LONG ISLAND SOUND STUDY

Nutrient Reduction Action Plan Demonstration Projects

Over the past three years, the Long Island Sound Study (LISS) has been investigating the nature of the **hypoxia** (low dissolved oxygen) problem in Long Island Sound. There is a growing consensus among researchers that excess nutrients are the primary cause of the reduced oxygen levels observed in the Sound (see Fact Sheet #1). Measures to improve this condition, such as controlling the flow of nutrients. particularly nitrogen, to the Sound. are challenging and could be costly. Original estimates attached a price tag of several billion dollars to the reduction of nutrient pollution from point sources — sewage treatment plants and industry.

To determine the effectiveness of several "low-cost"nutrient reduction measures, the LISS is funding two pilot projects called Action Plan Demonstration Projects. Each will investigate the effectiveness and applicability of certain nutrient reduction technologies in the Sound's watershed.

Biological Nutrient Removal Project

Currently, wastewater is treated by two processes, **called primary and secondary treatment** before being discharged into the Sound. Primary treatment removes solids and some organic matter, while secondary uses biological processes to treat wastewater to further reduce organic wastes in the effluent (see Fact Sheet #3). Conventional wastewater treatment plants remove only small amounts of the nutrients nitrogen and phosphorus. Typically, a primary treatment plant can remove 5 to 15 percent of the total nitrogen and phosphorus from the waste stream. A secondary plant will remove an additional 5 to 10 percent of these nutrients.

Nutrient Reduction: New Solutions to Old Problems

Using **biological** nutrient **removal** (BNR) techniques, wastewater treatment experts believe that it may be possible to increase nutrient removal from existing sewage treatment plants at reduced costs. The BNR process, shown in Figure 1, transforms nitrogen, which enters the plant as ammonia, into nitrogen gas that is released into the atmosphere. BNR is a two-step process utilizing natural reactions. **nitrification** and **denitrification.** Figure 2 gives one example of these reactions in nature. To set up BNR for wastewater treatment. the aeration tank is altered so that an anoxic or anaerobic (low or no oxygen) zone is created at one end and the other sections remain aerated or aerobic. Sewage and bacteria from secondary settling tanks are mixed into the low oxygen zone. In the aerated section% ammonia (NH_4^+) is converted to nitrate (NO_3^-) in a two-stage reaction called nitrification. Denitrification requires low oxygen conditions. The bacteria extract oxygen from nitrates, causing harmless nitrogen gas (N_2) to be released into the atmosphere. Consequently, nitrogen is reduced in the wastewater effluent (discharge).

These BNR techniques may require only minor changes in operation and process control rather than complete reconstruction of the plant where they can be applied.

Two sewage treatment plants that discharge into the Long Island Sound Study area, the Stamford Water Pollution Control Facility in Stamford, CT and the Tallman Island Sewage Treatment Plant in Queens, NY are evaluating the BNR method. Their goal is to biologically remove 80 percent of the nitrogen from the effluent. These plants were selected because of their facility designs, past records of compliance with permit limits, and plant operator skills and controls. Additionally, neither plant is at or over capacity.

The Stamford facility implemented BNR on March 1, 1990. This plant, designed to treat 20 million gallons per day (MGD)

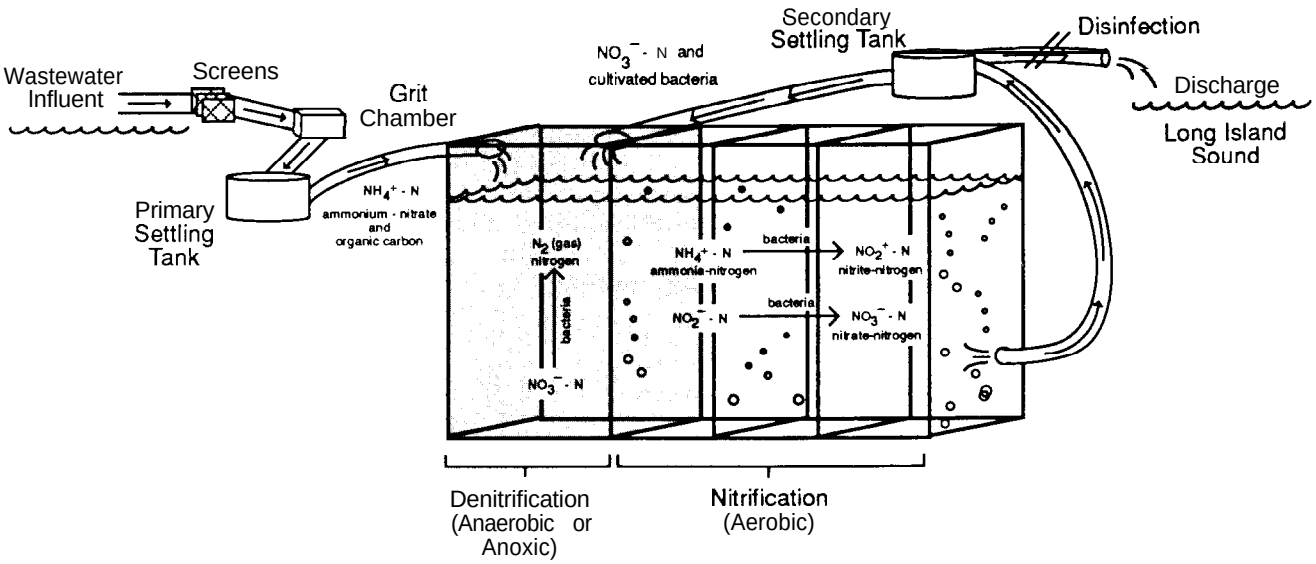

Figure 1. Example of biological nutrient removal process in an altered aeration tank

