INFORMATION REPORT

TO:	Chair and Members Public Works Committee
COMMITTEE DATE:	July 10, 2019
SUBJECT/REPORT NO:	Annual Report on Watermain Breaks - 2018 (PW19060) (City Wide) **(Outstanding Business List Item)**
WARD(S) AFFECTED:	City Wide
PREPARED BY:	Dave Alberton (905) 546-2424 Ext. 1090 Erika Waite (905) 546-2424 Ext. 6397
SUBMITTED BY: **SIGNATURE:**	Andrew Grice Director, Hamilton Water Public Works Department
SUBMITTED BY: **SIGNATURE:**	Gord McGuire Director, Engineering Services Public Works Department

COUNCIL DIRECTION

At the January 23, 2019 meeting of Council (Council Minutes 19-002, Item 7.3), Council directed staff to provide the Public Works Committee with an annual report on watermain breaks, the total number, cause and cost of each break, as well as the distance of water mains relined with total cost and overall report on sustainability.

INFORMATION

Total Number, Cause and Cost of Watermain Breaks:

During the year of 2018, Hamilton Water experienced a total of 306 watermain breaks resulting in a total repair cost of approximately $3.18M. The total repair cost is the summation of repair cost valued at $2.15M (including excavation, repair, and temporary

restoration), and permanent restoration valued at $1.03M. Approximately 27% of the watermain breaks were caused by corrosion, 71% were caused by ground movement, and 2% were the result of displaced pipe joints. A summary of watermain breaks by cost and mode of failure is represented in Figure 1 below. Moreover, a detailed report of the cost and mode of failure of each watermain break can be found in Appendix "A" to Report PW19060.

