

## Document 2 – Large-Diameter Watermain Condition Assessment Program

As part of the City's large-diameter watermain condition assessment program, staff are able to proactively assess and identify deficiencies that can be addressed in a planned and controlled fashion, limiting impacts to customers. There are currently 235 kilometers of large-diameter watermains ( $\geq 610$  millimeters) in the city. The expected service life is between 80 and 110 years and the current average age is approximately 37 years.

Although the program was formally established in June 2012, the City has been engaged in watermain condition assessment activities since 2007.

The program continues to be governed by a working group composed of technical experts and management representatives from multiple Infrastructure and Water Services Department Branches. The working group discusses strategies and puts forth recommendations for the inspection program based on a risk-based prioritization approach, considering competing priorities within the drinking water system. The program has focused the inspections on the approximately 52.6 kilometers of pipeline that was installed from approximately 1972 to 1979.

It is recognized industry-wide that the 1972-79 C301 pipe has experienced a modest tendency for premature failure, in comparison to concrete pressure pipe material manufactured and installed before and after this period. To date, the City has completed 42.4 kilometers (81 per cent) of unique structural condition assessment and 43.2 kilometers (90 per cent) of unique leak detection on this cohort of pipes. The outstanding structural inspections on this cohort of pipes all require capital projects to be completed prior to an inspection being possible. In total, 47.6 kilometers (20 per cent) of unique structural condition assessments and 123.8 kilometers (53 per cent) of leak detections have been completed on large-diameter watermains in the city.

The following inspections were completed in 2022:

- Vanier B watermain segment from North River Road to Beechwood Avenue: Structural inspection completed for 2.2 kilometers. This was previously leak inspected in 2019.
- Baseline Phase 3 waterman segment from Queensway Carleton Hospital to Bexley Place: Structural inspection completed for 1.1 kilometers. This was previously leak inspected in 2015.
- Britannia A watermain segment from Britannia Water Purification Plant to Carling: Leak detection completed for 1.4 kilometers.
- David Drive and Woodroffe A/C watermain segments from Castle Hill to the Nepean Sportsplex: Leak detection completed for 6 kilometers.

- Forest Ridge and East Urban Communities watermain segments from Forest Ridge Pumping Station to Mer Bleue: Leak detection completed for 6.3 kilometers.
- Castlefrank watermain segment from Hazeldean Road to McCurdy Drive: Leak detection for 1.3 kilometers and survey level average wall thickness for 1.3 kilometers.
- A structural inspection of Eagleson B watermain segment (1.1 kilometers) was delayed to spring 2023 due to supply delays.

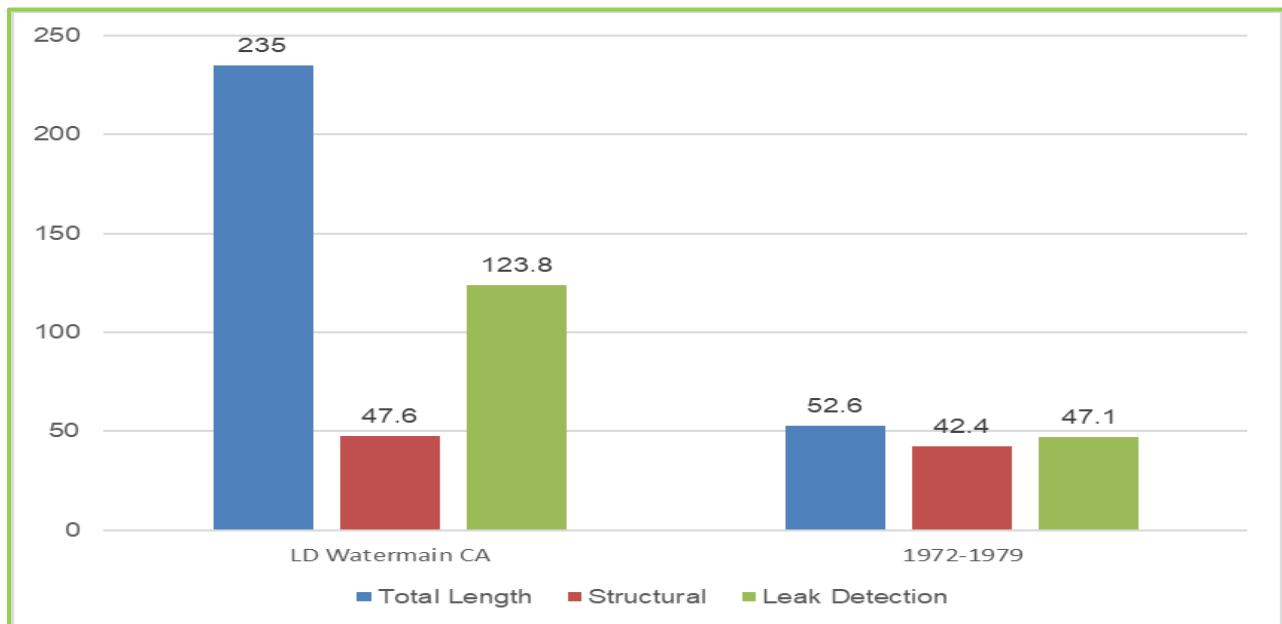
Through this program, 20.1 kilometers of large-diameter watermain was inspected for leaks and 3.4 kilometers for structural deficiencies in 2022. Each type of inspection provides unique condition information used for rehabilitation and lifecycle decisions. Completion of both types of condition assessments often takes multiple years. A watermain segment is considered to be completely inspected when both leak detection and structural condition have been assessed. In 2022 8.7 kilometers of watermain were considered fully completed. The working group continues to look for opportunities to increase the amount of structural inspections completed each year. The table below provides a summary of the completed assessments.

