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REHAB ALONG THE NORTHWEST ARM

Halifax Water Completes Its Largest CIPP Project

ALSO INSIDE

PRESERVING THE

Trenchless Shines on Daunting Underground Overhaul Project in Halifax

By Mike Kezdi

FUNDING for large-scale infrastructure renewal projects is often the biggest stumbling block for utilities. When provincial and federal governments step in to cover 75 per cent of the bill, you jump at the offer even if the deadline is tight.

This was the case in the second half of 2016 when Halifax Water found out that its Underground Overhaul (Northwest Arm Trunk Sewer Rehabilitation) project was eligible for the Clean Water and Wastewater Fund Program. The caveat: The $23 million project needed to be complete by March 2018.

"The good and bad news was that it provided 75 per cent funding, which made this practically affordable in the near-term. However, we needed to accelerate the project timeline because of the caveat that the project had to be completed by March 2018," says Jamie Hannam P.Eng., director, Engineering and Information Services at Halifax Water. "Essentially, it meant we had the rest of 2016 to complete the designs and the 2017 construction season to complete the project. This should and could have been a multi-year project."

The Northwest Arm Trunk Sewer (NATS) began service in 1917 and was constructed mostly through tunnelling at depths of 300 mm to 5 m. The 1,200-mm round and 1,200-mm by 1,500-mm arch-shaped sewer is made of concrete and clay tile and runs parallel to the Northwest Arm (the Arm). The Arm is an inlet off the Atlantic Ocean and a popular recreational area for both aquatic and land-based activities. The sewer is about 10 to 15 m from shore and runs mostly through the yards of multi-million dollar residential properties.

Halifax Water, the utility which handles water, wastewater and storm water systems for the Halifax Regional Municipality, first learned that the NATS was in distress in 2007 after it completed the Harbour Solutions Project to stop the flow of raw sewage into the Halifax Harbour.

"Because of the raw sewage discharge into the harbour, it masked the fact that there were some leaks on this trunk sewer," Hannam says. "We could see the old pipe was leaking in some areas and putting waste into the harbour. It showed the pipe had structural issues which we validated that with inspection."

Halifax Water, no stranger to cured-in-place pipe (CIPP) renewal projects, completed a successful pilot project along approximately 460 m of the easiest to access portion of NATS to test the feasibility of using CIPP on this large diameter trunk sewer. Halifax Water knew that trenchless was the best alternative, given the narrow linear easement and the location of the pipe a stone's throw from the water's edge.

Of the $23 million, approximately $18.5 million was the trenchless renewal portion — including cleaning, assessment and post-installation inspections. Robinson Consultants, of Ontario, the prime consultant and engineer on the project began condition assessment and design work in July 2016. Request for proposals (RFP) went out in February 2017. Ontario-based LiquiForce Services was awarded the contract in May 2017.

According to Kevin Bainbridge, A.Sc.T, project manager at Robinson Consultants, because the project had a significant amount of challenges to be addressed, the decision was made to issue an RFP, allowing contractors some innovation in their approach. Based on the options analysis completed and the previous work the Utility had completed, the RFP allowed for the use of either sliplining using Fiberglass reinforced panels (FRP) or CIPP, however the approach to address the site challenges (access, etc.) was left for contractors to propose.

Given that CIPP is not typically used on non-circular sewers and the ASTM F1216 design methodology not being applicable, careful consideration had to be given to the engineering design of the liner. As a result, the RFP was written with specific parameters and design requirements to achieve the expected performance. Due to the tight deadline, limited access, numerous changes in the horizontal alignment

of the pipe and limited work space along the Arm, Insituform CIPP proved to be the best product and method.

As the prime contractor on the project, LiquiForce handled project management, the 141 residential and all of the mainline bypass and the required community engagement with the residents directly affected by this project. LiquiForce also assembled the sub-contractor team that included Insituform Technology (all CIPP work), Uni-Jet Industrial Pipe Services (preliminary cleaning), EmPipe Solutions Ltd. (CCTV inspection and pipe final pipe cleaning), G&R Kelly and Absolute Traffic Services.

"Although there was definitely risk in this project, we were confident that with the team as proposed we would be able to manage and mitigate this risk," says Kim M. Lewis, vice president business development at LiquiForce. "To bring all of this technology together into one job was unique for us. We need to give kudos to the engineering team on this project. Robinson did a fabulous job from their end organizing the project and information in advance and, as things came up, working to find the best solution."

The lack of accessibility to the easement is daunting in and of itself, requiring many discussions with the residents. *(See sidebar on pg. 14)*

"The homeowners along the project route were exceptional in terms of working with us, understanding the issues and wanting the issues corrected," Bainbridge says. "The residents were receptive of the project and the disruptions it entailed, understanding what would have been needed if we did not take a trenchless approach."