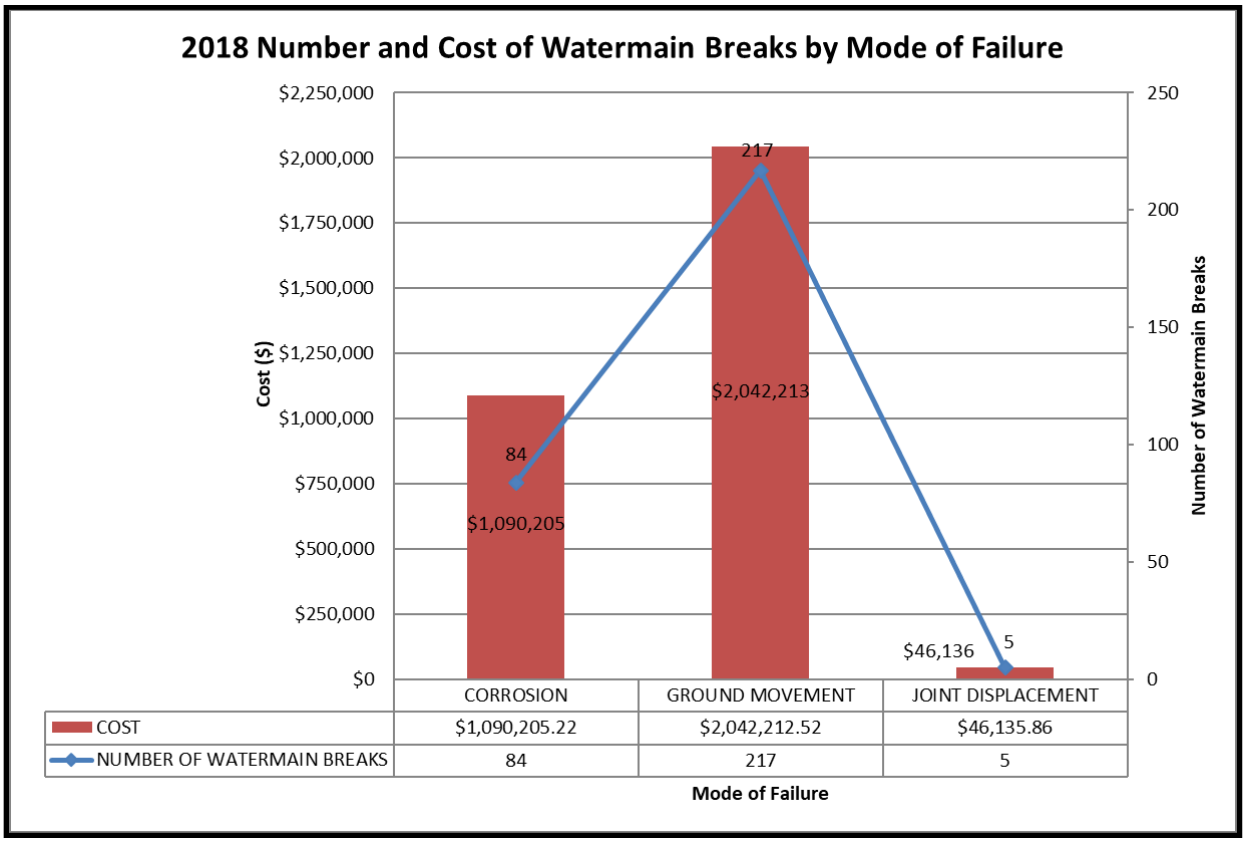

Figure 1 - Number and Cost of Watermain Breaks by Mode of Failure

On average, from 2012 to 2018, the City of Hamilton experienced approximately 318 watermain breaks per year. Seasonal temperature variations can have impacts on the number of watermain breaks experienced each year as indicated in the graph "watermain breaks vs. ambient temperature" in Appendix "B" to Report PW19060. Please note that a surge above the average number of watermain breaks in the years of 2014 and 2015 was a result of increased watermain breaks during the months of January to March in each year. Abnormally low ambient temperatures in 2014 and 2015 were a by-product of polar vortex events.

The graph below in Figure 2 illustrates the yearly total of watermain breaks experienced within the City of Hamilton during the years of 2012 to 2018.

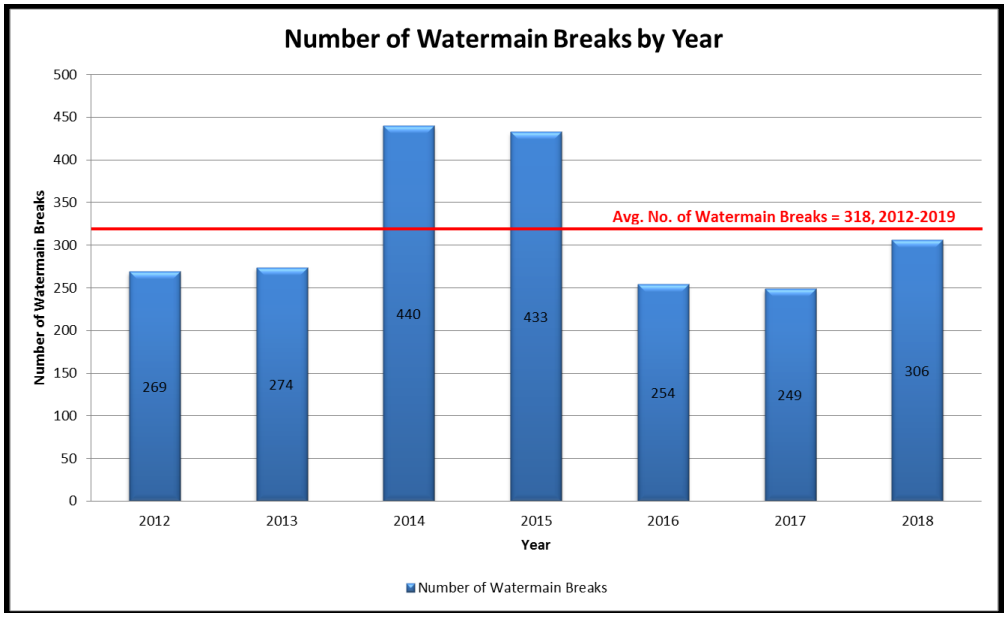

Figure 2 - Watermain Breaks by Year

Distance and Cost of Watermain Relining Program:

The Engineering Services Division monitors and tracks the length and cost of watermains that are replaced and rehabilitated (relined). As illustrated below in Figure 3, the cost of watermains rehabilitated (relined) in 2018 was $4.6M and the cost of watermains replaced was $6.0M, each with a length of approximately 5,000 metres.

