

Large Diameter Watermain Rehabilitation in the City of Toronto

The City of Toronto's water distribution system comprises 550 km of transmission watermain, 5,550 km of distribution watermain, 18 pumping stations, 4 elevated tanks, and 11 reservoirs. The maintenance of this large number of assets is an integral part of keeping water supply in the City flowing and safe for public use. The City has experienced significant failures of legacy cast iron pipes that form part of the transmission system.

WSP was retained by the City of Toronto for the project management, design, and construction administration of cast iron transmission watermain replacements on Macpherson Avenue, Russel Hill Road and Boulton Drive. The watermain on Macpherson is 900mm diameter and was constructed in 1914 and the pipe on Russell Hill Road and Boulton Drive is 750mm diameter and was constructed in 1935. These pipes form part of the original transmission system built by the City and are the supply to and discharge from the High Level Pumping Station, also constructed in the early 1900's. The construction of the lining works took place between July 2017 and October 2018 and was completed by Clearway Construction Inc. with the watermain lining by AquaRehab.

The project presented a number of challenges including isolation, condition assessment, and pipe transitions. Each of these challenges required innovative engineering solutions to overcome, and allow the successful completion of the project.

To complete the condition assessment and the lining of the pipelines, isolation of the watermains was critical. However, when isolation of the transmission watermains was attempted during construction, it was discovered that the perimeter valves were inoperable. To isolate the 750mm diameter transmission main without disrupting the adjacent distribution system, it was necessary for two new valves to be installed: an insertion valve and a line stop.

This assessment included a thorough review of as built drawings, a detailed inspection of all valve chambers, and a CCTV investigation to visually assess the condition of each watermain and determine appropriate renewal method. The completion of the CCTV inspection was a challenge due to difficulties in gaining access into the existing watermains. It was determined that a track mounted remotely operated vehicle would be used to complete the inspection.

At one of the transition locations, an unexpected condition was found, which required reengineering the connection detail. The as built drawings relied on during design were not up to date and instead of a straight pipe, a sweeping bend encased in concrete was found. The concrete encasement had to be carefully removed and alternate coupling options had to be investigated. A Hymax coupling was selected for use at this location, which required modifications to the new stainless steel pipe already manufactured.

In addition to addressing an existing infrastructure issue using an innovative method, the rehabilitation of the watermains extended the lifespan of existing materials and limited disruption of critical services. With increasing demands for responsible resource use and service reliability, it is anticipated that this type of rehabilitation method will be increasingly adopted to upkeep infrastructure at a pace matching future trends and service demands.