



Office of the Auditor General

**Audit of Public Works and Environmental
Services Department – Frozen Services and
Hydrant Management and Maintenance**

**Tabled at Audit Committee
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Original signed by:

Auditor General

Executive summary

Purpose

The Audit of Public Works and Environmental Services Department (PWESD) – Frozen Services and Hydrant Management and Maintenance examined the efficiency and effectiveness of PWESD’s management of costs related to frozen water services. It also examined the management and maintenance of the City’s fire hydrants in support of their availability and functionality, while protecting the water supply from theft and contamination.

The Audit of Environmental Services (Part II) – Operational Review, subsequently renamed Audit of PWESD, was included in the 2017 Audit Plan of the Office of the Auditor General, approved by City Council on December 14, 2016. This audit of PWESD’s contract management activities, along with an audit of Contract Management, were completed in accordance with the 2017 Audit Plan.

Management of costs associated with frozen water services

Due to Ottawa’s cold winters, water service pipes can be exposed to periods of severe and uninterrupted cold that can cause underground water service pipes to freeze and prevent water from reaching residents and businesses. Incidents of freezing can occur on sections of pipe that are part of the City’s public drinking water system, such as City water mains, or on privately owned service pipes that are the responsibility of the property owner. Prevention of frozen services is more cost-effective for the City and for property owners than remediation following an incident.

One way to help prevent freezing incidents on City water mains is through construction activities (i.e. water main replacement and rehabilitation) whereby pipes are replaced, lowered and/or insulated by the City’s Infrastructure Services (IS) Department. Aligning construction activities to prevent frozen service has the potential to reduce the City’s overall costs. It is PWESD’s responsibility to share frozen services information with Infrastructure Services in support of this alignment.

Also, as part of its responsibility to manage costs associated with frozen services, PWESD maintains a multi-phased notification system designed to help prevent such incidents. Under this system, properties that are “at risk” of experiencing a frozen service are contacted by mail and provided with information on steps they can take to

reduce the likelihood of such an incident. Where the risk of freezing is on public property, the City covers the property owner's cost to run water¹. PWESD tracks all incidents of freezing to update their list of "at risk" properties and maintains first response capabilities whereby technicians can be deployed to provide remediation service to homeowners and businesses that have experienced a frozen service.

As frozen service incidents on City property are both costly to remediate and inconvenient for effected properties, it is important that PWESD's prevention, monitoring and remediation activities are both effective and efficient.

Management and maintenance of hydrants

The Water Distribution unit within PWESD is responsible to maintain over 22,000 fire hydrants. The accessibility and functionality of these hydrants is critical to helping ensure that Ottawa Fire Services (OFS) is equipped in the event of an emergency. There is a wide range of factors impacting functionality of a hydrant such as snow cover, accidents, improper usage, aging components, and related hydrant maintenance activities can include routine inspections and tests, repairs and other general maintenance activities (e.g. painting, thawing, snow removal, etc.). Given the OFS's reliance on functional and accessible hydrants, it is imperative that inspection and maintenance of these hydrants is both timely and completed to a high standard.

The City also maintains a Flusher Hydrant Program whereby up to 35 hydrants are designated as "flusher hydrants." Under this Program, the City issues permits to businesses requiring non-potable water for services such as street cleaning or pool filling. Unauthorized use of flusher hydrants can result in fines. Obtaining water from a flusher hydrant requires that the permit holder access and attach their equipment to the hydrant. This exposes the hydrant to the risk of damage through improper use and may expose the water supply to contaminants as the permit holder's tank may come in contact with the water supply. It is important that PWESD has effective processes to mitigate the risk of theft, improper hydrant usage and contamination associated with this Program.

¹ Even at a slow rate, moving water is less prone to freezing compared to still water.

Findings

Area 1: Frozen water services

The audit focused on assessing the following items as they relate to the management of costs associated with frozen services:

- Impact of frozen service history on water main replacement and rehabilitation;
- Timely and effective notifications to homes and businesses at risk; and
- Assessing the effectiveness and efficiency of prevention, monitoring and Remediation activities.

Key findings associated with each of these items are as follows:

1. Impact of frozen service history on water main replacement and rehabilitation

Each year, the City's Infrastructure Services (IS) Department undertakes water main replacement and rehabilitation (e.g. lowering the service, insulating the pipe, etc.). To the extent such work is planned, it is driven by an annual plan that established priorities. Priorities are based on a number of factors, with the most important factor being the age of the water main. The history of frozen water services is another factor in replacement and rehabilitation if such work can greatly reduce or eliminate the risk, and related costs, of frozen service incidents. Providing information on frozen services is the responsibility of PWESD. Moreover, it was expected that PWESD would consider the impact of water main replacement and remediation on its own frozen service prevention activities and programs.

