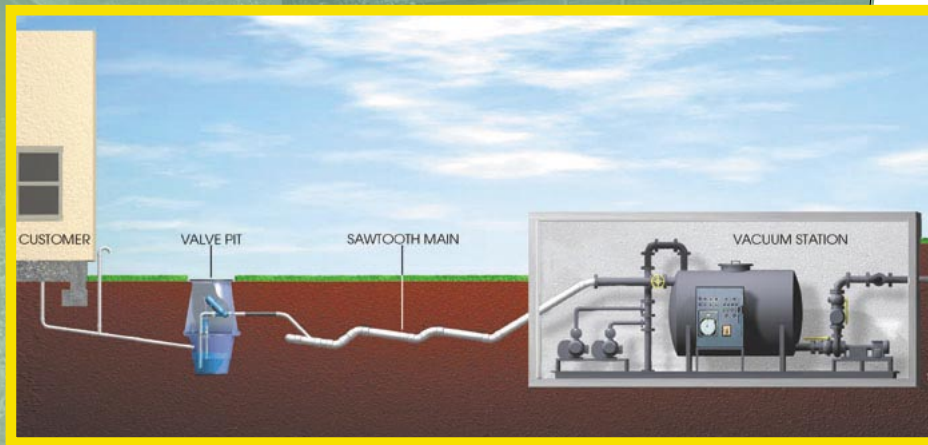


# CE

## NEWS

FOR THE BUSINESS OF CIVIL ENGINEERING

# An innovative solution to wastewater collection



## North Carolina town embraces vacuum sewer technology

BY DAVID MUSE, P.E.

Just because New Bern, N.C., is an historic city, it doesn't mean that it's old fashioned. Founded in 1710, it is the second-oldest town in the state and is home to more than 150 historic landmarks, including a Civil War battle site. New Bern is located at the confluence of the Trent and Neuse Rivers and always has been a vital center for commerce and transportation. In addition to its rich and distinguished history, New Bern (population 23,800) can claim a reputation for innovation. In fact, in 1898, a local drug store owner developed a drink that later became known as Pepsi Cola.

Today, a different type of innovation is helping New Bern solve a very old public works problem: creating a cost-effective wastewater collection system. For nearly a decade, the town has used vacuum sewer technology from AIRVAC, Inc., of Rochester, Ind., to provide wastewater collection for many of its residents. Now, the city's vacuum system is being expanded to include the neighboring town of Trent Woods, which is being annexed by New Bern. This technology requires minimal digging and disruption, and has many inherent, long-term cost advantages. For those and many other reasons, New Bern has embraced vacuum sewers as an effective solution to deal with wastewater collection.

### The most attractive alternative

Because of the expansion, New Bern is adding approximately 2,000 homes to its wastewater system.

Part of the annexation agreement required New Bern to replace the septic systems that are common in this area. After some research, officials decided that vacuum technology was the most cost-effective and least disruptive alternative. Two new vacuum stations are now being built to service the areas, and an existing vacuum station is being expanded.

For local engineers, the argument for vacuum sewers was made several years ago. In 1989, New Bern installed its first vacuum sewer: four vacuum stations and 17.2 miles of vacuum lines to service approximately 700 homes. After a few minor operational issues were ironed out, the system became a

model of efficiency and low-cost maintenance.

"We looked at three alternatives: pressure sewer, gravity sewer, and vacuum sewer," said consulting engineer Randy Gould, vice president of Rivers and Associates in Greenville, N.C. "We liked [the] vacuum sewer because of the cost savings related to installation. Now, a decade later, we know there are other benefits associated with vacuum sewers as well."

According to Gould, the advantages include design flexibility, ease of installation, elimination of infiltration and exfiltration, ease of service, and virtual elimination of human contact with raw sewage. Additionally, the cost estimate for a new gravity-flow collection system (including excavation and pumping stations) to service the recently annexed areas was significantly greater (about \$17 million) than the vacuum system, which is being installed at a cost of about \$9 million.

