strategy to attain the nitrogen reductions required through the TMDL report to achieve water quality standards for dissolved oxygen in Long Island Sound. A nitrogen credit exchange was enabled by CT's legislature in 2001 and developed in 2002. Trading reports are produced every year.
(https://www.ct.gov/deep/cwp/view.asp?a=2719&q=325572&deepNav_GID=1635)

Long Island Sound Hypoxia Season Review. Produced annually, this report presents an analysis of field data (ex. dissolved oxygen, pH, water temperature) collected during the hypoxia season. Beginning with the 2016 report, both CTDEEP and IEC data have been combined into one report.
(https://www.ct.gov/deep/cwp/view.asp?a=2719&q=325568&deepNav_GID=1635)

EPA Nitrogen Reduction Strategy for Long Island Sound. Initiated in 2015, EPA's effort to develop nitrogen endpoints to enhance the LIS TMDL. More information about this project can be obtained at the following website:
http://longislandsoundstudy.net/our-vision-and-plan/clean-waters-and-healthy-watersheds/nitrogen-strategy/