GEO 111 ENVIRONMENTAL GEOLOGY LABORATORY
FIELD TRIP TO STONY BROOK SEWAGE TREATMENT PLANT

The field trip to the sewage treatment plant near the north entrance to the west campus gives you a close look at the actual processes involved in the treatment of wastewater. Most of this assignment involves observation. It is essential that you take a complete set of notes. Particularly note the design of each component and its significance. Also understand the important role that bacteria play. Pictures of the sewage treatment plant are on the web at www.geo.sunysb.edu/geo111.

BACKGROUND

The University sanitary sewer system serves the entire campus and an area south of the campus to Nesconsett Highway. This goes as far west as the Waldbaum shopping center and east to the Technical Center on Belle Meade road. The sewage plant was built in the late 80's. Prior to then the raw sewage from the campus was sent directly to the Port Jefferson's sewage treatment plant. There the sewage underwent only limited treatment before being discharged into Port Jefferson Harbor. The tertiary treated sewage from the campus plant now flows directly into Port Jefferson Harbor. The groundwater table under the campus is 30 to 40 feet above M.S.L. The elevation of the plant is about 100 feet. So the sewage pipes and system are well above the groundwater table.

TREATMENT

The treatment plant provides tertiary treatment of wastewater. Secondary and tertiary treatment takes place in the oxidation ditch by bacteria that naturally occur in the sewage. The final water meets drinking water standards for nitrate and phosphate.

THE SEWAGE TREATMENT PLANT

This facility can treat more than 2.5 M.G.D. (million gallons per day), with influent concentrations up to 170 mg/L of Total Suspended Solids and 170 mg/L of B.O.D. (Biochemical Oxygen Demand). Organic nitrogen and ammonium are the dominant form of nitrogen in the raw sewage. Nitrogen in the sewage typically has a concentration of about 20 to 40 ppm. The bacteria in the oxidation ditch convert organic nitrogen to ammonia to nitrite to nitrate and then under more reducing conditions it converts the nitrate to nitrogen gas. The effluent then goes to the clarifier where most of the solids settle out. Some of this sludge goes back to the oxidation ditch to provide biomass for the continued treatment of the sewage.

Before treatment, the waste water passes through bar screens with bars placed at 1.75-inch intervals. This filters out large solid material. The wastewater then goes to the treatment plant.

Primary Treatment. Four rotating wire screens, each with 0.30-inch openings, filter the solids in the Screen Building. These self-cleaning screens remove about 15% to 25% of the suspended solids and about 15% to 20% of BOD. A discharge "doctor" blade removes the screenings into a dumpster. Further treatment of the wastewater takes place in the oxidation ditch.

Secondary and Tertiary Treatment. This treatment occurs in the oxidation ditch. The three concentric channels making up the ditch have a total volume of 1.5 million gallons. The percentage of total volume for each channel, from outer to inner respectively, is 50%, 33%, and 17%. At average flow, 2.5 M.G.D., the residence time in the ditch is approximately 15 hours. The ditch can operate at 17%, 33%, 50%, 83%, or 100% of total capacity.

The **oxidation ditch** is an aeration system. The water in the tank moves in a clockwise rotational flow. The average temperature of the water is about 22° C. As long as the water is kept moving by the rotating brushes, it will not freeze. Variable speed surface mounted disc aerators transfer oxygen for oxidation, nitrification, and denitrification. Adding, removing, or changing the direction of the discs in the aerators adjusts oxygen transfer. Hoods minimize splashing as well as icing and heat loss in the winter. The bacteria in the

oxidation ditch convert organic nitrogen and ammonia to nitrate under aerobic conditions. Away from the brushes the oxygen content of the sewage is reduced where bacteria convert the nitrate to nitrogen gas, under near anaerobic conditions. In the oxidation ditch, bacteria also digest the organic material, which reduces the BOD. The effluent then goes to the **clarifiers** where the solids settle out as sludge. Much of this sludge is pumped back to the aeration ditch to provide biomass for the continued treatment of the sewage.

There are two secondary settling clarifiers. Scraper mechanisms on the bottom remove secondary solids. Much of this sludge is pumped back to the aeration ditch to provide biomass for the continued treatment of the sewage. Excess sludge is pumped to the **gravity thickener** where excess water is removed.

Disinfection Odor Control and Sludge Treatment The clarified water is pumped to the the Parshall flumes where the rate of flow is recorded. Sodium hypochloride, a disinfectant, is added to kill microbes. The water is then pumped to Port Jefferson Harbor. Sodium hypochlorite is stored in the basement of the Screen Building in two 2,000 gallon storage tanks. The sodium hypochlorite is pumped to a diffuser in the effluent channel of the plant where it is added to the water. To help control odors, the chemical can also be injected into the thickener, scrubber, sludge holding, raw sewage, and the return waste sludge systems. Ventilation is also important.

The collection of sludge takes place in the gravity thickener. Here, scraper blades move the sludge to a central hopper and vertical pickets thicken the sludge in the hopper by stirring. Scum is removed from the thickener with a skimmer. For about four hours per day, waste-activated sludge at concentrations of 0.8% to 1.0% is pumped to the thickener. Fresh water is added for the rest of the time to control odors. The solids removed in the thickener are pumped into sludge holding tanks. The sludge is thickened even further by decanting. Tanker trucks transport the sludge for disposal off-site.

QUESTIONS

You will need to use text books, references from the library or the web to satisfactorily answer some of these questions.

1. Draw a flowchart of the entire sewage treatment plant system. Indicate the route of the wastewater.

2. Explain what are primary, secondary and tertiary treatments of water.

2. For each major component in the system, give a description of the processes that take place and the role the component plays in wastewater treatment?

3. Explain the role that the bacteria play in the wastewater treatment. How are they able to manipulate the natural bacteria to treat the water?

4. Would you recharge the water into the groundwater system instead of pumping it to Port Jefferson? Why or why not?

5. Is it necessary to use a sewage system to treat the water? If so, why is it necessary to produce tertiary water? It just goes into the Long Island Sound. Explain why they decided not to use septic tanks?

6. Is this the only way to produce tertiary treatment of waste water? What are some other ways?