

CASE STUDY

An Affordable Wastewater Treatment Solution for Municipalities and Communities

PINEBROOK, NEW YORK

Problem

In 2014, the community of Pinebrook in Hyde Park, New York, began having trouble with its wastewater treatment plant, a rotating biological contactor (RBC). Discharge from the plant was contaminating the Maritje Kill (a tributary of the Hudson River), and sewer lines backed up into the community building. By the end of the year, a full evaluation of the plant concluded that the RBC had significant performance, structural, operational, and safety deficiencies and was not worth salvaging.

Solution

The Dutchess County Water and Wastewater Authority commissioned a Preliminary Engineering Report to recommend alternatives for replacing the failing RBC. Three options were evaluated: a brand-new RBC, a membrane bioreactor, and a packed-bed filtration system. Because of its many advantages – including low life-cycle costs¹, consistently high-quality effluent, minimal operation & maintenance requirements, and a small footprint – an AdvanTex (packed-bed filter) Wastewater Treatment System was recommended.

Community Wastewater Treatment Plant Needs Replacement



An AdvanTex® AX-Max™ Wastewater Treatment System – with its low life-cycle costs and small footprint – was chosen as the best replacement for a failing treatment plant in the community of Pinebrook. (Photo courtesy of Julie Barown.)

Development of the Pinebrook community in Hyde Park, New York, began in the 1980's. Gravity sewer lines delivered wastewater to a rotating biological contactor (RBC) at the community's wastewater treatment plant. As the community grew, it added additional sections of gravity sewer collection lines through 2009. At that time, ownership and management of the sewer and the treatment plant was turned over to the Town of Hyde Park.

Municipal and Community Market

Project Overview

PINEBROOK, HYDE PARK, NEW YORK



Design Parameters

- 132 residential connections
- 15,000 gpd (57 m³/day) average flow
- 60,000 gpd (227 m³/day) maximum flow

NPDES Permit Limits

- 5 mg/L cBOD₅
- 10 mg/L TSS
- 0.93 mg/L NH₃-N (summer)
- 1.3 mg/L NH₃-N (winter)

Effluent Quality*

- 2 mg/L cBOD₅
- 0.5 mg/L TSS
- 0.24 mg/L NH₃-N

Start-Up Date

- February 2019

Project Cost

- \$2.24 million

Funding Sources

- New York Department of State (grant)
- Environmental Facilities Corporation (NY):
 - Water Infrastructure Improvement Act (grant)
 - Clean Water State Revolving Fund (loan)

Collection System

- Gravity sewer

Primary Treatment

- Two 15,000-gallon (57-m³) tanks

* Samples collected and analyzed by a third party between 7 May 2019 and 7 October 2019.

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PINEBROOK, NEW YORK



Between November and April, six AdvanTex AX-Max units were installed to replace Pinebrook's failed rotating biological contactor (RBC). The final photo on the right shows that the RBC and the building once housing it have been removed. (Photos courtesy of the Dutchess County Water and Wastewater Authority.)

By 2013, there were 450 people living in the Pinebrook community. Unfortunately, environmental issues became evident the next year when the RBC plant was no longer able to meet its permit limits, and wastewater from the plant was discovered to have contaminated the nearby Maritje Kill, a tributary of the Hudson River. The situation worsened when sewage backed up into the community building.

A complete evaluation of the plant concluded that, due to major performance, structural, operational, and safety issues, the RBC would need to be replaced.

In 2015, the Dutchess County Water and Wastewater Authority (DCWWA) accepted ownership and responsibility for the plant from the Town of Hyde Park. The DCWWA commissioned a Preliminary Engineer's Report to recommend alternatives for replacement. A major challenge during the replacement process would be the community's need for the existing RBC to remain in operation while the new treatment site was under construction. In addition, the reporting engineer had to consider these challenges posed by the site itself:

- Very small, intermittent receiving stream for discharge
- Existing plant site of less than an acre
- Limited open space outside of existing plant footprint
- Proximity to residences of about 100 ft (30 m)

A replacement system would also need to fulfill these requirements:

- Able to meet strict discharge permit limits for ammonia, cBOD₅, and TSS
- Simple and safe for a part-time (1 hour/day) operator
- Low up-front capital costs
- Low life-cycle costs, including operation and maintenance (O&M)
- Small footprint
- Minimal community impact (sight, sound, and odor)
- Reliable operation

Engineering Report Recommends Biofiltration

The report evaluated three options: a brand-new RBC, a membrane bioreactor, and a biofiltration (packed-bed) system. Replacing the worn-out RBC with a new one may have seemed like an obvious choice, but the engineering report found that a new RBC would not eliminate the noise and odor that nearby residents had been complaining about regarding the existing RBC. Pinebrook is a development that's completely built-out, with no other property to locate the wastewater treatment plant on other than the current site of less than one acre. And the site where the plant is located is in a well-populated, quiet residential area.