Table 1 – Inspection Distances by Year (km)

<b>Year</b>	<b>Structural</b>	<b>Leak Detection</b>	<b>Fully Completed</b>
2007	n/a	1.0	n/a
2008	3.8	n/a	n/a
2011	8.5	3.5	3.5
2012	4.1	3.6	3.6
2013	4.2	n/a	n/a
2014	1.9	2.2	3.3
2015	9.7	10.8	7.0
2016	1.5	16.8	11.4
2017	7.2	22.4	3.7
2018	0.9	10.9	8.2
2019	3.6	17.6	9.7
2020	3.2	11.9	6.2
2021	3.9	11.2	7.5
2022	3.4	22.1	8.7

The figure below illustrates the progress on inspections to date for the Large Watermain Condition Assessment Program - the left-side shows the total large diameter watermains (including the cohort of pipes installed from approximately 1972 to 1979) and the right side shows the cohort of the pipes installed from approximately 1972 to 1979.

Figure 1- Large Diameter Condition Assessment Progress Unique Inspections to Date (km)



It should be noted that Pure Technologies<sup>1</sup> has found that the current average per cent of distressed segments across all of their inspections is around 3.00 per cent (The Water Research Foundation<sup>2</sup> previously published industry distress rate in 2012 was 3.7 per cent). To provide more details regarding the actions taken based on assessment results, the following definitions were used:

- Immediate Action Required: Pipe segment condition is such that it needs to be repaired or replaced before bringing the pipe back into service. Urgent Repair required.
- Short-Term Action Required: Pipes should be scheduled for repair or replacement in the next few years. The timeline depends on the severity of the distress and professional opinion of the structural engineer. The pipe can be put back in service, but steps should be taken to repair or replace it. Planned Repair required.

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<sup>1</sup> Pure Technologies is a Xylem brand which performs inspections of pipelines using electromagnetic and acoustic technologies.

<sup>2</sup> The Water Research Foundation (WRF) is non-profit, educational organization that funds, manages, and publishes research on the technology, operation, and management of drinking water, wastewater, reuse, and stormwater systems—all in pursuit of ensuring water quality and improving water services to the public.

- To Be Monitored Long-Term: There is distress in the pipe section, but it is relatively minor. No repair or replacement intervention planned. The pipe will be reassessed after the next inspection. The timing of the next inspection is to be determined through regular program planning.

Table 2 – Summary Leak Detection Results for 2022

<b>Watermain Segment</b>	<b>Total Distance (m)</b>	<b># of Leaks</b>	<b>Management Strategy</b>
Castlefrank	1319	0	No leaks detected
Britannia A	1420	0	No leaks detected
David Dr	6018	0	A leak was detected at Woodroffe and Meadowlands and was repaired.
Forest Ridge	6274	2	2 suspected feature leaks identified on a air and a drain valve.
Woodroffe BCD	7037	1	1 small leak (>5 L/s) found. Water Distribution is working to locate and verify the leak.

All inspections happen in Q4 of the inspection year, this is to allow time for the inspections and, if required, any repairs before May of the following year when water demands typically increase. As such, repair and replacement occur in the following year(s).

The plan for 2023 is to build upon existing initiatives, including the following:

- Evaluate the transient pressures in some of the higher risk C301 pipes to more accurately assess the stresses on the distressed pipes and risk.
- Continue to look for opportunities to increase the length of structural inspections performed each year within the current restricted time window.
- Continue to work with Asset Management to refine the frequency and level of inspection each watermain requires.
- Explore potential for new technology and vendors
- Continue program planning over a 3 to 5-year horizon
- Continue to work with Water Distribution on aligning the watermain condition assessments with large valve and chamber condition assessments and repair to reduce the downtime of the watermains

The plans provided in the table below are impacted by some constraints such as:

- Level of service expectations

- Resources
- Hydraulic impacts
- Other concurrent capital construction projects

Table 3 - Proposed 2023, 2024, 2025 Large Watermain Condition Assessment Program

Watermain Segment	Age (Yrs)	Risk Rank	Inspection Length (km)	
			Condition Assessment	Leak Detection
<b>2023</b>				
Eagleson B	50	13	1.1	0
St. Joseph A	50	12	2.2	2.2
Ottawa South A	51	9	2	5
2C-A	66	54	0	4.5
Robertson Phase 1	48	2	4.2	4.2
Robertson Ph0	51	18	0	1.2
<b>2024</b>				
Laurier	40	31	0	1.4
Gloucester	40	58	0	1.3
Bridlewood A	47	14	1.6	0
Ogilvie	58	53	0	3.9
Orleans B	50	15	2.4	0
St. Joseph B	48	21	0.9	0.9
Britannia Discharge A	47	20	1.4	0
<b>2025</b>				
Baseline Ph5	49	23	2.9	0
Fallowfield A	45	17	1.9	0
Barrhaven PS Suction	36	58	0.5	0
Orleans Res	48	10	2.2	0
Hazeldean A2	48	19	1.2	1.2
Hazeldean B2	8	68	0	0.9
Richmond	64	43	0	4.5
Scott Street	73	55	0	2.8