LONG ISLAND SOUND STUDY
A Partnership To Restore And Protect The Sound

UPDATE

Winter 1996

In This Issue

A Message From Executive Director Carolyn Hughes

Since the passage of the Clean Water Act in 1972, there have been substantial improvements in the water quality of Long Island Sound. The gross pollution problems and acute health issues have long since been addressed. We've come a long way from the days when raw sewage and raw factory wastes were dumped into our waters. This is good news! It's cause for celebration.

But it doesn't mean we can relax our vigilance, or that we've been totally successful. Problems still remain:

- oxygen levels in some parts of the Sound are well below levels healthy for estuarine life.
- there are still areas of the Sound where shellfishing is restricted or where beaches have to be closed periodically because of pollution.
- and trash and debris still wash up on our beaches with every tide.

This issue of *Update* focuses on nitrogen, the biggest problem facing the Sound. Sewage treatment plants and runoff from the land are the biggest sources of these nutrients. They rob the oxygen from the water, harming estuarine life.

The plan to clean up Long Island Sound lays out a strategy to control nitrogen loads by upgrading sewage treatment plants and controlling nonpoint sources of pollution. Upgrading the sewage treatment plants is the job of government, and will require a significant investment and a strong partnership at the federal, state and local levels. Achieving this goal will require the development of innovative technology and innovative financing options. It will be expensive, it will take time, but it can be done.

Nonpoint source pollution will be more difficult to control. This type of pollution is caused by runoff from roads, parking lots and atmospheric deposition. Septic systems and things like fertilizers and other chemicals we put on our lawns, are also sources of nonpoint pollution. Whatever is not used by the plants washes off the lawn and eventually ends up in Long Island Sound.

Controlling nonpoint sources will require reducing pollution from smaller and more diffuse sources and will also require changes in individual behavior. Because everyone who lives in the Long Island Sound watershed contributes to water pollution in the Sound -- everyone needs to be involved in helping to clean it up.

Remember -- it was the individual action of millions of people coming together in 1970 to protest what was happening to the earth that created the strong environmental programs we have today. Now, more than ever, that individual commitment and action is needed if we are to continue the trend of the past 25 years of environmental improvement.

It is important to stay informed, make your voice heard, and make some small behavior changes to help protect our natural resources. The future of Long Island Sound and the larger environment depends on individuals getting involved. Make the commitment. The cumulative impact of these individual actions will make a difference.

Check It Out

LISS materials and information on the World Wide Web. To access LISS information:
http://www.epa.gov/eparegions/region1.html

UPDATE

THE LONG ISLAND SOUND STUDY *UPDATE* IS PUBLISHED QUARTERLY BY THE PUBLIC OUTREACH PROGRAM OF THE LONG ISLAND SOUND STUDY TO INFORM THE PUBLIC ABOUT ISSUES PERTAINING TO THE STUDY.

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What is Nitrogen and why is it a problem?

Nitrogen is a colorless, tasteless, odorless gas that constitutes 78 percent of the atmosphere, and occurs as a constituent of all living tissues. It enters the aquatic environment from natural sources including precipitation, dustfall, and runoff from the land. It must be transformed into compounds, usually by bacteria or commercial processes creating fertilizer and other products used by humans, that are useable by plants and animals. Forms of nitrogen delivered to the Sound include: organic nitrogen, which is incorporated in dead or living plants and animals; ammonia, primarily a by-product of waste products and bacterial decay of plants and animals; nitrite and nitrate, both by-products of bacterial decay, and nitrate from atmospheric deposition, which originates from combustion of fossil fuels.

Human activities can significantly increase the amounts of nitrogen entering the aquatic system. Human-related sources include lawns and gardens; septic systems and industrial wastes, runoff from urban areas, livestock feedlots and agricultural lands; municipal wastewater discharges; and atmospheric deposition from auto and other emissions.

In the water, nitrogen acts as a fertilizer, stimulating the growth of algae. When the algae die, they sink to the bottom and decompose. The process of decomposition robs the oxygen from the water, contributing to a condition called hypoxia. Hypoxia, or low dissolved oxygen poses problems for fish and aquatic life, since fish, like humans need oxygen to breathe in order to survive.

