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# Boston Harbor Project Pilot Plant

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As the Massachusetts Water Resources Authority begins construction of its new secondary treatment plant on Deer Island, a small-scale replica of the new plant will be testing new plant treatment options. The testing will assist the Authority in sizing, designing and operating a cost-effective facility that will meet Clean Water Act requirements. In addition to wastewater-treatment testing, the pilot plant will provide a permanent plant-operator training facility, produce sludge for residuals testing and gases for odor-control equipment testing. It will also provide a source of high-quality chlorinated water for functional and hydrostatic testing of the full-scale facility's grit chambers, primary clarifiers, south-system pump station, the inter-island tunnel and all secondary tankage. When the pilot plant goes on line in August 1993, it will be the first permanent Boston Harbor Project facility to be completed on Deer Island. The first completed BHP facility was the sludge-to-fertilizer pelletizing plant located at the Fore River Staging Area in Quincy.

## Purpose of an on-site testing facility

The pilot plant will allow the MWRA to test and compare a variety of biological and physical treatment processes on a large scale before those processes become part of the full-scale facility. With a 2 million-gallon-per-day treatment capacity, the pilot plant is large enough to service a small city. Testing results will provide the Authority with information necessary to confirm design criteria used in sizing the secondary treatment plant's oxygen reactors and stacked clarifiers, evaluate alternative technologies and optimize operation of the full-scale facility.

The pilot plant includes stacked clarifiers and pure-oxygen reactors, features that other pilot plants, and even many wastewater treatment plants, do not have. Chemicals that may enhance pollutant removal can be added to the wastewater flow and the plant's variable rate-controllers system allows the plant operator to regulate flow rates. In addition, the selectors preceding the pure-oxygen reactors can be operated aerobically and anaerobically. Such flexibility makes the pilot plant a great research tool.

Tests at the pilot plant will be used to evaluate the performance of wastewater treatment processes, sludge yield, sludge settling properties, oxygen demand and power consumption.

The pilot plant is equipped with an odor-control system that includes covers for flocculation tanks, primary clarifiers, selectors and reactors. Odors will be removed by activated-charcoal units.

## Pilot plant components

- The plant has two trains, each consisting of:
  - Influent distribution box
  - Four flocculation tanks
  - Two primary clarifiers stacked one above the other
  - A secondary distribution box
  - Four anaerobic selectors
  - Four oxygen reactors
  - A mixed-liquor channel
  - Two secondary clarifiers stacked one above the other
  - An effluent chamber (common to both trains)

## Staff training

Last spring Deer Island treatment plant managers developed and presented a 4-hour pilot plant overview to over 200 Deer and Nut island workers. The overview included a general description of the plant and of processes that are different from those at the existing plant. The training has prepared everyone — manager, groundskeepers, maintenance people and operators — in the maintenance and operation of the new plant.

Beginning in March and continuing through September, maintenance and operations people will participate in 120 hours of vendor training on new-plant equipment, including state-of-the-art instrumentation, liquid oxygen and secondary processes.

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Beginning this month and throughout the first year of pilot plant operation, MWRA personnel will job-shadow professional Malcolm-Pirnie plant operators, in order to enhance the skills of MWRA employees in the cutting-edge technologies and equipment that are part of the pilot plant.

MWRA workers are responsible for maintaining pilot plant equipment from start up. The pilot plant will be used as a training facility for operators of the full-scale secondary-treatment plant.

## The Process

Wastewater will enter the pilot plant from two separate lines: the north-main pump station and the south-system pump station (the south-system pump station will not be completed until 1995).

Wastewater in the influent tanks flows by gravity to flocculation tanks where chemicals may be added to increase the settling-out properties of the wastewater. The flow then moves to primary clarifiers for settling, then to the secondary distribution boxes where it goes to anaerobic selectors, to oxygen reactors and to the mixed liquor channels. The wastewater is then clarified in secondary settling tanks and finally flows to the effluent chamber before being discharged back to the primary treatment plant.

After testing and treatment at the pilot plant, the wastewater will be discharged to the existing primary treatment plant's influent lines, thus the pilot plant's wastewater discharge will have no impact on effluent limits.

## Design and construction

The pilot plant was designed by Malcolm-Pirnie, Inc. of White Plains, New York and is being constructed by Peabody Construction Co. of Braintree. Construction began in January 1992 and will be completed in August 1993.

## Pilot plant management

Under the direction of the MWRA's Program Management Division, Malcolm-Pirnie will serve as interim plant manager. The MWRA will maintain the plant and take over plant management next year. Pilot plant personnel includes a manager, an assistant operator and a lab technician.

## The first Deer Island pilot plant

The permanent pilot plant is the second testing facility on Deer Island. For six months in 1989, a trailer-mounted pilot plant processed wastewater to provide information to help the MWRA design the new secondary plant by testing key treatment components.

Each day approximately 10,000 gallons of primary effluent from the existing Deer Island facility's settling tanks were pumped to the pilot plant to test an anaerobic selector, a relatively new and innovative approach to wastewater technology that is now part of the full-scale secondary treatment plant. Tests included suspended solids removal rates, biochemical oxygen demand (BOD), effluent quality, solids settling and residuals.

## Answering some questions

The pilot plant will test various alternative treatment technologies such as chemically enhanced primary treatment (CEPT), and will provide the MWRA and state and federal environmental agencies with essential information on wastewater treatment technologies.

## Glossary

**Aerobic** — Oxygen rich.

**Anaerobic** — Oxygen deprived.

**Anaerobic selectors** — Oxygen-free, covered tanks for the select growth of microorganisms that will settle well in the secondary clarifiers.

**Clarifiers** — Large tanks where solids settle out of wastewater.

**Effluent** — Treated wastewater discharge.

**Flocculate** — To increase the settling properties of wastewater solids by adding polymers or other materials to promote the "flocking" together of particles.

**Influent** — Raw wastewater coming into a treatment plant.

**Oxygen reactors** — Airtight tanks where liquid oxygen is introduced to support the microorganisms that are used in the treatment of wastewater.

**Sludge** — Solids settled out of wastewater.

**Train** — A complete set of wastewater-treatment units.