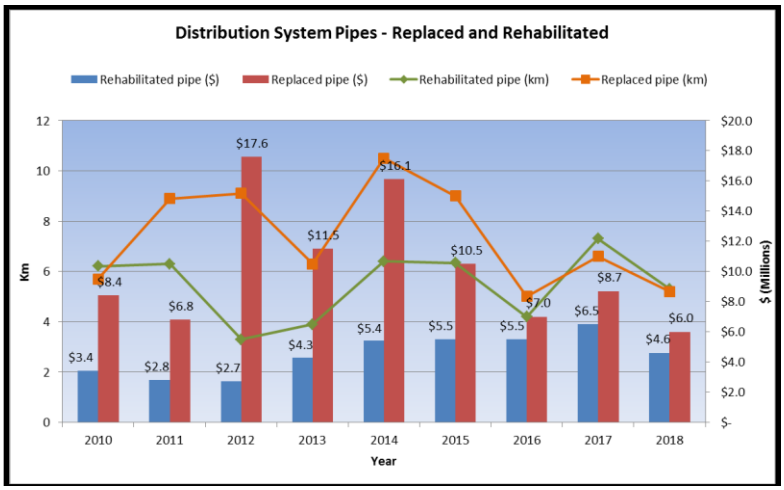

Figure 3 - Cost and Length of Watermain Replacement and Rehabilitation (Relined)

To supplement the cost and length of watermain replaced and rehabilitated (relined) in Figure 3, the table below in Figure 4 provides detailed cost and length information.

	Rehabilitated		Replaced	
Year	Pipe (km)	$ (Millions)	Pipe (km)	$ (Millions)
2010	6.2	$ 3.4	5.7	$ 8.4
2011	6.3	$ 2.8	8.9	$ 6.8
2012	3.3	$ 2.7	9.1	$ 17.6
2013	3.9	$ 4.3	6.3	$ 11.5
2014	6.4	$ 5.4	10.5	$ 16.1
2015	6.3	$ 5.5	9.0	$ 10.5
2016	4.2	$ 5.5	5.0	$ 7.0
2017	7.3	$ 6.5	6.6	$ 8.7
2018	5.3	$ 4.6	5.2	$ 6.0
Total (2010-2018)	49.24	$ 40.7	66.3	$ 92.6
% Overall System (2010-2018)	2.35%	-	3.17%	-

Figure 4 - Length and Cost of Watermain Rehabilitation and Replacement

Management of the City's Watermain Inventory:

The Engineering Services Division, Asset Management Section is responsible for managing the asset lifecycle for City-owned infrastructure that exists within the municipal road allowance including the City's watermains. The strategic asset management program for watermains is currently in progress to comply with O.Reg. 588/17 under the Infrastructure for Jobs and Prosperity Act that requires a Strategic Asset Management Policy to be approved by Council by July 1st, 2019 and an Asset Management Plan (AMP) for all core assets, including watermains, to be approved by Council by July 1st, 2021. Sustainability of the watermain network has been previously analysed through State of the Infrastructure reporting iterations and a provincially required Asset Management Plan (AMP), completed in 2014, Report PW14010.

The Hamilton Water Division, Water Distribution & Wastewater Collection Section is responsible for maintenance and repairs of the City's watermains throughout the asset lifecycle. This work adheres to the strict legislative requirements surrounding potable water in municipal distribution networks, issued by the Ministry of the Environment, Conservation, and Parks (MECP).

The primary objective of the City's asset management, maintenance, and repair programs for watermains are to ensure the uninterrupted supply of high quality potable water to the City's residents and industrial, commercial and institutional customers. It is very important to note that the City's water distribution systems are designed with a significant amount of redundancy, such that sections of watermain can be isolated for maintenance and

repairs to be completed with minimal to no disruption to the supply of potable water to our customers.

The City has 327 kilometres of transmission mains and 1748 kilometres of local watermains.