Installation is a critical cost component, especially in an area such as New Bern, which is located on North Carolina's coastal plain and has a high groundwater table. A gravity sewer in this

**Wastewater flows from each house to a valve pit equipped with a closed vacuum interface valve. When 10 gallons accumulate in the sump, the valve opens, the contents are evacuated, and the wastewater enters the vacuum main. It collects in the vacuum station and is pumped to the treatment plant.**



**Valve pits are an important part of the AIRVAC technology. Up to four houses can be connected to a single valve pit. The valve operates pneumatically, so no electric power is necessary.**

area requires many pumping stations to take effluent from its source to the treatment facility. Excavation is difficult, as trenches have to be cut deep and dewatering is necessary. Additionally, much of the area is well-developed, so the installation crews would have to dig up lawns, shrubs, and streets. When all the costs were analyzed, a gravity sewer simply was too expensive for this community.

A vacuum sewer line requires neither deep trenches nor lift stations. Typically, vacuum lines are buried 3 feet to 5 feet deep, and, if an unexpected obstruction is encountered, the vacuum pipe can simply be placed under or to the side of it, without change orders or re-engineering. Vacuum sewers also don't require manholes, which eliminates another major construction expense and potential maintenance issue.

Houses are connected to the system via a valve pit, and up to four homes can connect to a single 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 gallons. Then, the valve opens and allows the vacuum system to empty the sump. Operation of the valve is completely pneumatic, so external power is not required.

The cost of a septic tank effluent pump (STEP) system also proved to be prohibitive. A STEP system requires the installation of a pump at each house or business, which would require excavation and electrical work at every connection. There also are long-term maintenance concerns.

"The pumps tend to clog and fail," said Chuck Adams, operations manager for the city of New Bern. "We took over a county system that had a STEP system. We typically got three to four calls per day to come and repair a failed pump. Plus, you get a lot of infiltration with a STEP system, and that means greater treatment costs."

### Lessons learned

New Bern's operational experiences with vacuum sewers have been exemplary for several years. However, there was a time when the city had minor maintenance issues. "Basically, they were not maintaining it properly," said Adams, who moved to New Bern after the system was installed.

Adams researched vacuum sewers and traveled to AIRVAC's headquarters to talk to company technicians. He also arranged for a field service representative to provide on-site maintenance training.

"Training our employees made an enormous difference in how we conducted our maintenance program," said Adams. "AIRVAC provided us with some very useful, everyday preventive maintenance tips. Now, we spend about 10 minutes each day at each of our four vacuum stations, just checking on small maintenance details. As a result, we now have virtually no problems with our vacuum sewer."

He compared the service time spent on the system with the amount of time his crews spend on the town's conventional gravity sewers and said that he has two crews working on the gravity sewers every day.

"Infiltration and inflow is a terrible problem in our gravity systems," he said. "A crack in a gravity line allows a lot of water into the system, and that runs power costs up because of the pumping that's necessary. We can go from 3.75 million gallons a day at the treatment plant to 11 million gallons a day during a rain event. That's a lot of money in treatment costs."

With vacuum sewers, there is no infiltration and inflow. The system is completely contained, which means workers have no exposure to the raw sewage, and there is little or no smell, even at the vacuum station.

"The nice thing about AIRVAC is that it's all contained," said Adams. "It's all clean, and, for the most part, it's odorless. The vacuum stations look like houses, not like an industrial facility. The aesthetics are just great."

### New generation technology

Even as New Bern expands its vacuum sewer system, it should be noted that vacuum systems are not always the best solution for every wastewater collection situation. Vacuum technology is useful in situations where installing gravity sewers is difficult. However, in cases where excavation is easy and disruption of traffic is not an issue, gravity may be a more effective choice. There also are cases where septic tanks or STEP systems are preferred, such as sparsely developed areas with low ground water tables.

Engineers and public works officials should consider vacuum technology for most new or retrofit sewer installations. The cost savings, along with the efficiencies, make vacuum technology an attractive alternative. ■

## AIRVAC vacuum sewer systems are superior and cost less.

**AIRVAC vacuum sewer systems save up to 60% compared to other systems and offer additional advantages:**

- Eliminate multiple lift stations
- No power required at the house
- Shallow burial depth
- Smaller pipe
- Minimal surface disruption
- Ease of field changes
- Environmentally sound
- Low O&M
- No infiltration, inflow or exfiltration
- No operator exposure to raw sewage

# AIRVAC®

*The World Leader in Vacuum Sewer Technology*

**Call 813-855-6297 for a Free System Layout & Estimate.**