For the impacts of hypoxia on the aquatic life in the Sound see the article on the *Biological Effects of Hypoxia in Long Island Sound* on Page 3.

Sources of Nitrogen To Long Island Sound

by Kimberly Zimmer

A total of 93,600 tons of nitrogen are estimated to be delivered to the Sound each year. Of this, about 39,900 tons originate from natural sources. The amount of nitrogen from natural sources approximates the amount delivered to the Sound by rivers, runoff and groundwater in pre-colonial days. Today, human activities account for the remaining 53,700 tons of the Sound's annual nitrogen load. The LISS has targeted the human generated nitrogen activities for priority management attention.

The human generated nitrogen is transported to the Sound in the same fashion as natural sources. However, the amount carried is significantly higher than under natural conditions. The activities most responsible for the increased load are sewage treatment plants that discharge both directly to the Sound and into tributaries leading to the Sound; alteration of landcover by development; agriculture and atmospheric deposition. These pollution sources are generally categorized as either point sources or nonpoint sources.

Point sources are any single identifiable source of pollution like a sewage treatment plant outfall pipe. While, treatment plants effectively remove many damaging pollutants and meet standards once believed to be stringent enough to solve most surface water quality problems, they do not remove much nitrogen (unless specifically designed to do so). Worse still, conventional sewage treatment plants convert nitrogen from human and other organic waste into forms most readily usable by estuarine plant life -- ammonia and nitrate-- the same nutrients applied to lawns and agricultural crops as fertilizers to stimulate growth. More than half of the nitrogen delivered to the Sound attributable to human sources comes

from these point sources and most of that in areas very close to the Sound rather than far up the tributary rivers.

Nonpoint source pollution --unlike point sources-- is quite diffuse, both in terms of its origin and in the manner in which it enters ground and surface waters. Every activity within the watershed of the Sound can potentially contribute to nonpoint source pollution. Airborne pollutants like sulfur, lead and nitrogen, which are emitted from smoke stacks and automobiles, fall to the ground with rain or as particulate "dry" deposition. When rainwater hits the ground it picks up sediments, floatable debris, lawn and farm chemicals, oil and grease from cars and other materials. In urban areas where much of the land is paved, water cannot filter through the soil, so the volume of runoff and the amount of pollution it carries increases. The LISS estimates that 20 percent of the human nitrogen contributions come from nonpoint sources. Steps are being taken to control these sources through the use of management practices that contain runoff and pollutants on land. These may include best management practices (BMPs) which are structural or nonstructural methods that reduce the flow and pollutant content of runoff, but maintain the productivity of the land.

The large input of nitrogen across the Sound's boundaries (through the East River and The Race) is generated by the same sources identified above: point, nonpoint, and atmospheric deposition however, at The Race the source is nutrient regeneration from upwelling offshore. The boundary contribution is roughly equivalent to the nonpoint and atmospheric load, accounting for about 20 percent of the human related load.

Nitrogen Enrichment by Source

tons/year

Coastal Point 25,700 (50%)
Tributary Point 3,900 (8%)
Coastal Nonpoint 3,500 (7%)
Tributary Nonpoint 4,900 (10%)
Atmosphere 2,200 (4%)
Boundary 10,700 (21%)

Total Load 50,900 tons/year

Kimberly Zimmer works for New York Sea Grant and is the New York Outreach Coordinator for the LISS.

Calendar

The third "Long Island Sound Educators Conference" will be held at The Maritime Center at Norwalk on **Saturday, March 23, 1996** from 8:30 to 4:00 pm. Please call Varlerie Cournoyer or Amy Haddow at (203)852-0700, ext. 234 or 214 for more information.

The sixth annual Long Island Sound Watershed Alliance Citizen's Summit will be held on **Saturday, March 30, 1996** at Norwalk Community Technical College in Norwalk, CT. For further details concerning the conference contact Luciana Castro at Save The Sound, Inc.:(203)327-9786.