Further complicating the project was the CN Railway. To access a significant portion of the project, crews had to travel over weight-restricted CN Railway bridges. This meant typical loads in vacuum trucks, resin trucks and refrigerated liner trucks had to be split into smaller loads.

Weights and Access

Uni-Jet began cleaning in June. The pipe, which had never been cleaned before, yielded more than 700 cubic metres of debris. Because of the restrictions Uni-Jet could not get its equipment to the cleaning sites, but had to deploy smaller vacuum trucks to carry the debris away. This, Lewis says, was accomplished using multiple smaller units working in cycles.

A complex project, Underground Overhaul was divided into four zones and the CIPP work completed in 13 installations that began in August. As the project progressed through the zones, LiquiForce worked with the affected residents to install sewer lateral interruption crocks to divert sewer flows during the lining process.

In many cases installation and curing took eight to 10 days. The flows as intercepted from the residential lines and the tributary lines were tied into LiquiForce's local diversion piping and the main flows were tied into twin, 18-in. high density polyethylene pipes and four 12-in. pumps – rented from Atlas Dewatering – to handle diversion of the NATS during relining.

"As a combined sewer, when it rains ,this system immediately reacts to the wet weather," Lewis says "We had to be ready for those events."

The CIPP installations ranged in lengths of approximately 75 m to the longest install of 682 m. By all accounts, based on research by all involved in the project, the 682-m install is the longest single CIPP install completed in Canada to date.

"The first 1,000 m was mainly on the road or easily accessible from the road," Bainbridge says. "The next 3,000 m we were restricted to four inversion locations and Insituform averaged 450 m per installation."

Like Uni-Jet, Insituform had to lighten its load to make the project work. This meant that five of the 13 CIPP installations were completed using an over-the-hole wetout, including the 682-m install, because the wetted-out liners – at those lengths – were too heavy for the bridges.

David Runge, regional manager Insituform Technologies, describes the project as not being in the same millennia as the other projects he has been party to in his more than 20-year career with Insituform.

"Because of the weight restrictions, we could only take half of a tank of resin over the bridges at the time," Runge says. "This required us to have shuttle tankers with the resin manufactured in

WORKING IN THE NEIGHBOURHOOD

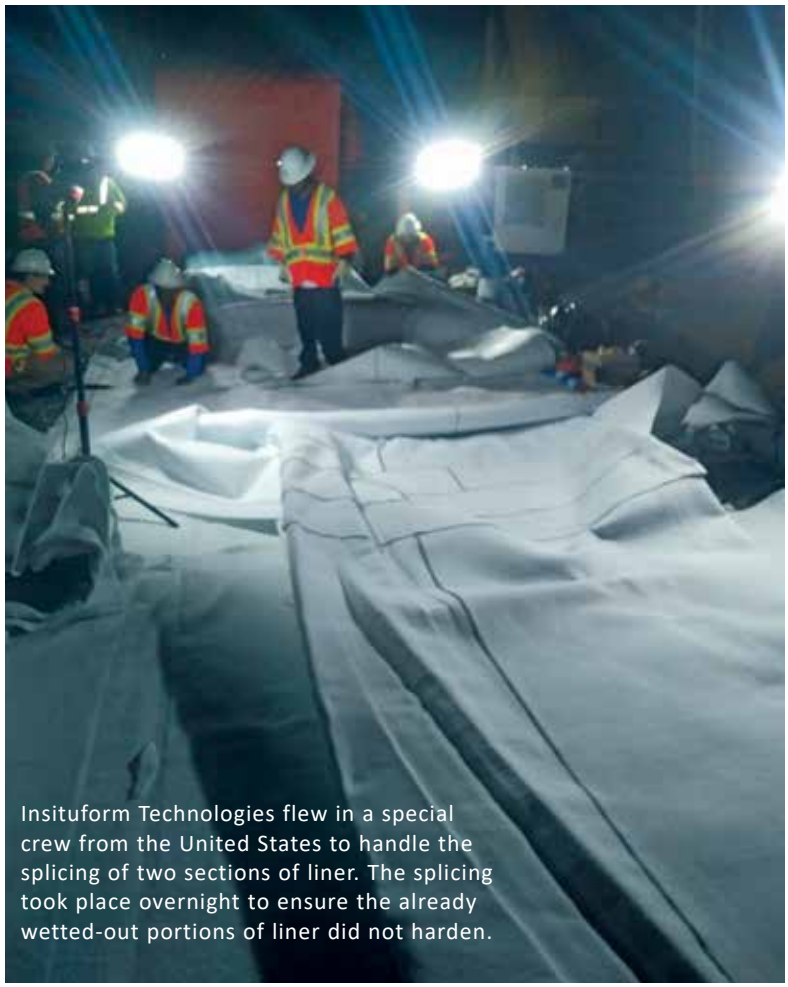
Jamie Hannam, P.Eng., director, Engineering and Information Services at Halifax Water, knew at the beginning of the Underground Overhaul project that working with the residents along the Northwest Arm (the Arm) was a must. Without buy-in from the people whose waterfront backyards held the easement for the Northwest Arm Trunk Sewer (NATS), completing the project in one construction season would be next to impossible.

