

CCE Awards 2023

Jefferson East Combined Sewer Relief - Semple Trunk Sewer



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#### **Project Overview**

The City of Winnipeg engaged AECOM to design and implement a combined sewer relief program for the Jefferson East Combined Sewer District to reduce the risk of both basement flooding and combined sewer overflows to the nearby Red River. The Semple Trunk Sewer is the backbone of the system and was constructed utilizing tunneling methods to minimize disruption to the quiet residential neighbourhood. The tunnel was completed in a single drive of over 1.5 kilometers.





# **Table of Contents**

1. Innovation	.3
2. Complexity	.4
3. Social and/or Economic Benefits	.5
4. Environmental Benefits	.6
5. Meeting Client's Needs	7

## 1. Innovation

The Jefferson East Combined Sewer District represents an area of 475 hectares of predominantly residential area in a mature neighbourhood in Winnipeg, Manitoba which had previously experienced issues with basement flooding. AECOM was engaged by the City of Winnipeg in 2009 to develop the conceptual basement flooding relief and pollution abatement plan. We then began implementation of the program in 2011.

Construction work is segmented into 10 different construction contracts, focusing on different catchment areas. One critical part of this work was the Semple Trunk Sewer. Completed in 2021, the new LDS trunk relieves hydraulic load on the combined sewer system, reducing risk of basement flooding and combined sewer overflows to the nearby Red River. The trunk is the launch point for future sewer separation contracts in the district.

The area for construction of the new trunk sewer is a largely residential, mature neighbourhood located in north Winnipeg. The trunk spans approximately 1,540 metres along Semple Avenue and crosses eight intersections including Main Street. Given the compact and well-established nature of the neighbourhood, minimizing the impact on homeowners was the top priority when reviewing potential construction technologies, monitoring requirements and mitigation measures. Trenchless construction methods were identified early in the design phase as the only acceptable method of construction that would be suitable to the area.

AECOM identified two viable trenchless construction methods:

- 1. Single-Pass Tunneling with Pipe Jacking
- 2. Two-Pass Tunneling with Grouted in Place Carrier Pipe

Despite limiting allowable tunneling methods to two primary technologies, innovation and creativity were encouraged during the procurement process. The intent was to allow for a wide range of technical approaches to the means and methods including various laydown and working areas, shaft construction techniques, pipe materials, and drive lengths. Proponents were also permitted to upsize pipe diameters, should that be of benefit to the contractor's means and methods. A prequalification process was used to identify experienced and capable contractors. The successful proponent, McNally Construction Ltd., used the two-pass tunneling system.

The procurement methods utilized encouraged industry to utilize innovation and allowed for proponents to consider a wide variety of means and methods to achieve the desired end result of successful and safe sewer installation. The flexible approach in procurement resulted in a competitive, open market, and cost-effective means of tendering the project with a wide range of high-quality proponents.





## 2. Complexity

The project is located in a quiet, compact and wellestablished residential neighbourhood. Minimizing the impact on homeowners was the top priority when reviewing potential construction technologies, monitoring requirements and mitigation measures.

While constructing via trenchless technology solved some issues, there were still challenges of the subsurface conditions, utility density (buried and overhead), noise, vibration, construction footprint, traffic disruption, and close vertical proximity of existing combined sewer trunks (less than 150 millimetres). AECOM completed a geotechnical report investigation which included paying particular attention to an area where a former historical waterway, Inkster's Creek, since backfilled or rerouted, crossed the alignment. Assessing both surface and subsurface risk was a critical component of the sewer design and technology selection process. Given the nature of trenchless construction and the desire to allow for the possibility of 24hour construction, the City of Winnipeg granted exemptions to the noise by-law for activities deemed critical and necessary to tunneling operations. A Vibration Monitoring Plan was used by the contractor to document the impact of potential vibrations caused by construction. The alignment of the proposed trunk crosses under several active sewer and water utilities including watermains and combined sewers. Clearances around the utilities varied, but some required temporary relocation or bypass pumping. A surface and subsurface monitoring plan will monitor affected utilities for settlement.