The next Long Island Sound Research Conference will be held **October 25-26, 1996** in Connecticut. Contact Sue MacNamara at (203)392-6266 for more information.

New Watershed Initiative Launched

On September 29, 1995 EPA and the Natural Resources Conservation Service (NRCS) entered into an agreement to jointly establish a watershed initiative. Under the agreement, Walter Smith, a 10 year veteran of NRCS, has been detailed into the Long Island Sound Office for a two year period.

Walter will focus on watershed issues to support implementation of the CCMP. He will work with local government, community groups, and other federal and state agencies to identify opportunities to improve the quality of water resources --both locally and in the Sound. We are pleased to have Walter on our team. Walter can be reached at (203)977-1543.

Biological Effects of Hypoxia in Long Island Sound

by Don Miller and Bill Wise

What are the effects of reduced summertime dissolved oxygen levels on the biota of the Sound? What concentration of dissolved oxygen is necessary to adequately protect the Sound's valuable finfish and shellfish populations? These and related questions are occupying the attention of scientists, resource managers, and environmental modelers as the Long Island Sound Study determines how, where, and to what extent nutrient loadings should be reduced to protect the Sound from the adverse effects of hypoxia.

Aquatic creatures need oxygen to survive as much as do terrestrial organisms. Severe hypoxia results in death of aquatic life. More moderate hypoxia can affect the physioloy and the behavior of animals in several negative ways. The nature and extent of an organism's response to hypoxia depends on several factors, including the concentration of oxygen in the water, the duration of the organism's exposure, and the age of and physiological condition of the organism. Physiological changes may result in reduced growth and reproductive impairment. Some aquatic animals may behaviorally avoid low dissolved oxygen water, yet this behavior may result in increased predation, and the animals no longer have access to preferred feeding areas or spawning habitats.

Scientists have documented the response of marine and estuarine creatures to hypoxia, both by exposing animals in the laboratory to different levels of dissolved oxygen for variable time periods and documenting the lethal and sublethal effects, and by conducting fisheries surveys in the Sound and correlating catch rates to oxygen levels.

The lab-based research has been conducted using native species of Long Island Sound fish and crustaceans at the US EPA Environmental Research Laboratory, in Narragansett, Rhode Island, and is supported in part by the

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Long Island Sound Study.

The EPA studies found dissolved oxygen concentrations around 4.5 milligrams per liter (mg/l) significantly reduced the growth of larval and postlarval mud crabs. At 3.5 mg/l, growth reduction in these crabs became more severe (up to 50%), while at 3.2 to 3.0 mg/l, American lobster postlarvae and newly settled juveniles also began to suffer slower growth. The life of larvae is generally a race between growth and predation, the slower the growth, the higher the chance for predation. When dissolved oxygen falls below 3.0 mg/l, larval crustaceans begin to die and the growth rate of juvenile crustaceans and finfish, which are generally more robust than larvae, begins to drop. Lethality in juvenile finfish and crustaceans begins at dissolved oxygen levels less than 2.0 mg/l. Each of these species and life stages inhabit the subsurface waters of the Sound.

Fishery trawl surveys document certain consequences of hypoxia on the sound's finfish and shellfish at both the population and community level. Summer trawl surveys conducted by the Connecticut Department of Environmental Protection show that where there is low dissolved oxygen, there are fewer fish and fewer kinds of fish. Bottom living fish species are influenced the most. The weight of the bottom fish caught per standard tow began to decline when dissolved oxygen fell below 3.7 mg/l and the number of bottom species captured began to decline in waters of 3.5 mg/l. Areas outside these low dissolved oxygen waters often produced unusually high trawl catches, suggesting the fish were avoiding areas of low oxygen and crowding well-oxygenated portions of the Sound.

The laboratory and field studies observed sublethal effects of hypoxia in the range of 4.5 to 3.5 mg/l, with increasingly deleterious effects at lower concentrations. Biologists, modelers and environmental managers will use this information to describe the impacts of hypoxia on living marine resources and predict the benefits of various levels of nitrogen reduction on the health and vitality of aquatic animals in the Sound. This research will provide the basis for the establishment of dissolved oxygen criteria for Long Island Sound to fully protect the Sound's living marine resources from summertime hypoxia. These criteria would supplant the interim dissovled oxygen goals contained in the Long Island Sound Comprehensive Conservation and Management Plan.