Transmission mains are large watermains which allow for large volumes of water to be transported across the City to fill potable water storage facilities (reservoirs and towers), to supply water pumping stations, and to supply local watermains. Transmission mains carry the largest risk for the City in terms of ensuring that the supply of potable water remains uninterrupted.

Local watermains, or distribution mains, are smaller (400mm or less), and they supply potable water to the serviced properties within the City. As mentioned previously, the distribution network for local watermains includes a significant amount of redundancy, such that sections of watermain can be isolated for maintenance and repairs to be completed with minimal to no disruption to the supply of potable water to our customers.

Figure 5 below identifies the age distribution of the City's watermain inventory.

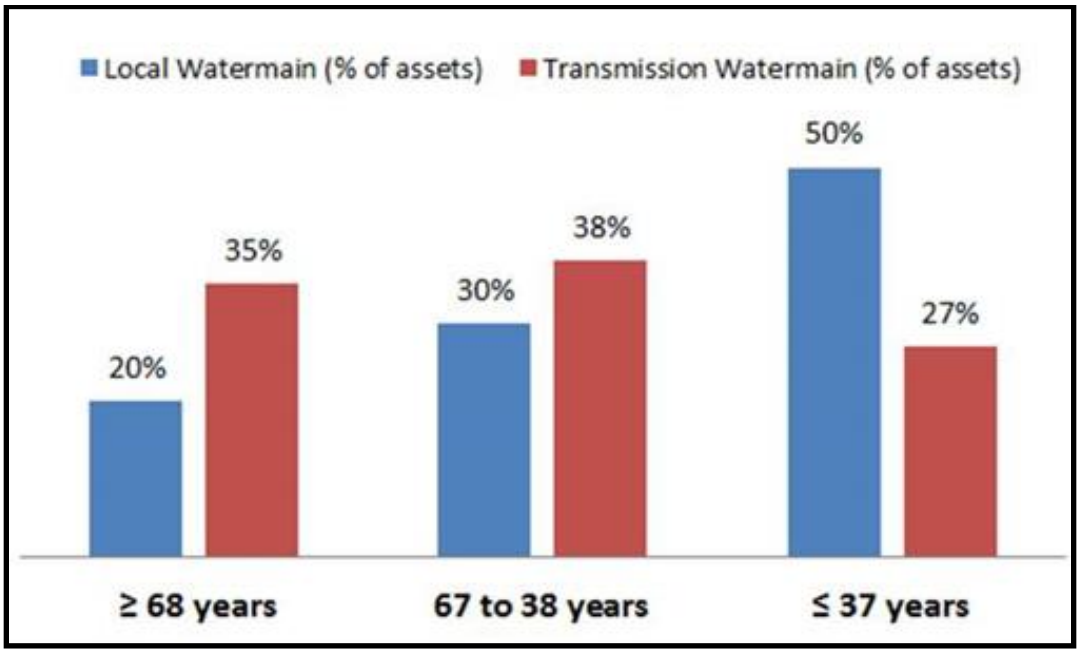

Figure 5 - Age Distribution of Local and Transmission Watermains

Sustainable management of the City's watermains includes prevention through design; lifecycle maintenance and repair; and lifecycle rehabilitation or replacement.

The Engineering Services Division (Design and Asset Management Sections) and the Hamilton Water Division work together to apply watermain best practices to maintain or enhance sustainability of watermain assets as illustrated in Figure 6 below.