Most importantly, of the three alternatives being

evaluated, an RBC would have the highest capital, life-cycle, and sludge-removal costs, not to mention concerns for operator safety. An RBC would also require regular motor maintenance and the periodic, significant expense of motor, shaft, and media replacement.

While the second option of installing a membrane bioreactor (MBR) would mean a much smaller footprint and more moderate life-cycle costs, the engineering report voiced concerns over the cost of membrane replacement, electricity, sludge removal, and steel tank maintenance and replacement. Plus, an MBR would need to be installed inside a tall, obtrusive building, both for weather protection and to minimize odor, sound, and vibration. Other concerns included reparability, operability, operator safety, and the availability of a higher-level operator with the expertise to handle an MBR.

The third option evaluated was biofiltration, or the use of a packed-bed filter (PBF). A PBF uses a passive, attached-growth treatment process that is inherently stable and highly reliable. Microbes attach to and grow on the treatment media, which hangs in sheets in aligned rows. The media isn't submerged,

so the aerobic microbes operate in unsaturated conditions. They form a thin film on the media sheets and extract and digest soluble organic matter from the wastewater, which is applied over the media in small doses.

Weighing all factors, the engineering report recommended a biofiltration system. PBF filtrate is typically low in biochemical oxygen demand, suspended solids, and concentrations of pathogenic organisms. And a PBF would meet all of the project requirements, as well as offer the following advantages:

- High-quality effluent that outperforms permit standards
- Minimal O&M requirements (only periodic inspections needed, not constant oversight)
- Lowest life-cycle cost² of all three options
- Low energy use³, due to intermittent dosing from small-horsepower pumps
- Optional in-ground installation
- Minimal odor and noise (no aeration blowers)
- A good fit for community aesthetics (not an "ugly" treatment plant)



The AX-Max uses a passive, attached-growth treatment process that is inherently stable and has minimal operation and maintenance requirements. The Max also minimizes noise and odor, making it "neighborhood-friendly." (Photo courtesy of the Dutchess County Water and Wastewater Authority.)

PINEBROOK, NEW YORK

Fast-Track Construction

Because Pinebrook's existing RBC treatment system was in imminent danger of failure, construction on the new system needed to be fast-tracked. To accomplish this, the DCWWA chose to pre-purchase the main treatment equipment, which allowed the system to be manufactured while bidding for the installation was taking place, saving more than six months on the project schedule. Purchasing the equipment up front also saved money by eliminating the contractor markup.

The completed project came in significantly under budget, primarily because the original cost estimate had been based on the idea of replacing the failing RBC with a new one. Switching to an AdvanTex Wastewater Treatment System offered the community substantial savings.

Another advantage was the fact that the RBC could remain in service while the AdvanTex units were being installed. Jonathan Churins, Project Facilitator with DCWWA said, "The modular nature of the Orenco system allowed the new plant to be constructed around the old, enabling dual operation and a smooth transition."

The AdvanTex facility has a footprint of fewer than 10,000 ft² (929 m²). That includes tanks for primary and pre-anoxic treatment, plus six AdvanTex AX-Max treatment units. There's also a building that houses a TCOM™ control panel from Orenco Controls™, an automatic alkalinity feed system, magnetic flow meters, and a UV disinfection unit.

Neighborhoods like Pinebrook have historically faced enormous challenges when constructing and maintaining wastewater systems. These communities typically have limited experience with construction or operation of wastewater infrastructure, and their systems are frequently responsible for environmental violations related to wastewater treatment and disposal.

With its low maintenance and energy⁴ requirements, Orenco's reliable AdvanTex technology has proven its value over and over again by helping engineers find answers for neighborhoods and communities that need affordable wastewater solutions.

¹ Rennia Engineering Design, PLLC, "Preliminary Engineering Report for Pine Brook Sewer District," June 13, 2016, Appendix E.

² Ibid.

³ About 3.17 kWh per 1000 treated gallons. Orenco Systems, Inc., "How to Compare Power Consumption of Advanced Treatment Systems," AHO-ATX-POWER-1, 2006.

⁴ Ibid.

Data used by Orenco to derive the representations and conclusions contained within this Case Study were current as of January 2020.

Municipal and Community Market

Pre-Anoxic Treatment

- Two 15,000-gallon (57-m³) tanks

Secondary Treatment

- Stage 1: four 42-ft (12.8-meter) AdvanTex AX-Max units
- Stage 2: two 35-ft (10.7-meter) AdvanTex AX-Max units

Disinfection

- UV system

Discharge

- Surface discharge to Maritje Kill, a tributary of the Hudson River

Monitoring and Control

- Orenco Controls TCOM panel

Engineering

- Rennia Design Engineering
- Tighe & Bond

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— Jonathan Churins, Dutchess County
Water and Wastewater Authority

For information about Prelos™ Sewer, AdvanTex® Wastewater Treatment, or Orenco Controls™, contact Orenco Systems®, Inc.



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