

Wastewater Alternative For Coastal Conditions

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No two public works projects are alike. However, there are certain profiles that are repeated, especially in similar geographic areas. For example, oceanside communities with flat topography, sandy soil and high groundwater are a recurring situation that we see along the coast in North Carolina. These conditions present significant problems when designing wastewater collection systems. Gravity systems, in these circumstances, are especially difficult to install because of the issues associated with deep trenching and dewatering. The water table in many seaside areas is only 3 or 4 feet below grade. Installing large gravity-flow lines may require trenches that are 15 feet deep. It is a costly, dangerous and disruptive combination of factors.

Experience has taught us that vacuum sewer technology is an excellent alternative to gravity systems in these conditions. The characteristics of vacuum technology eliminate many of the issues that make the installation of gravity sewers expensive and disruptive in these seaside communities. For a variety of reasons, vacuum sewer technologies such as AIR-VAC are now recommended for projects like the one recently completed in Holden Beach, North Carolina.

Holden Beach is located on one of the barrier islands along the Atlantic coast. It has all of the geographic characteristics that we often see in this region – sandy soil, high groundwater, and flat ter-

rain. The community is primarily a resort location populated with vacation homes and rental properties. Real estate values are very high and available space is at a premium.

Having studied and designed several sewer systems in coastal areas similar to Holden Beach, we can usually point to five specific areas where vacuum technology is superior to gravity systems. Almost every time we see circumstances like Holden Beach we immediately think “vacuum” because of the following benefits.



Holden Beach had its four vacuum stations built below grade in watertight vaults, which provides an aesthetic benefit and protects the system from storm surges.



INSTALLATION EASE

In flat topography with high groundwater, vacuum sewers are much easier and faster to install than gravity sewers. Vacuum collection lines are often smaller than gravity lines. They are typically about 4, 6, 8 and 10 inches in diameter and made of SDR 21 or Schedule 40 PVC pipes. These small, lightweight pipes can be installed with small equipment. Because of the sawtooth profile, the lines can be buried in shallower trenches, typically 4-6 feet deep. This typically means less digging, less dewatering and fewer construction-related restoration issues.

Installation progress can be much faster, too. In Holden Beach the installation crews estimated that they were laying up to 200 linear feet (lf) per day. A gravity sanitary sewer installation would have probably accomplished less than 100 lf per day because of localized conditions.

Perhaps even more important, the design called for only four vacuum stations to serve approximately 3,000 connections. Had we installed a gravity system, we would have needed about 15 pumping sta-

Lightweight, vacuum collection lines, typically 4 inches to 10 inches in diameter, can be buried in trenches only about 4 to 6 feet deep.



Vacuum stations provide a clean, safe environment for system operation and monitoring.

tions. Considering the property values in Holden Beach, this was an important cost-saving factor. It was also a quality of life factor that was valued by the town.

OPERATIONS AND MAINTENANCE

Vacuum systems are very easy to maintain. Most vacuum system functions can be monitored at the vacuum stations. If there is ever a loss of vacuum pressure in the collection lines, the problem can be isolated quickly and repaired easily. Remember, the lines are typically only 4-6 feet deep, so excavation is not difficult. Vacuum lines require no cleaning, as the velocity of the flow in the pipes scours the lines and helps prevent buildups and clogs. And, because vacuum sewers are closed systems (no infiltration or exfiltration), they are not required to have periodic TV inspections as is common with gravity sewers. Operations and Maintenance personnel also appreciate the fact that they seldom if ever come in contact with raw sewage.

In the case of Holden Beach, AIRVAC provided training and brought in field service technicians

to answer questions and provide advice. They also conducted plumber workshops advising local plumbers on the correct way to connect a residence to the AIRVAC system.

STORM SURVIVABILITY

Similar to most communities along the Atlantic coast, Holden Beach is subject to hurricanes and storm damage. When electrical power is lost or when there is a storm surge, a conventional gravity sanitary sewer is often knocked out of commission, leading to sanitary sewer overflows. A vacuum system, on the other hand, can be designed and operated to lessen the calamity of a tropical event.

In the case of Holden Beach, the four vacuum stations are built below grade in watertight vaults. Not only is this an aesthetic benefit (no vacuum stations to block the beautiful sea views), it also protects the system from storm surges. And because it is a closed system, storm water and sand can't infiltrate and clog the lines or overwhelm the treatment facility. With regard to electrical power, the individual valve pits that connect the homes to the system

operate by pneumatic pressure – no electricity is required. Vacuum stations are kept operational by using portable generators.

GREEN ISSUES

Some of the factors that led Holden Beach to examine a new sewage collection system were the problems associated with septic tanks and failing drain fields. Regardless of the sewer technology selected, the town saw removing the onsite systems as a step towards a cleaner environment.

The new vacuum sewer system in Holden Beach supports the town’s goal of environmental stewardship by providing a closed system that is much less prone to sanitary sewer overflows when compared to a conventional gravity sanitary system. In particular, the elimination of infiltration and inflow makes vacuum sewer technology attractive to coastal communities.

VALUE OF EXPERIENCE

Objectivity is essential in engineering. We look at every situation individually and make recommendations only after careful analysis and consultation. But experience is important, as well. Vacuum technology is proven effective for conditions such as those in Holden Beach. It saves time and money and provides an effective sewer collection process that is easy to maintain and durable.

When the conditions are right, vacuum sewers are the logical choice for sewage conveyance.



Frank Bland, AIRVAC regional manager (left), and Bart Sanders, AIRVAC field representative (right), explain how a vacuum valve pit works to Steve Wheeler, Holden Beach town manager (center).

How AIRVAC Works:

- 1 Traditional gravity lines carry wastewater from up to 4 customers to an AIRVAC valve pit package.
- 2 When 10 gallons of wastewater collects in the sump, the AIRVAC valve opens and differential pressure propels the contents into the vacuum main.
- 3 Wastewater travels at 15 to 18 fps in the vacuum main, which is laid in a sawtooth fashion to insure adequate vacuum levels at the end of each line.
- 4 Wastewater enters the collection tank. When the tank fills to a predetermined level, sewage pumps transfer the contents to the treatment plant via a force main.