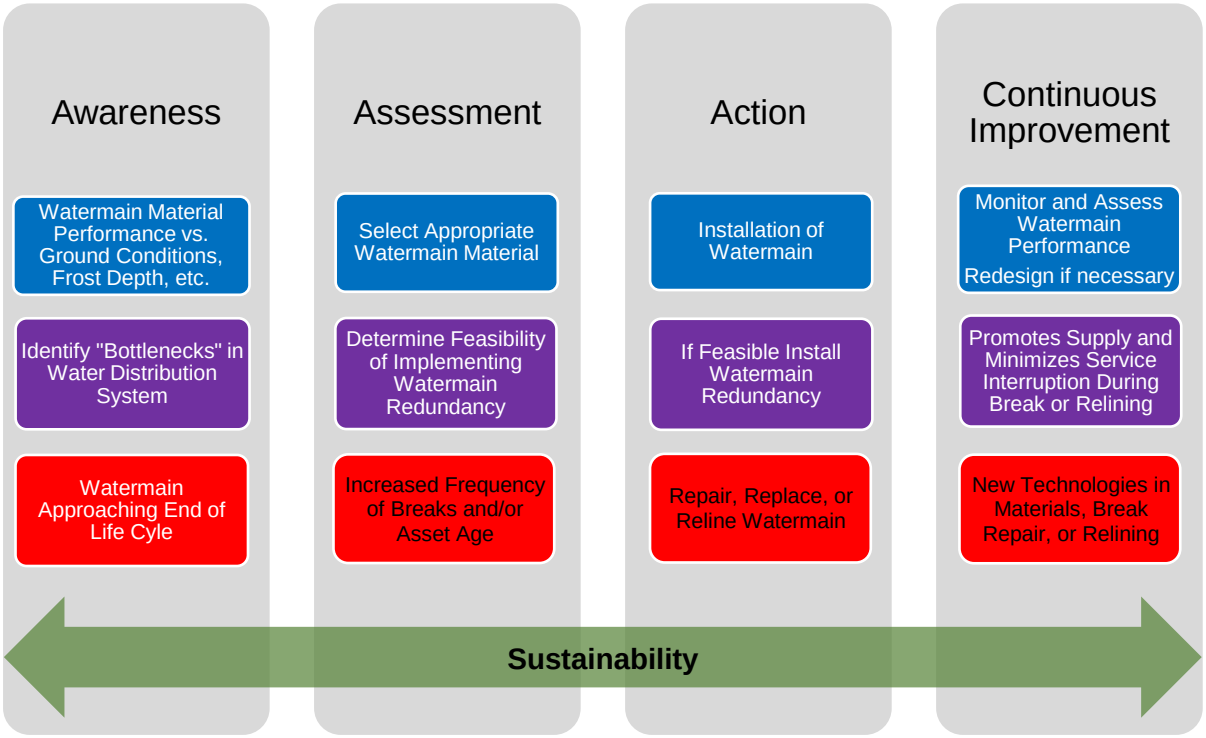

Figure 6 - Watermain Sustainability Cycle

As indicated in Figure 6 above, many factors are considered when evaluating and designing for lifecycle management regarding new or rehabilitated watermain assets. Coupling sustainability with various design expectations such as life expectancy against anticipated expenditures provides additional criteria for designing and implementing the appropriate solution. It should be noted that watermain relining and new installations are designed for a full lifespan.

Through interdivisional coordination within Public Works, Asset Management staff is able to utilize data to assess the current state of a watermain based on the failure information reported by Hamilton Water staff when repairs are completed. Through the analysis of watermain performance data, the project list, included as Appendix “C” to Report PW19060, is generated by the Asset Management Section to coordinate with other impacted city-owned assets, such as roads, bridges, wastewater and storm water, and prioritize the rehabilitation or replacement of watermains at an optimized point of their lifespan.

Another means by which Hamilton Water is using continuous improvement to ensure value for money is through its proactive leak detection program. Hamilton Water is exploring new technologies to improve the program through the application of advanced acoustic correlator technologies. These technologies have noticeable positive impacts in reducing repair and restoration costs, by identifying small leaks for repair before they turn into larger issues (e.g. large watermain breaks that result in the wash-out of road bedding, road surface failure, and damage to other utilities, etc.).

Sustainability of the City's Watermain Inventory:

Figure 7 below depicts the City's average investments in water, wastewater, and storm water infrastructure compared to the recommended municipal funding target as established by the Canadian Infrastructure Report Card (CIRC) Guidelines. Based on this guideline it can be seen that the City has historically been underinvesting in almost all of the infrastructure categories, with the exception of horizontal water infrastructure (e.g. watermains). However, the average reinvestment rates for all of these categories have been calculated for a limited historical time period, and the guidelines do not take into account what level of investment would be required to make-up for historical underinvestment in these infrastructure categories.