Don Miller works for the EPA Narragansett Lab and Bill Wise is the Director of the Living Marine Resources Institute at Marine Sciences Research Center at Stony Brook.

Summary of Biological Effects of Hypoxia

Effect concentrations (MG/L) for X% impairment for LIS species — From CT DEP and EPA Narragansett hypoxia studies

Species/end point	Impairment %			
	10	25	50	75
Trawl study:				
finfish biomass	3.3	2.8	2.3	1.8
demersal species richness	2.8	2.3	1.8	1.2
Growth:				
American lobster juvenile	—	3.1	2.5	1.8
grass shrimp post larval	—	2.7	—	—
sheepshead minnow larvae	—	2.2	1.5	1.0
Survival:				
winter flounder juvenile	1.7	1.6	1.5	1.2
crustacean juvenile	1.5	1.3	1.1	0.9
tautog juvenile	1.1	1.0	0.7	0.7

Wastewater Discharge To Cold Spring Harbor Eliminated

The Cold Spring Harbor Laboratory, located on Cold Spring Harbor on the north shore of Long Island, New York operated its own 0.3 million gallons per day wastewater treatment plant for 18 years, from 1976 to 1994, discharging into the inner portion of the Harbor and ultimately to Long Island Sound.

In recent years, the plant had become antiquated and at times was overloaded. This caused the plant to experience difficulties in complying with its State Pollutant Discharge Elimination System discharge permit limits and the risk of polluting the inner Harbor became a concern. Based on this concern, the lab has eliminated the plant's discharge. The plant has been converted to a pump station, connected to a municipal sanitary sewerage system, located 2 1/2 miles away and the wastewater is now discharged into the Atlantic Ocean.

The Project, which was put on-line in April 1994, has received the 1995 Quality of Life Award from the Long Island Branch of the American Society of Civil Engineers. The Award recognizes civil engineering projects which improve the quality of life on Long Island.

Habitat Surveys Returned

As part of our efforts to develop a bi-state habitat restoration strategy (see Habitat Restoration for LIS in Fall 1995 issue of *UPDATE*), the LISO recently conducted a survey to identify sites around the Sound that may be candidates for restoration. To date, nearly 100 surveys have been returned, identifying numerous sites throughout NY and CT that have been degraded and may have the potential to be restored. LISO staff will be working with staff of the US Fish and Wildlife Service to map the sites using a Geographic Information System. The Habitat Team will use this information to establish priorities for restoration, and develop a draft Habitat Restoration Strategy, for public review. If you missed the deadline, but would like to nominate a site, please contact Carolyn Hughes at (203) 977-1541.

National Perspective on Nitrogen in Estuaries

by Suzanne Schwartz

Estuaries have it bad these days and that's not good. They support an extraordinary array of human uses and ecological benefits, making them among the most intensively exploited, developed, and inhabited places on earth. Being at the end of their watershed "pipelines," they experience not only the concentrated impacts of adjacent people and activities, but also the cumulative pollutant burden of hundreds of upstream sources.

Long Island Sound, with its enormous watershed and population, shows some extreme, although not unique, examples of these impacts, including diminished productivity of wetlands, intertidal areas, and other habitats, and contaminated sediments in embayments and selected bottom areas. The most critical problem exemplified by the Sound, however, is the extent of hypoxia, or conditions of low dissolved oxygen in the water, which affects large areas of the Sound, rendering them unfit for fish and shellfish.

But Long Island Sound is not alone. In 1992 and 1994, the US EPA's report to Congress on the quality of the nation's waters overwhelmingly identified nutrients as the leading cause of impairment in estuaries, followed closely by pathogens and organic enrichment/low dissolved oxygen. This evidence of a shared nutrient problem should not be a surprise. Clearly, estuaries and coastal areas are being subjected to pressures from high population densities and industry. An assessment designed to identify and target areas potentially needing special management attention found that more than 2,200 industrial facilities and wastewater treatment plants discharge directly into estuaries and near coastal waters; thousands more discharge upstream.