Ultimately, the 1.5-kilometer tunnel was completed successfully, even through a cold Winnipeg winter, where temperatures dropped as low as -38.8°C. The tunnel was the longest ever completed in Manitoba.



## Social and/or Economic Benefits

During wet weather events, the capacity of the combined sewer systems can be overwhelmed by heavy rainfall resulting in basement flooding events and overflows to the rivers. The Semple land drainage sewer (LDS) trunk relieves hydraulic load on the combined sewer system by removing wet weather runoff from the combined sewer system, reducing the risk of basement flooding and combined sewer overflows to the nearby Red River.

Homeowners and businesses in the area will benefit from the reduction in basement flooding events and the associated stress, clean up, and restoration costs that accompany these events. The reduction in combined sewer overflows to the Red River during large storm events will aid in improving water quality in both the Red River and Lake Winnipeg. The Red River and Lake Winnipeg are both popular recreational waterbodies. Protecting them from environmental damage will allow residents to continue to enjoy these waterbodies.

The mitigations taken during construction including the requirements for long tunnel drive lengths, vibration monitoring, and noise mitigation allowed construction to occur over a footprint of approximately 1.5 kilometres with minimal impact on residents in vicinity of the trunk.



## 4. Environmental Benefits

The wet weather events can cause the combined sewer system to overflow to the nearby Red River when system capacity is exceeded. These overflows result in the temporary discharge of diluted sewage to the river, which contains bacteria, floating debris, and organic materials. The construction of the Semple LDS and adjacent sewer relief work relieves pressure on the combined sewer system and reduces the likelihood of combined sewer overflows to the river. The reduction of combined sewer overflows to our waterways is key to maintaining the health of our rivers and lakes. The Semple Avenue right of way includes a large canopy of mature elm trees that are highly valued by the neighbourhood and are home to a vast array of birds, squirrels, and other animals. Trees provide other benefits to urban areas including cooling the streets and adjacent homes in the summer, reducing rainwater runoff and air pollution, improving mental and physical health, as well as beautifying the city. The trenchless construction technologies utilized for the project allowed construction to occur without the need to remove trees, which would not have been possible using traditional open cut methods.



## 5. Meeting Client's Needs

The successful installation of the Semple Trunk Sewer met several objectives for the City, including:

- Improved capacity in the existing combined sewer and wastewater system
- Reduction in basement flooding events in the district
- Reduction in combined sewer overflow events in the district, improving water quality in both the Red River and Lake Winnipeg
- Minimal disruption to the neighbourhood due to single drive tunnel installation

The complex nature and duration of the project required clear and consistent communication between AECOM, the contractor, the City, as well as homeowners, schools and businesses in the area. The procurement methods chosen encouraged industry to be creative, innovate and consider a variety of technical approaches in their means and methods to achieve the desired end result of a safe and successful sewer installation. The flexible approach in procurement resulted in a competitive, open market, and cost-effective means of tendering the project with a wide range of high-quality proponents. Bids ranged from approximately \$17,400,000 to over \$32,000,000. The project commenced in August 2020 and was successfully completed on budget of Fall 2021.

In 2022, this project was awarded an ACEC-MB Award of Excellence.



#### About AECOM

AECOM is the world's trusted infrastructure consulting firm, delivering professional services throughout the project lifecycle – from advisory, planning, design and engineering to program and construction management. On projects spanning transportation, buildings, water, new energy and the environment, our public- and private-sector clients trust us to solve their most complex challenges. Our teams are driven by a common purpose to deliver a better world through our unrivaled technical and digital expertise, a culture of equity, diversity and inclusion, and a commitment to environmental, social and governance priorities. AECOM is a *Fortune 500* firm and its Professional Services business had revenue of \$13.1 billion in fiscal year 2022. See how we are delivering sustainable legacies for generations to come at aecom.com and @AECOM.