

Pump Technology Conquers Tough Flows

New generation pump provides the right connection for Martha's Vineyard hospital.

Nearly every wastewater utility confronts its own unique operational considerations. However, few rival those on Martha's Vineyard, the premier vacation island off the coast of Cape Cod, MA. This historic offshore retreat has been the setting for countless beach bonfires, a movie about a Great White shark, and the playground for the rich and politically powerful. Millions more of average means have traipsed the island whose legacy traces back centuries.

For but a few months each summer, the island has only 15,000 residents, but that number explodes up to 100,000 when the mainland vacationers arrive. Islanders call them "wash-ashores," but none discount their importance as the island's economic lifeblood.

Joe Alosso, facilities manager for both Edgartown and Oak Bluffs wastewater utilities, oversees the treatment plants. The utilities have a modest number of connections—600 in Oak Bluffs versus 750 served in Edgartown—but they serve the island's restaurants, lodgings, shops, and homes concentrated in the towns and subject to unusual seasonal peaks.

"We have adopted a proactive stance in managing our facilities that consists of an SBR package plant and an EIMCO carousel plant with a dual collection system comprised of 10- and 12-in. gravity lines and small force main sewers," Alosso said. "We tried to use a small diameter system that would get into areas with close quarters or shallow conditions. We put grinder pumps on many of these connections where they serve two or three homes or businesses."

An estimated 85 to 90 percent of the island's development remains dependent on septic systems. In fact, the package

plants Alosso oversees for Oak Bluffs and Edgartown are two of only three towns that operate sewage treatment plants on the island. The .750-mgd plant serving Edgartown is older and earned an EPA award in 1999. It also treats all septic waste pumped from the entire island. The .375-mgd Siemens Water Technologies (www.water.siemens.com) SBR plant for Oak Bluffs entered service six years ago and has had the surplus capacity to resolve problems for two major institutions. The plant was equipped with UV disinfection because of the growing acceptance of the alternative and the resistance by the ferry service to haul chlorine tanks.

Because laws prohibit ocean discharge of even the highest grade of treated effluent, the Oak Bluffs plant operates under a Department of Environmental Protection groundwater discharge permit. The subsurface discharge occurs beneath Ocean Park, the centerpiece of the town that is located less than ten yards from shore. Oak Bluffs recently completed new leaching beds under the park, consisting of sand and stone capped by a permanent filtering material to entrap small fines. The effluent percolates through the 28, 50-ft by 100-ft beds before reaching the underlying groundwater. The receiving system, whose performance is recorded quarterly at six, 6-ft to 19-ft deep monitoring wells, has brought nitrogen levels down to consistently less than the typical 40



Hospital discharge from the blue pipe is transferred to the wastewater treatment plant by two pumps.

mg/L, Alosso added. Meanwhile, the utility tests the treated wastewater stream at the plant daily to ensure the highest quality level.

"We meet drinking water standards with the treated effluent," Alosso noted. "The coliform is always less than two mg/L, whereas they don't even close the beach here unless it reaches 200 mg/L. We put out less than five mg/L of total nitrogen, although ten mg/L would be considered safe."

The seaside park is the town's most popular outdoor venue where 10,000 spectators gathered this past year to hear Natalie Cole perform with the Boston Pops Orchestra. The annual August fireworks program was another magnetic draw for the throngs of tourists and islanders. Few would ever have suspected that just two to three feet under them

was the final link in the process chain for the wastewater treatment plant, Alosso said.

Until recently, the Oak Bluffs plant served primarily the commercial businesses and in-town residences that either lacked adequate sites for a septic system or where soils were ill-suited for the alternative. Facilities such as the local hospital and high school operated standalone package plants to treat their wastewater. That changed earlier this year when the local hospital connected to the Oak Bluffs utility to treat the .02 to .03 mgd wastewater stream instead of continuing to operate a 50-year old standalone package plant at the campus. The regional high school is the next candidate for a connection. The later arrangement will accept and treat the school's sewage and return the high-quality effluent to the school's existing on-site sub-surface receiving system under the track facility.

Special Considerations

Both the hospital and high school have presented special considerations to Scholfield, Barbini & Hoehn, Inc., the island-based engineers for both new connection projects that include a new lift station. Aside from debris that inmates flush into lines at prisons, most utility operators would concur that their biggest operational headaches are hospitals, schools, and restaurants whose wastewater streams contribute to clogged lift stations and operational problems even at their downline wastewater treatment plants.

In the case of the hospital, now building a new \$44-million replacement facility, the institution agreed to build the necessary lift station and related infrastructure before relinquishing ownership and maintenance to Oak Bluffs. Early in the planning, it became evident that the new lift station being designed for the hospital had to have the ability to overcome the chronic clogging that plagued the lift station that previously served the hospital. Hospital wastewater often carries improperly disposed hand towels, bandages, and other medical waste flushed into the system.

"The old lift station they operated there would experience clogging episodes at least twice a week," said Richard J.

Barbini, P.E., who led the design of the new lift station. "Until recent years, we would have lived with the problem by installing a grinder pump, sometimes with screening, at the new lift station. We initially considered this solution until it became apparent we couldn't get the needed head capacity."

A more effective alternative presented itself in a pump technology developed by ITT Flygt (www.flygtus.com). This global Sweden-based company that developed the submersible pump decades ago had brought the new "N-Pump" technology to the United States several years prior to Barbini's firm designing the new lift station for the hospital. The features of the new-generation pump were impressive.

Most importantly, the energy-efficient pump units feature a volute with the self-cleaning impeller. A stationary relief groove in the volute clears the semi-open impeller of all debris so that it can be carried away through the pump. The patented engineering achievement virtually eliminates built-up debris that induces clogging. Proven now in scores of installations around the globe, the N-Pump is inherently more reliable than traditional chopper pumps that can grind rags and other debris into pieces small enough to pass through lift

stations, but are resistant to rocks, wood, or other hard foreign materials. Also, the shredded material can even cause problems at the downline treatment plant unless the plant has screens at the headworks to capture it.

Barbini sized the new hospital lift station to serve present and future flows, as well as that from potential medical office development near it. He sized the 35-hp Model NP 3171 pump unit using design points of 80 to 115 gpm. The long force main served by the new station required 240 total dynamic head at 100 gpm. Despite the challenging low-flow, high-head conditions experienced since becoming operational in May 2007, the installation has passed the test at the hospital, which makes the N-Pump a likely candidate for a similar lift station at the high school that is under order to abandon its on-site treatment plant. The new hospital lift station has clearly tested the waters of advanced pump technology and cured the clogging problem that plagued the abandoned lift station.

"I haven't heard of a clog yet," Barbini said. Alosso is equally impressed because the utility has also ordered a five-hp N-Pump to replace an existing, but larger horsepower chopper pump at the plant. GE



First time pump is removed from pit for visual inspection; it is clean and unclogged. The old hospital is visible in the background.