One of the most valuable findings emerging from the National Estuary Program (NEP) has been a greater understanding of the extent and cumulative impacts of these discharges, especially nutrients. Beyond the discovery that impacts are worse and occur on a greater scale than anyone had expected, another important finding by the NEP is the surprisingly high nitrogen contributions from air deposition and septic systems. For example Tampa Bay now estimates, that as much as 67 percent of total nitrogen loadings to the bay come from atmospheric deposition, much of it from remote sources. At the other end of the scale, Buzzards Bay in Massachusetts and Indian River Lagoon in Florida have identified septic systems -even those systems that are operating properly- as major nitrogen contributors. In Delaware Inland Bays and Albemarle-Pamlico Sounds, the nutrient culprit is agricultural runoff.

Nutrients are a serious threat or problem in virtually all of the 28 estuaries now included in the NEP. In response to this universal issue, programs in the NEP have built up an impressive inventory of innovative technical and management approaches. Certainly we at the US EPA, consider the experience gained by the NEP as invaluable as the agency moves more into watershed and community-based environmental protection. The Long Island Sound Study and other estuary programs are leaders in these efforts, and their technical and management expertise should be sought more aggressively and shared more widely. In these financially strapped times, the judicious use of appropriate technologies will become ever more important for achieving our coastal protection and habitat restoration goals.

Suzanne Schwartz is Acting Director of EPA's Oceans and Coastal Protection Division in Washington,DC.

BNR Retrofit - City of Norwalk

by Fred Treffeisen

In December 1994, the City of Norwalk, Connecticut completed a project to retrofit the Norwalk wastewater treatment plant for biological nutrient removal (BNR). This project, which involved modifications to the existing process tanks, was undertaken as a result of an agreement between EPA and the States of Connecticut and New York establishing a policy of "No Net Increase" of nitrogen to Long Island Sound.

The project was part of a $15 million pilot program, funded by the State of Connecticut, to test the effectiveness of low-cost, short-term nitrogen reduction control strategies. The intent of the "No Net Increase" pilot program was to get the best "bang for the buck" of total nitrogen removal from Connecticut's coastal wastewater treatment plants.

The operations staff at the Norwalk Plant believe the program is successful because the total nitrogen removed is significant, given the cost incurred. The retrofit cost approximately $1 million. The first six month period of operation produced an average of 767 lbs/day of total nitrogen compared to the 1990 baseline of 1470 lbs/day of total nitrogen. This equates to more than a 50% reduction from the 1990 base and a total removal rate of 73% . The plant's operational costs have actually decreased because the retrofit included a more efficient aeration system which lowered the utility costs.

Better removal rates are expected following further experimentation of the new BNR process. If the other Connecticut Coastal Retrofits are this successful, the program should be considered a major first step in removing total nitrogen for Long Island Sound.

Fred Treffeisen is employed by Malcom Pirnie as the manager of Environmental Services for the City of Norwalk.

NEW VIDEO

The Connecticut Department of Environmental Protection is producing a video which will explain the nature of the hypoxia problem in LIS. It will also show how the LIS 3.0 model is being used as a sophisticated management tool by water quality managers, allowing precise designation of nutrient reduction targets. The video will be available in the Spring of 1996. For additional information contact Jim Murphy of the CT DEP at (860)424-3641.

LIS 1995 Summer Dissolved Oxygen Monitoring

Monitoring of dissolved oxygen conditions in LIS is conducted by Connecticut Department of Environmental Protection (CT DEP), New York City Department of Environmental Protection (NYC DEP), and the Interstate Sanitation Commission (ISC). This summer CT DEP completed its fifth year of intensively monitoring LIS during the summer months for dissolved oxygen concentrations. This is part of their ongoing year-round Water Quality Monitoring Program. Dissolved oxygen data are being collected from more than forty sites by staff aboard the Department's Research Vessel *John Dempsey*. Oxygen is regularly monitored to quantify the areal extent of hypoxia -- the condition of low dissolved oxygen concentrations -- which has been chronically present in the bottom waters of the western part of LIS during the summer months.

