

Vacuum Sewer Saves York

As public works officials like to say, if the toilets flush, nobody cares about the sewers. True.

Most citizens don't know or care about the state of their sewer infrastructure unless there is a tax issue involved or they are buying or selling property. It's a classic case of out of sight, out of mind. Many professionals, however, sincerely appreciate the importance of properly functioning sewers.

Consider York County, VA. In the 1980s many York County residents had primitive wastewater treatment methods. Most had septic systems that were either ineffective or downright offensive to the senses and the environment. Homeowners often had to deal with sewer backups. Untreated wastewater regularly made its way into the creeks and rivers in the area, and from there, into the Chesapeake Bay. The pollution was so bad that it was illegal to harvest shellfish from many of the county's local waterways.

Today, many York County residents are connected to a state-of-the-art vacuum sewer system. There is no longer any stench from on-site sewage disposal systems. Shellfish harvesting has returned to some areas again. Property values have increased and more land is available for development. Real estate officials in York County estimate that more than 200 lots that were non-buildable

due to sewer issues now have homes on them. All this came as a result of a modern cost-effective sewer construction effort.

"There have been a lot of intrinsic benefits associated with our new wastewater systems," said Mark Swilley, an engineer with the York County Department of Environmental and Development Services. "The neighborhoods are nicer, you don't have odors and puddles from septic tank systems. People don't have toilets backing up into their bathtubs. Most of the neighborhoods got new roads out of the deal and the rural aura of the neighborhoods remains intact. The prevailing thought around here is that even with the connection fee and the cost of installing a lateral pipe, the investment in new wastewater systems was money well spent."

A Better Alternative

York County has completed 12 separate vacuum sewer construction projects over the past 11 years in seven different communities. When engineer Michael Elam joined York County in 1984 the county was already trying to address its sewage problem. This was still four years before the Virginia legislature passed the Chesapeake Bay Preservation Act that mandated all Virginia counties border-

ing the bay and its tributaries to address their water pollution issues.

"We began by prioritizing the areas by need," said Elam. "Topography was certainly an issue. We have a lot of flat land and a high water table. For gravity sewers we were looking at a lot of deep trenches, a lot of dewatering and many pump stations."

Elam said a cost projection was done in the early 1990s for a gravity-flow system. When the bids came in the cost worked out to about \$10,000 per house connection. Elam had experience with vacuum sewer technology in a previous job and encouraged the county to examine vacuum sewers as an option. Another cost analysis was done and the vacuum system came in at about \$7,500 per connection.

"With vacuum technology we saw significant savings, fewer maintenance requirements, and shallower trenches," said Elam. "Instead of four or five pump stations, we would need only one vacuum station."

The number of pump stations required for a gravity sewer was a significant factor in the decision process. Property in York County is extremely expensive. Chief of Utilities Brian Woodward, P.E., explained the cost comparison.

"In many areas we would need three to five pump stations at a cost of \$300,000 to \$350,000 each," explained Woodward. "A single vacuum station can serve the same area at a cost of about \$800,000. Obviously the vacuum system was more cost effective."

Much of the sewer construction work in York County has been accomplished in existing, mature neighborhoods. Vacuum lines can be buried much shallower than gravity lines, so the prospect of shallower trenches was also appealing. The York County engi-



Wastewater flows by gravity from each house to a valve pit. Each pit is equipped with a normally closed vacuum interface valve that prevents system vacuum from entering the house plumbing. When 10 gal of wastewater accumulate in the sump, the interface valve opens, the contents of the sump are evacuated, and the wastewater enters the vacuum main. Wastewater then travels through the vacuum mains to the vacuum station where it is collected and pumped to the treatment plant.

Much of the installation work was done by hand because most vacuum sewer components are lightweight.

neers also noted that much of the PVC pipe used for the vacuum systems was laid in place by hand.

"With vacuum technology you're digging trenches 5 or 6 ft deep compared to 20 to 25 ft deep for a gravity system," explained Jim Tobler, project manager for York County's Division of Utilities. "From my point of view I'd rather see a vacuum system any day compared to a gravity system because there is less disruption, you don't have the spoil piles, and there is a greater safety factor."

A Reliable Partner

AIRVAC (www.airvac.com), a pioneer in vacuum sewer technology, has been York County's supplier on all of the county's vacuum sewer projects since 1993. Vacuum sewers have been around for decades. In a vacuum sewer system, a central vacuum station maintains vacuum pressure within the sewer collection lines. Wastewater flows from each house by gravity line to a vacuum valve pit nearby. Up to four homes can be connected to a single valve pit.

