Airvac
Vacuum Technology Solutions

Case Study

This is an excerpt taken from the article "Birth of a Smart Sewer" published in Water & Wastes Digest, March 2018 . The entire article can be downloaded from this page. Nor'easters in Massachusetts are routine. They happen most winters and often dump heavy snow throughout the region. No big deal. No one, however, was prepared for the winter of 2015.

The Challenge

An unprecedented series of weather events in January and February dropped about 110 in. of snow along the Massachusetts coastline in a four-week time frame. By comparison, the average annual snowfall is about 43 in. Snow buried everything. Travel and commerce stopped; there were not enough snowplows to adequately clear the roads. Meanwhile, temperatures plummeted to near-record lows. The governor declared a state of emergency. Not surprisingly, a number of public utilities were adversely affected. Blizzards followed by multiple days of sub-freezing temperatures often cause service failures. Power lines break, water pipes freeze, and devices such as grinder pumps and vacuum sewer valves can malfunction. Plum Island is a barrier reef island along the Atlantic coast about 30 minutes north of Boston. The city of Newburyport provides water and sewer services for residents there. As collection system superintendent for the Department of Public Services, I (Jamie Tuccolo) assembled the team that dealt with the incredible storm of 2015. It was a culmination of weather problems that were unexpected and unprecedented—a convergence of circumstances that crippled the sewer system on Plum Island.

Vacuum sewers systems like the one installed on Plum Island typically are very low maintenance, even in bad weather. During the winter of 2015, amid one of the blizzards, we began to get alerts on our standard alarm system indicating low pressure in a collection line. A low-vacuum alarm is an infrequent but normal event; a vacuum pit valve may sometimes stick in the open position, reducing vacuum pressure in that line. Our monitoring equipment identifies the low-pressure line, and then we find the exact valve that needs attention by listening to the air intakes, which are located near the valve pits along the line. Once found, a valve can be adjusted or replaced in minutes. However, during the blizzard of 2015, it was impossible to locate an individual valve or valve pit because the streets and sidewalks were buried under almost 10 ft of snow. The air intakes, which project above ground about 3 ft, were well below the snow piles, which were made deeper by the snow plows. Soon other valves were not functioning properly, likely due to low pressure within the collection line caused by the open valve; a domino effect. In order to get the system back online, our crews worked three shifts, 24 hours a day, seven days a week for three weeks. We contacted Airvac, the system manufacturer and an authority on vacuum sewer technology. It immediately sent two of its top people to help solve the problem, but they were stymied as well. There was simply too much snow to find the open valves. Within a few days, much of the sewer system in Plum Island was shut down. As a result, the city had to notify residents that sewer service was temporarily offline and that they were to be relocated to hotels until the situation was resolved.

The winter storm of 2015 dumped about 110 in. of snowfall in just four weeks in the Massachusetts community of Plum Island. The storm made normal utility maintenance almost impossible.

The Solution

The series of blizzards in 2015 likely was a once-in-a-lifetime event, so we may never face such a problem again, but if we do, we are prepared. Our new sewer monitoring technology is perhaps the most advanced in the world and may be the model for new vacuum systems to come. The question we began to ask ourselves was, how do you locate problems belowground when the ground is covered by almost 10 ft of snow? We contacted Airvac, and after discussing their various monitoring solutions, we determined a radio-based unit was best for the Plum Island system. We worked closely with the Airvac engineering team and developed a transmitter solution that could be located within the buried valve pit, so none of our roads would be disrupted. Some creative thinking led us to consider geographic information systems (GIS) technology, which is made possible by satellite imaging. With this technology, you can create a detailed map of just about anything, and it is accurate within inches. By mapping the sewers, valve pits, division valves and air intakes, and coupling that information with our existing monitoring system, we can exactly locate every system component. We conveyed all this information to Gerald Whitten of the Merrimac Valley Planning Commission, who worked to develop a draft mobile device application. After a few revisions to the technology, a final version of the app was ready for use. We now have handheld technology that identifies the precise location of a sewer issue. There is no need to visit the central monitoring system at the vacuum station, no guesswork and no wasted time. Vacuum sewers might not be the best solution for every sewer collection application, but for a seaside community like Plum Island, they are the smart solution.

Handheld technology allows utility department personnel to access information in the field. They can address sewer problems within minutes without returning to the vacuum station to check monitoring equipment.

Additional Information

Birth of a Smart Sewer - WWD 2018
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