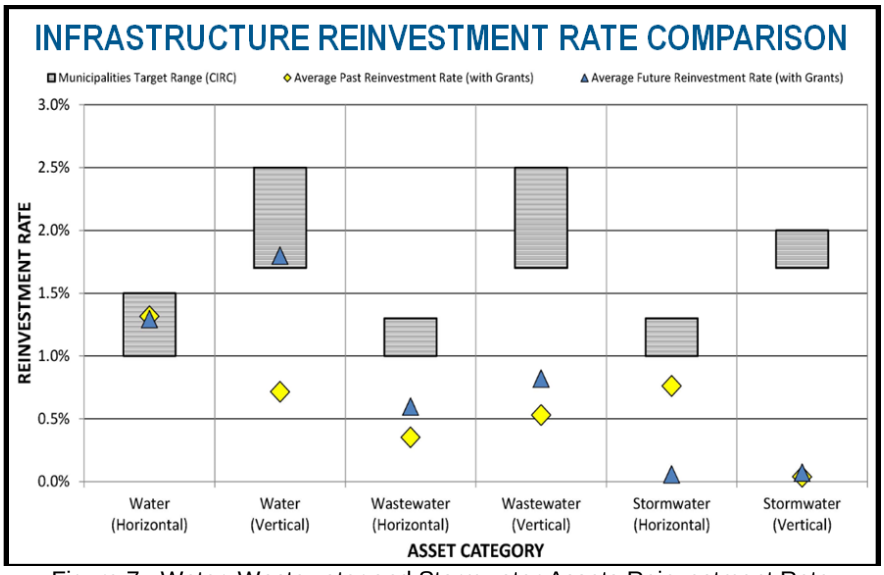

Figure 7 - Water, Wastewater and Stormwater Assets Reinvestment Rate

Continued funding support (grants) from provincial and federal partners will be relied upon as part of foreseeable future financing strategies. Through activities required for compliance with O.Reg. 588/17, levels of service, risk models and applicable funding requirements will be analysed and calibrated to Hamilton's needs through the Asset Management Plan: Phase 1. Council approval will be required for all core municipal assets, including water infrastructure, by July 1, 2021.

Conclusion:

Hamilton Water experienced 306 watermain breaks in 2018 (below the historic average of 318 watermain breaks per year), and the associated watermain repairs and surface restoration cost the City approximately $2.78M. Approximately 27% of the watermain breaks were caused by corrosion, 71% were caused by ground movement, and 2% were the result of displaced pipe joints. More watermain breaks can be expected in years with very cold and prolonged winter seasons.

The Engineering Services Division monitors and tracks the length and cost of watermains that are replaced and rehabilitated (relined). In 2018, 5.3 km of watermains were rehabilitated (relined) at a cost of $4.6M, and 5.2 km of watermains were replaced at a cost of $6.0M. The annual average for watermain rehabilitation and replacement from 2010 through 2018 is 5.5 km and 7.4 km respectively. Since 2010, 5.5% of the City's total watermain inventory has been rehabilitated or replaced.

Sustainable management of the City's watermains is currently being addressed through activities for compliance with O.Reg 588/17 (Bill 6) under the Infrastructure for Jobs and Prosperity Act. Sustainability of the City's watermain network has been previously analysed through State of the Infrastructure reporting iterations and a provincially required Asset Management Plan (AMP) completed in 2014. A by-product of the Engineering Services Division's sustainability processes is the "10-year replacement and relining window for watermains" illustrated in Appendix "C" to Report PW19060. An overall report on sustainability will be provided by the Engineering Services Division at a future Committee meeting.

This Information Report addresses Outstanding Business List Item No. AI (Annual Report on Watermain Breaks) this item can be removed from the Public Works Committee Outstanding Business List.

APPENDICES AND SCHEDULES ATTACHED

Appendix "A" - Detailed Watermain Break Cause and Cost Summary Data

Appendix "B" - Watermain Breaks vs. Ambient Temperature

Appendix "C" - Watermain Relining and Replacement Projects