has an average daily flow rate of 16 MGD and is now removing more than 97 percent of the ammonium-nitrogen (NH_4^+) and 65 to 75 percent of the total nitrogen in the effluent.

In June 1990, work began at the **Tallman** Island plant to implement a similar wastewater treatment process. This plant is much larger than the one in Stamford. Designed to treat 80 MGD, it treats an average of 63 MGD. The BNR treatment process will be evaluated in one quarter of the plant (affecting 16 MGD of the flow through the plant) and the effluent quality of both the BNR and old treatment processes will be monitored closely.

The $105,500 LISS demonstration grant will enable the **Tallman** and Stamford facilities to document the operational limits associated with the BNR process. One important factor that will be tested is the technique's effectiveness in colder temperatures, when bacteria are less active.

The staff at both facilities and their city governments are very dedicated to the project's success. They have increased personnel and provided financial resources to ensure the project's thorough analysis.

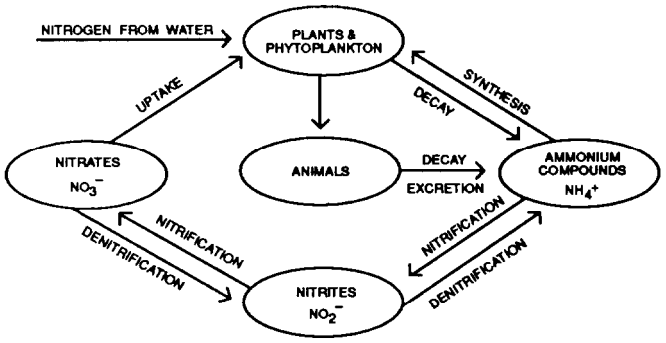

Figure 2. Example of nitrogen cycle in nature. Adapted from Garrels, Mackenzie and Hunt, 1975.

Agricultural Nutrient Management Project

Nonpoint sources of pollution also contribute nutrients to Long Island Sound via land and river runoff. In the Housatonic River basin, the Litchfield County Soil and Water Conservation District, the Connecticut Council on Soil and Water Conservation, the USDA Soil Conservation Service and Connecticut Cooperative Extension System have received funding from the LISS and the Connecticut Department of Environmental Protection to conduct an agricultural nutrient management demonstration project. The objective of this project is to demonstrate the feasibility of using customized agricultural nutrient management plans to decrease nutrient runoff to Long Island Sound.

Present inorganic fertilizer application practices and poor distribution of animal wastes on croplands may result in overfertilization of some fields. The excess fertilizers may run off the land into the surface waters or be transported in the groundwater to nearby streams. Eventually the streams will transport the nutrients to Long Island Sound.

Soils are tested to measure nutrient levels and to determine whether it is necessary to apply fertilizer and in what amounts. Fertilizer added to soil already containing enough nutrients to support the crop to be grown may wash away with **runoff** or **leach** into the groundwater.

By 1991 twenty-seven farms will have prepared individual nutrient management plans. The plans will be based on the type of farm, nutrient levels in the soil and current fertilizer and manure application practices. The management plans will be evaluated for their effectiveness in maintaining crops and reducing runoff of nutrients from each property.

An integral part of this project is an information and education program designed to encourage farmers to volunteer to participate in the project. By participating, farmers can decrease their operational cost by using less fertilizer on their land.

The results of this $80,000 demonstration grant will be applicable throughout the Sound's drainage basin and will identify the economic and environmental benefits of using agricultural nutrient management plans.

The Long Island Sound Study

The Long Island Sound Study (LISS) is a six-year research and management project that began in 1985 as part of the National Estuary Program, a recent addition to the federal Clean Water Act created **to** protect estuaries of national importance. The LISS is a cooperative effort involving researchinstitutions, regulatory agencies, marine user groups and other concerned organizations and individuals. The purpose of the Study is to produce a management plan for the Sound that will be administered by the three major LISS partners, the Environmental Protection Agency and the states of New York and Connecticut. To get involvedwiththe Study, or for more information, contact: the New York Sea Grant Extension Program, 125 Nassau **Hall,** SUNY, Stony Brook, NY 11794, Tel. **(516)632–8737**; or the Connecticut Sea Grant Marine Advisory Program, 43 Marne Street, **Hamden,** CT 06514, Tel. **(203)789–7865**.

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