Results of Summer Surveys:

Typically, dissolved oxygen levels in LIS start to decline in late May and early June as warmer temperatures heat surface waters. The warmer less dense surface waters float on top of the cooler bottom waters, forming a barrier that prevents mixing. For the past few years, hypoxic waters have been observed in the western end of LIS during the first two weeks of July.

In 1995 hypoxia was first observed in late July and extended from Execution Rocks, New York to Greenwich, Connecticut. By the first week in August the hot, still weather patterns created a large hypoxic area that extended from Execution Rocks to west of Stratford Shoals, with additional hypoxic areas present off the mouth of the Housatonic River, Port Jefferson, and east of Herod Point Shoal. By mid August, cooler, windier days and nights mixed the water layers and limited the hypoxic areas to the far western Sound. Thereafter, the wind and wave surges that were created by the hurricanes moving northward in the Atlantic Ocean mixed the Sound's waters and by September the Sound had dissolved oxygen concentrations above the critical level of 3.0 mg/l.

The late onset of hypoxia in 1995, in comparison to previous summers may have resulted from the very mild southern New England weather during the previous winter. The mild winter lessened the degree of stratification between surface and bottom waters during the summer. As a result the extent, duration, and severity of hypoxia in 1995 were not as bad as the severly hypoxic summer of 1994. The weather patterns both during the winter of 1994-1995 and the late summer helped limit and eliminate the hypoxic waters. By contrast in 1994, New England suffered a bitter winter, causing bottom waters to remain colder longer. Coupled with an early heat wave in June 1994, these factors created one of the severest hypoxia events observed since monitoring began.

The CT DEP Long Island Sound Ambient Water Quality Monitoring Survey has been ongoing, with funding assistance from the US Environmental Protection Agency, since 1991. It provides data to establish the extent, duration and trends of hypoxia, as well as trends in ambient nutrient concentrations throughout the Sound. The intensive summertime hypoxia monitoring survey consists of sampling every other week, beginning in late June, at approximately 38-48 fixed stations throughout Long Island Sound. The monthly water quality monitoring survey consists of sampling 18 fixed stations (extending from Manhasset Neck on Long Island in the west to Block Island Sound in the east) for temperature, dissolved oxygen, salinity, photosynthetically active radiation, chlorophyll *a*, phytoplankton abundances, total suspended solids and nutrients (both dissolved and particulate forms of nitrogen, phosphorous, silica, and carbon).

Since 1991, under a grant from US EPA Region II, the ISC has conducted weekly surveys from late June through mid September of the Upper East River and the western Sound during the critical summer season. Since 1992 ISC has sampled 18 stations for temperature, salinity, dissolved oxygen and chlorophyll *a*. Two of the stations are also sampled by CT DEP, serving as a check on the accuracy of the data.

NYC DEP's 52 station harbor survey, in its 86th year, includes five stations in the East River and 11 in the western Sound. The survey was expanded in 1988 to include year-round dissolved oxygen, temperature, salinity, density, nutrient, and chlorophyll monitoring. These surveys are conducted approximately twice per month. The NYC DEP station off of Throgs Neck is also sampled by CT DEP and ISC, in order to provide a reference for assessing the accuracy of the data and proper functioning of the monitoring equipment. NYC DEP also splits samples monthly from 3 of the East River stations to send to the CT DEP for expanded nutrient analyses.

Chronology of Hypoxia Management

1975 — Study published by the New England River Basin Commission recommends that nutrient enrichment of the western Sound be investigated and the relative significance of point and nonpoint sources be identified.

1985 — Congress appropriated funds for the US Environmental Protection Agency to research, monitor, and assess the water quality of LIS.

1986 — Monitoring of LIS reveals larger area of LIS affected by low dissolved oxygen levels (hypoxia) than previously believed.