The audit found that PWESD was providing lists of addresses identified as "at risk" of frozen services to the Asset Management Branch (AMB). While there was no formally agreed schedule for providing these lists, it was generally provided once per year upon request from AMB. Notwithstanding this sharing of information, the audit also determined that frozen service history is not a significant factor in AMB's prioritization of planned water main replacement or rehabilitation. This was confirmed by audit's review of a sample of 2018 projects, which revealed that none were identified as priorities because of their history of frozen services. Further audit testing revealed examples where water main work was completed along a street where frozen services were known to occur, yet the water main work did not extend to the "at risk" addresses. As

such, it is unclear what if any value or efficiencies are being gained, or even expected, in sharing frozen services information.

Without establishing clear expectations related to the rationale and objective of sharing frozen services information, there is a risk that opportunities to coordinate water main construction activities will be missed and result in additional costs and/or lost opportunities for efficiency.

2. Timely and effective notifications to homes and businesses at risk

Remediating a frozen services incident is costlier than preventing the incident in the first place. Moreover, when the incident occurs on sections of pipe that are part of the public drinking water system, the cost of remediation falls directly to the City. While variables such as frost depth, snow cover, and depth of existing water lines cannot be controlled, a proven way to help prevent a freezing incident is to keep the water moving by continuously running water at a slow rate. This is the premise for PWESD's *Let Water Run* program whereby owners of "at risk" addresses are notified about their risk of a freezing incident and providing them with information about how to mitigate the likelihood of such an event. This includes a request that the property owner continuously run their water as a way to reduce the likelihood of freezing. Addresses that are identified as "at risk" appear on a notification list, which is maintained by PWESD. For the winter of 2017/18, the notification list contained 2,091 addresses. Each address identifies if the risk of freezing is related to public or private water lines and at which frost depth the owner will be notified by mail. Where the risk of freezing is on public property, the City covers the property owner's cost to run water from the time of notification to April 15.

Given the opportunities for cost savings potential to avoid the disruption created by a frozen service event, the audit expected the PWESD would have effective processes and practices to ensure the timely notification of "at risk" property owners under the *Let Water Run* program. It was noted that PWESD had developed standard operating procedures that would result in notification letters being sent to property owners that were identified on a formal "notification list". However, audit examination revealed that the process and rationale for updating this notification list was neither clear nor effective. For example, there was no mechanism to ensure that an address with a history of frozen services was included on the list. Audit testing revealed examples of addresses experiencing frozen services four or more times in the last 10 years, but that were not on the list. There was also no evidence that the list was being updated to

account for addresses no longer “at risk due” to water main remediation or replacement activities undertaken by IS.

To the extent the list includes properties that may no longer be “at risk”, it represents an unnecessary water cost to either the City or the property owner. On the other hand, to the extent the list is missing properties, there is a risk of a potentially preventable frozen incident resulting in a costly remediation, to either the City or the property owner.

3. Assessing the effectiveness and efficiency of prevention, monitoring and remediation activities

The audit also expected that PWESD would demonstrate an ability to assess the effectiveness and efficiency of their frozen services prevention, monitoring and remediation activities. While information on costs related to these activities was found to exist, there was no evidence that PWESD was using this information to support cost analysis and related decision-making. For example, there was no evidence of analysis regarding the effectiveness of the *Let Water Run* water program, nor any analysis of prevention costs compared to the costs of remediating frozen services. In the absence of such analysis, there is a risk that the investment in these activities is achieving the intended results including the objective of cost-efficiency.

Area 2: Management and maintenance of City hydrants

The audit focused on assessing the following key activities:

- Management and Maintenance of Hydrants; and
- Management of the Flusher Hydrant Program.

Key findings associated with each of these key activities are as follows:

1. Management and maintenance of hydrants

The Water Distribution unit within PWESD is responsible to manage and maintain over 22,000 fire hydrants that can be accessed by Ottawa Fire Services (OFS) in the event of an emergency. The costs of hydrant management and maintenance vary from year to year, based on a number of factors including the amount of snowfall. For the four years from 2014 to 2017 inclusive, these costs were over \$11.5 million. Given the serious implications of malfunctioning or inadequate hydrants in the event of an emergency, the audit expected PWESD to have adopted formal hydrant management and maintenance

activities that were based on an appropriate standard and in compliance with applicable by-laws.

