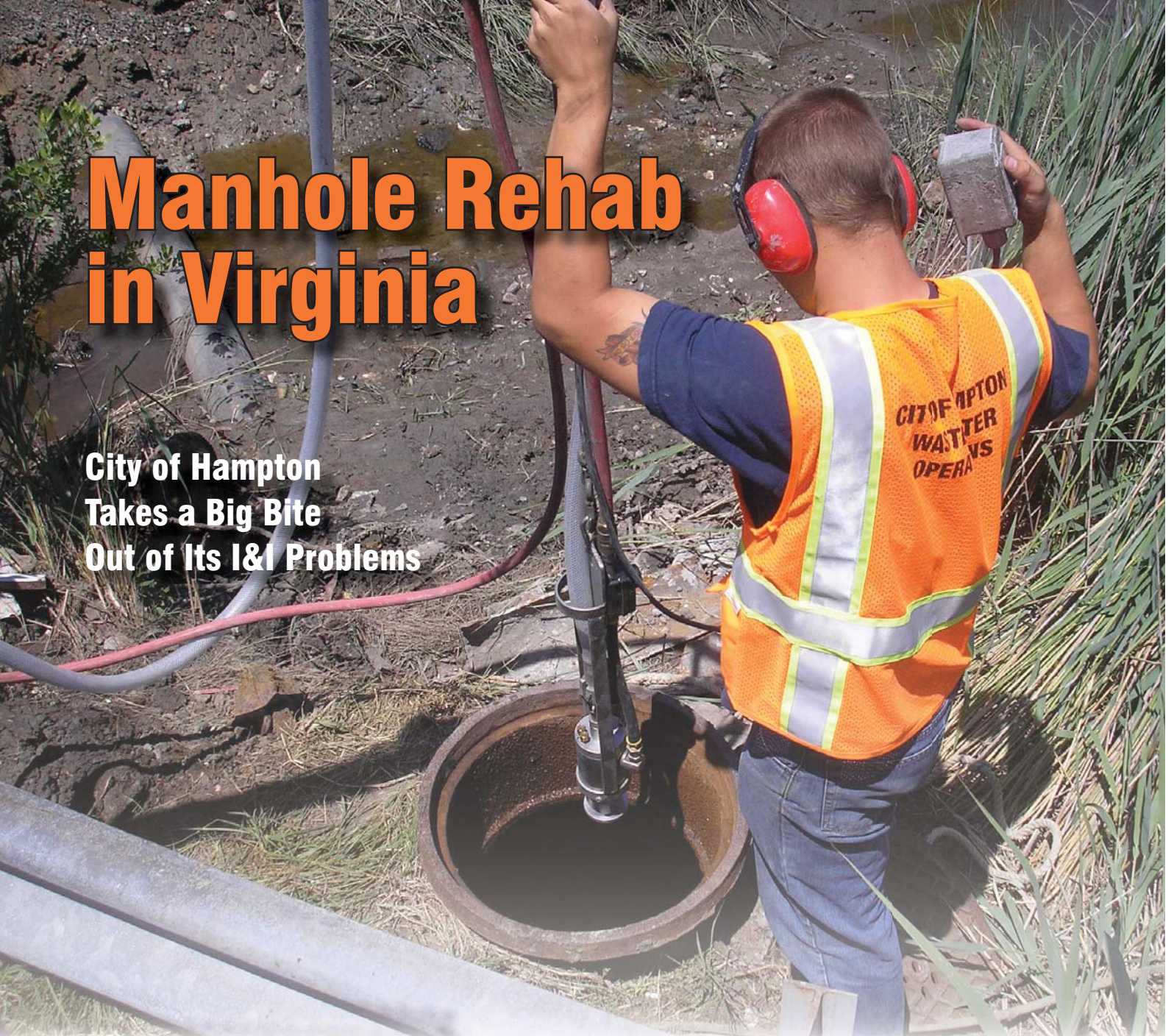


# Manhole Rehab in Virginia

City of Hampton  
Takes a Big Bite  
Out of Its I&I Problems



By Jason Mitchell

**T**he City of Hampton, Va., covers approximately 136 sq miles in the Hampton Roads area. With a population of 150,000 people, Hampton is the home of the Langley Air Force Base, the NASA Langley Research Center and the Virginia Air and Space Center. It also boasts a wide variety of business, industrial, retail and residential areas, historical sites and miles of beaches. This urban waterfront city is becoming a hot spot for tourists on the East Coast.