"We understood, from the get-go that the key piece of success on this project was to engage with all of the individual landowners, and it was not going to be as simple as sending a letter a week ahead of the work," Hannam says. "We started early when we were working through the design process to engage the landowners using a multi-channel communications plan consisting of formal open houses with the contractors and consultants where we invited the whole community."

Public open houses allowed residents to directly ask questions to the people completing the work. According to Kim M. Lewis, vice president business development at LiquiForce, they had anywhere from four to five people working on public relations during the project. This more hands-on approach was included in the RFP. Following the public meetings, Halifax Water created individual mailings and literature drop-offs so that everyone was informed on the front end. In a couple instances, all of the entities came together for site-specific public meetings on the jobsite.

The utility also created an Underground Overhaul section on its website that gave residents timely updates on the project. Halifax Water also posted signs along the project route with QR codes on them. When scanned, the codes took the inquiring person to the Underground Overhaul website.

"We communicated in every practical way to show them the need for the project and the method's benefits and then also the impact on each home," Hannam says. "LiquiForce and Insituform went door-to-door to speak with each homeowner at each property. The contractors really stepped up and made the home-by-home connection. In the end, we had complete cooperation because of our plan."



Insituform Technologies flew in a special crew from the United States to handle the splicing of two sections of liner. The splicing took place overnight to ensure the already wetted-out portions of liner did not harden.

Guelph, Ontario, then transported to Halifax and then we would split the load into smaller resin tankers to get the resin over the tracks."

Shot No. 9

As stressful as that was, one section – Shot No. 9 at Belmont on the Arm – required a rarely used method known as an in-field wet-splice. Runge jokes that in his time at Insituform, he has only heard of this scenario in folklore.

Because its launch location did not allow for an over-the-hole wetout coupled with the weight restrictions, the liner for Shot No. 9 — a 240-m section — was manufactured in two pieces. All but 7.62 m of each tube was impregnated with resin at Insituform's Montreal facility. A special crew was flown in from the United States to complete the install, which involved inserting 90 per cent of the first tube, stopping the install, stitching together the two dry sections, wetting out the 15.24 m dry section and commencing the insertion.

"Insituform completes an in-field splice during an over-the-hole wetout on about 5 per cent of our over-the-hole projects," Runge says. "This was further complicated because this is, what we are calling, an in-field wet splice. Insituform has probably done this 10 times and this was the first time it was ever done in Canada."

He can smile about it now, but Runge admits this was probably one of the most thoroughly planned portions of the project and took a lot of talking through because of the risks. The big challenges were temperature and sunlight control because both could cause the liner to prematurely harden and both sections of liner would need to be scrapped.

"We specifically planned it so it would be a cooler time in Halifax. When we did the in-field wet splice it was October and 3 degrees out. We completed the installation of the first tube during the day and the sewing of the tubes happened at nighttime and took 11 hours," Runge says. "The risk is that you have a tube 90 per cent in and the heat and sunlight get to it and you are concerned that the tube will prematurely exotherm and go hard before you get it to where you want to get it. Wetout of the dry portion took about seven hours the following morning. Shot No. 9 was the most complex project that I have been a part of."

"When I talk about this project, I smile because this is a proud project to be part of," Runge says. "It was challenging, I learned a lot and I am glad it is over and completed successfully."

The last section of liner was installed Dec. 4 and the system was operational Dec. 5 — well ahead of schedule and before any major snowfall could hamper progress.

"One cannot overstate the amount, nor the importance, of the upfront planning work that went into making this project a success. Our team had to design and clearly communicate through the RFP process, the details of our plan on how we would pull this project off from scheduling, to specific site safety plans, public relations, weight restrictions, restricted access, designs, materials, etc." Lewis says. "We pulled every tool out of the toolbox to pull this project off, and I am so proud of the entire project team."

According to Halifax Water, the Underground Overhaul project required more than 1 million lbs of resin. For the majority of the project, the resin had to be trucked in on smaller tankers due to CN Railway bridge weight restrictions.

Mike Kezdi is associate editor of *Trenchless Technology Canada*.