1987 — In amendments to the Clean Water Act, Congress creates the National Estuary Program (NEP). The LISS is added to the NEP and a management conference is convened to develop a *Comprehensive Conservation and Management Plan* (CCMP).

Water quality sampling conducted by the LISS observes anoxia (no dissolved oxygen) in the waters off Hempstead harbor.

1988 — Development begins on water quality and circulation models of LIS to understand the causes of hypoxia and identify actions needed to improve conditions. Most comprehensive monitoring of LIS ever conducted commences.

Nitrogen Removal at the Stamford, Connecticut Water Pollution Control Facility

by Jeannette Semon

The City of Stamford Water Pollution Control Facility is a secondary, activated sludge treatment plant which has been in operation since 1976. The plant treats an average daily flow of about 17 million gallons per day, of which about 85% is from domestic/commercial sources and 15% from industrial sources. Over the past several years, the City of Stamford has experimented with different ways to remove nitrogen from wastewater to help improve the water quality in Long Island Sound. Stamford has operationally modified the treatment process for biological nitrogen removal and is also operating a high biomass system called a biological upflow fluidized bed reactor.

Since 1988, personnel at the Stamford's water pollution control facility have experimented with a process called biological nitrogen removal. Since the experiment began, nitrogen removal efficiencies have ranged from a low of 49% to a high of 83%. The average is about 60% with an average effluent total nitrogen concentration of 8.9 mg/l. The original funding for this project came from the State of Connecticut. The plant is upgrading this process with a $2 million grant from the State of Connecticut and a local utility is providing a grant for installing energy efficient equipment.

Another system being tested at Stamford is called a biological fluidized bed reactor. Since 1993, the reactor has been used for denitrification of the secondary effluent produced at the treatment plant. The reactor treats about 0.35 million gallons per day of wastewater.

During the project period, this process has removed over 95% of the nitrogen entering the reactor with effluent total nitrogen concentrations less than 3 mg/l. This process is very easy to operate and requires very little land area since it is a high biomass system. This is especially important for plants that have to remove nitrogen, but have very little room for expansion.

Jeannette Semon is the supervisor for the Water Pollution Control Division for the City of Stamford.

The US EPA presented Jeannette Semon with the National Operations and Maintenance Excellence Award. The award was based on Jeannette's initiative in experimenting with ways of removing nitrogen from wastewater. The staff of the Stamford WPCF have been considered the leaders in nitrogen removal in the Long Island Sound Region.

Nitrogen Reduction at Tallman Island

In 1990 the New York City Department of Environmental Protection (NYCDEP) undertook a pilot project to assess the feasibility of nitrogen removal processes in existing treatment plants. The pilot project was intended to investigate techniques that could be employed using present equipment and only small capital expenditures. A portion of the Tallman Island Water Pollution Control Plant (WPCP) was the focus of the study.

The WPCP is located at 127th Street and the East River in College Point, New York and was originally designed in the mid-1930's. The design flow at the time was 40 million gallons a day (MGD), serving a population of 300,000, though the plant was designed with expansion potential to treat a flow of 80 MGD.

The original facility has gone through several upgrades and expansions in 1959, 1960, 1964, 1965, and 1969, bringing it to its present treatment capacity of 80 MGD. Tallman Island currently treats approximately 60 MGD.

The drainage area from Tallman Island is approximately 16,800 acres. The wastewater system within the service area contains storm sewers, sanitary sewers and combined sewers.

The results of the pilot project show that compared to traditional BNR treatment systems, secondary treatment can significantly reduce the amount of nitrogen being discharged to Long Island Sound at a much lower cost. The Tallman Island pilot plant required the installation of flow meters, samplers, baffles and mixers, at a cost of $40,000 granted by EPA and resulted in removal of about 60 percent of total nitrogen.

Based upon the pilot as well as additional research, and a centrate characterization and treatment study, the City of New York has prepared a Nitrogen Control Action Plan to meet the "no net increase" policy and Phase II nitrogen reduction targets for Upper East River and Jamaica Bay. Under the plan, BNR retrofits are underway at the Tallman Island, Hunt Point and Bowery Bay Plants. These BNR retrofits are scheduled to be completed by January 1997. The Hunt Point and Wards Island Plants will also add biological centrate treatment July 1996. The total cost of these improvements is $16,360,000. Full implementation is projected to reduce nitrogen discharges by approximately 40 percent from current discharge levels, and 20 percent beyond "no net increase" levels.