Each valve pit is equipped with a vacuum interface valve that activates when wastewater in the lower sump reaches a predetermined level, typically 10 gal. When the valve activates, wastewater enters the collector line followed by a volume of air. The wastewater forms a slug that is driven by the air due to differential pressure. Operation of the valve pit is completely pneumatic, so external power is not required. The sewage moves so rapidly through the line that buildups of grease or sludge are rare.

"I was concerned about grease buildup in the lines," said Elam, recalling his thoughts in 1993. "The way the vacuum system works, the wastewater shoots through there so fast that there is no chance for grease to settle in the system and clog it up."

That initial project in York County was in the Seaford community in 1993. About 400 residents were connected to the new system that year. There were some small initial glitches with silt in the

valve pits, but otherwise the first installations went smoothly and have continued to work well after a decade of use.

"We had AIRVAC field service representatives with us for the first three vacuum sewer systems we installed," said Tobler. "They taught us about proper installation techniques and gave us installation criteria to follow. Since then we've developed the criteria a bit to fit our own circumstances. We feel like our systems are some of the best around because of the way they were installed."

A Thing of the Future

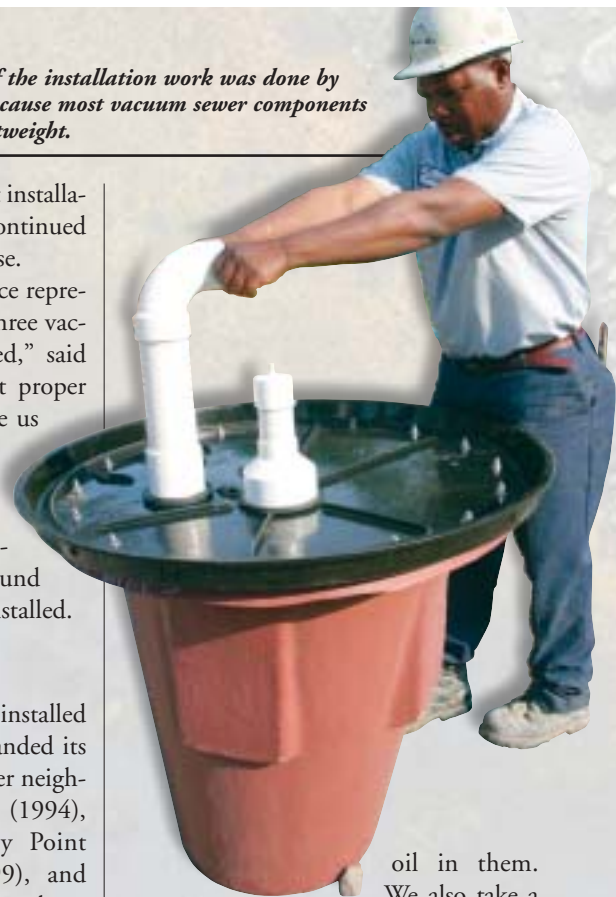
Since the Seaford system was installed in 1993, York County has expanded its use of vacuum sewers to six other neighborhoods Dandy (1994), Dare (1994), Patrick's Creek (1996), Piney Point (1998), Calthrop Neck (1999), and Marlbank Farm in 2004. Today about 2,000 York County residences are connected to vacuum sewers.

The Utilities Department of York County estimates it maintains some 52 miles of vacuum sewer lines and five vacuum stations, with another about to go into construction. A crew of two to three personnel maintain the vacuum sewers, which operate 24/7 because each pump station includes standby power should commercial power go out.

"The vacuum sewers comprise about 25 percent of our sewer infrastructure. We have 36 people who are in operations, but only two or three are required for vacuum sewer maintenance," said Woodward, the county's utilities chief. "I would say the maintenance is less than we anticipated in the beginning."

Earl Stewart has been on the vacuum maintenance team for more than eight years. He was trained on vacuum sewer technology by the manufacturer's staff so he's thoroughly knowledgeable about the system's nuances.

"We do a station check three times a week, and each check takes about 30 minutes," said Stewart. "We take readings on the vacuum pumps and check the



oil in them. We also take a little time to sweep and clean the station building. The rest of our time is spent doing inspections for new connections or an occasional repair of a vacuum valve. We do most of our own repair work.

"I see vacuum systems as being a thing of the future," Stewart continued. "I think more and more people will go to vacuum systems because it's a sealed system and if you have a problem you know about it right away. With gravity systems you usually don't know about a problem unless someone calls and complains."

Satisfied Customers

The most important endorsement of a product is always the customer. After ten years the citizens of York County are now completely familiar with the benefits of vacuum technology. "A lot of residents were skeptical of a vacuum sewer system at first," noted Tobler. "They just didn't understand how it works. We took the time to explain it. There are a lot fewer headaches from the resident's point of view. It's easier to install and it works well. The homeowners we've spoken with seem to like it very much." 