Wastewater Operations, a division of the Hampton Public Works Department, constructs and maintains the city's sanitary sewer system. Hampton's system has 11,000 manholes and transports about 12 million gals of raw sewage to the Hampton Roads Sanitation District for treatment every day. Its collection system dates back to the early 1940s and nearly 75 percent of the system is below the groundwater table. Therefore, inflow-and-infiltration (I&I) is a major is-

sue. During a rain event of 1 in. or more, the groundwater and rain derived inflow-and-infiltration (RDII) greatly overtax the system's capacity. In addition, I&I contributes to the wear and erosion of pipes and manholes and increases pumping and treatment costs.

Knowing that the City of Hampton needed an effective I&I reduction program, the Wastewater Operations management team researched the most cost-effective and proven-reliable rehabilitation systems available. After careful consideration, the team determined that performing most of the work in-house was the most cost-effective method. Internal staff had extensive manhole rehabilitation experience and knew their crews could successfully tackle that part of the program.

They determined that a self-installation program would provide flexible scheduling, optimize crew time, improve quality control, save money and give crews a sense of ac-



complishment and ownership in the project. Using their infrastructure database, GIS information and flow data, the management team established a pilot program, which targeted an area known to have severe I&I issues. This area was in a basin with 7,500 lf of pipe and 46 manholes.

The crews used the Permacast system from AP/M Permaform for centrifugally compacting high-strength cementitious grout on the prepared interior of a deteriorated manhole in every manhole. They also re-established the bench and inverts and installed a plastic manhole insert to stop the inflow. First, the crews cleaned the manholes with a high-pressure wash to remove loose material back to solid wall. Sometimes the corrosion had damaged more than 2 in. of the pre-cast concrete.

In masonry manholes, the bricks were still sound, but the mortar joints were gone. In both cases, the structures were seriously weakened and leaks were often prevalent. While the SpinCaster operator sets the equipment in place, the other crew member starts mixing. The operator raised and lowered the SpinCaster with a winch, making 20 to 30 passes through the center axis of the manhole, depending on the engineered thickness of 1/2 to 2 in. Half of the passes were made clockwise, and the other half were made counter-clockwise to ensure thorough coverage and complete compaction without having to trowel.

Hampton's tidal basin location coupled with warmer temperatures for most of the year contributes to a serious corrosion problem. Hot sewage, long retention times, high biological oxygen demand (BOD) levels and off-gassing generates lots of hydrogen sulfide gas, which becomes food for the bacteria that produces sulfuric acid. The corrosion chain is only broken if the bacteria cannot grow. Therefore, when rehabilitating its manholes, the city added ConShield, an EPA-registered antibacterial agent by ConShield Technologies, to the Permacast compound to prevent microbiologically induced corrosion (MIC).

"We discovered just how effective it is when we used the repair compound with ConShield on one manhole and not on the next manhole, which was 30 ft away on the same system. Five years later, the one without ConShield was severely corroded, while the other looked like it had just been installed," stated Barry Dobbins, Hampton's I&I manager. ConShield is regularly used in the manufacturing process of new concrete manholes and pipe in many cities throughout America.

Using the flow data and similar rain events to analyze the results, Wastewater Operation's efforts reduced inflow by 18 percent. The success of the pilot program enabled the department to implement a full I&I reduction program in 2000, with a goal to rehabilitate 100 percent of the city's 11,000 manholes.

Since the implementation of the full program in 2000, a three-person crew structurally lines about 400 manholes each season between April and October. The crew averages between three and four manhole rehabs each day, depending on depth, condition and access. Speed does not compromise the quality of the work. In fact, the high-speed



The SpinCaster makes 20 to 30 passes through the center of the manhole's axis.

rotational compaction ensures an even and uniform application every time, and the thickness is easily controlled by the number of passes up and down through the center of the manhole. It is important to avoid confined space entry whenever possible, and with the Permacast system, the city's crews only need to enter manholes to stop leaks, repair benches and perform final inspections.

"Since the inception of the program in 2000, we have rehabilitated about 3,000 manholes. The city's inflow-and-infiltration problems have not been completely eliminated, but this program has been extremely successful and it continues moving us in the right direction," said Dobbins.

Analysis confirms that inflow and infiltration has been reduced by roughly 18 percent in areas that were rehabilitated using this program. Manholes are not only a major source of I&I, but are also one of the easiest parts of the system to inspect, repair and monitor.

The I&I reduction program has already saved the city nearly \$100,000. The Wastewater Operations Division looks forward to its continued success and expansion of the program in coming years.

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