Additional Nitrogen Removal will occur at 6 other New York City facilities discharging to New York Harbor, Jamaica Bay and the Lower East River.

In Long Island Sound

1989 — Forty percent of the Sound (>500 square miles) experiences hypoxia in the late summer.

1990 — LISS issues *Status Report and Interim Actions for Hypoxia Management*, based on model using simplified water circulation (LIS 2.0). States of New York and Connecticut agree to take steps to cap nitrogen at 1990 levels.

1992 — Watershed-based management zones created to foster flexible, comprehensive planning for nitrogen reduction.

Pilot projects for nitrogen removal are initiated at 17 sewage treatment plants in NY and CT.

1994 — CCMP is approved by EPA and the states of New York and Connecticut. Commitments made to begin to reduce the discharge of nitrogen to LIS from point and nonpoint sources.

Water quality model using complex water circulation (LIS 3.0) approved for use in testing options to improve water quality.

1995 — Public meetings planned to solicit input on management options for establishing long-term nitrogen targets. Plan to be involved!

LISS begins using LIS 3.0 to identify benefits of various management scenarios. Model predicts significant improvements in dissolved oxygen concentrations can be achieved by reducing nitrogen discharges.

1996

Developing Phase III Nitrogen Reduction Targets

by Mark Tedesco

The Winter 1995 issue of the *UPDATE* reported on the approval of the computer model of Long Island Sound, called LIS 3.0, for use by environmental managers in assigning priorities for reducing nitrogen. The water quality model predicts the relative improvement in dissolved oxygen levels from actions to reduce sources of nitrogen from different areas of the watershed. LISS managers are currently using the model, combined with information on the cost of reducing nitrogen from sewage treatment plants and from nonpoint sources, to identify how to best use limited funding to improve the Sound's water quality.

There is cause for optimism. Previous estimates of the cost of upgrading sewage treatment plants were around $8 billion. As a result of the successful piloting of new technologies, the cost estimate of upgrading sewage treatment plants is now down to $2.5 billion.

The cost of improving sewage treatment plants and of controlling nonpoint sources of nitrogen can be further reduced by targeting actions where they result in the greatest benefit to the Sound's ecological health. That's where the LIS 3.0 model comes in. The LISS is using the model to predict the relative benefit of a number of scenarios, or levels of management, for reducing nitrogen. The dissolved oxygen levels from each scenario will be compared to the levels necessary to protect the Sound's living resources. While not a formal cost-benefit analysis, this approach will allow the LISS to identify the level of nitrogen reduction that maximizes the benefit of investments in improving water quality. This level will be translated into specific nitrogen reduction targets for each of the 11 watershed management zones that have been established. Within each zone, the states of NewYork and Connecticut will work with local governments to achieve the reductions in a flexible, cost-effective manner.

The LISS is investigating a relatively new concept called effluent trading as a way to allow flexibility. Effluent trading is an innovative way to develop more "common sense" solutions to water quality problems. For Long Island Sound, sources of pollution would be given the option of achieving needed further pollutant reductions on-site or by substituting a cost-effective and enforceable mix of additional controls on other sources. Effluent trading creates an economic incentive for dischargers with low-cost controls to go beyond minimum pollutant reduction requirements. Sources with high-cost controls would finance reductions at these low-cost sources.

Targeting nitrogen reduction and supporting flexibility in achieving them can reduce the cost of improving the Sound's water quality. But public understanding and support will still be needed. Once the nitrogen reduction targets are developed, the LISS will schedule public meetings at locations around the Sound to present the LIS 3.0 model results and to get feedback on the targets. Following public input, the nitrogen reduction targets will be presented to the Policy Committee for adoption.

Mark Tedesco is the Technical Director for the EPA Long Island Sound Office.

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