The audit identified that PWESD has adopted the American Water Works Association (AWWA) Practices for hydrant maintenance. Further, it was identified that PWESD has developed Standard Operating Procedures and formal roles and responsibilities regarding hydrant inspections and maintenance. However, it was also noted that a re-organization of PWESD in 2016 shifted accountabilities related to hydrant management and maintenance resided from a single supervisor and a dedicated hydrant group, to seven different functional groups each with its own supervisor and allocated geographic locations (known as “beats”). This shift has led to risks and concerns related to inconsistencies in the frequency of hydrant inspection activities from beat to beat across the City, as well as an overall decline in the average number of winter inspections compared to pre-2016. This concern is consistent with the December 2016 OAG Audit of the Environmental Services Department which noted that departmental units lacked effective processes to schedule and monitor activities to ensure work is completed in a timely and efficient manner.

Examination of documentation evidencing mandatory hydrant inspections revealed that such documentation was being captured and maintained only until late 2016, at which point PWESD discontinued use of the mobile devices that were used to capture and record these activities. While Water Services has indicated that re-introduction of mobile devices is under consideration, without these devices, the current paper-based approach to documentation of inspections and maintenance is not demonstrating conformance with AWWA practices and creates a potential risk scenario whereby the City cannot demonstrate inspection of a specific hydrant that is later discovered to be inoperable or deficient. This observation is consistent with the November 2017 OAG Audit of Road Services Branch, which raised concerns over missing information and errors associated with paper-based systems.

The audit also examined PWESD’s efforts to assess the effectiveness, efficiency and ongoing improvement of hydrant management and maintenance and found little evidence that PWESD was undertaking such assessments despite having access to relevant information. In fact, it was identified that management reporting, including benchmarking, was less prevalent than in prior years. In the absence of regular performance reporting and related analysis, management is not in a position to reliably assess the effectiveness and efficiency of hydrant management and maintenance.

2. Management of the Flusher Hydrant Program

Under the Flusher Hydrant Program, the City creates a list of hydrants (35 in the summer, and fewer in the winter) that are designated flusher hydrants. Permits are then issued to businesses that require non-potable water for services such as street cleaning, road construction or pool filling. Permit holders must obtain water only from designated flusher hydrants and must report each draw of water to the City for tracking and invoicing purposes within 24 hours. In addition to unreported or unauthorized access, when permit holders access and attach their equipment to a hydrant, it is exposed to damage through improper use. Moreover, the water supply could be exposed to any contaminants that may exist within the permit holder's tank. Based on these risks, the audit expected to find effective practices, supported by training, as well as clearly communicated roles, responsibilities and accountabilities applicable to permit holders and the PWESD personnel responsible to monitor and track usage under the program.

The audit identified that PWESD has assigned one employee with full-time responsibility to monitor the 35 flusher hydrants. This individual travels across the City to observe flusher hydrants and record details of permit holder's use of the hydrants. Given the volume of hydrants, their geographic distribution and the frequency of tank fills, it is not practical for one individual to observe all users of the flusher hydrants. While other PWESD personnel are routinely tasked with monitoring flusher hydrants when their other workloads permit, audit determined that records developed by these individuals were insufficient to demonstrate the effectiveness of their monitoring. Moreover, there was evidence that flusher hydrant monitoring activities do not reflect an efficient use of City resources. For example, audit testing revealed that a single flusher hydrant was identified as having 2,760.5 hours of monitoring time allocated to it during 2016 and 2017 compared to a total of 9,724.75 hours across all 35 flusher hydrants.

In terms of training, audit identified that permit holders are provided with an information package on how to operate hydrants and on program requirements, but that no training is provided to that group. This increases the likelihood that permit holders may unknowingly cause damage to a hydrant and/or expose the water supply to contaminants. A concern was also identified regarding the completeness of paper trails required to support billing when permit holders are able to leave a voice message that may be missing critical information such as company name, with their reported usage rather than submit a written form.

Finally, a significant concern was raised in connection to a formal response to a 2014 inquiry made through the City’s Fraud and Waste Hotline. The response to this inquiry included a commitment that Water Services “...would develop a business case to review various technological and business practices available to sustain water revenue and reduce water theft while not exposing the City to undue risk and liability.”² This business case was scheduled for presentation to the Environment and Climate Protection Committee and to Council in 2017 but it was deferred and has not been updated since March 2017. This business case was expected to outline long-term options for the Flusher Hydrant Program (e.g. maintaining the current system or moving to bulk water filling stations at one or more key locations) and will identify the option, which is the most cost efficient, effectively mitigates risks and provides the greatest level of service for the clients. As such, the delays in completing the business case may be delaying important strategic decisions impacting the entire Flusher Hydrant Program.

Conclusion

Overall, the audit identified evidence that PWESD had developed a number of formal and informal practices and procedures intended to support the management of costs associated with frozen services and the ongoing availability and functionality of hydrants.

In terms of frozen services, we identified efforts to share relevant information (i.e. a listing of addresses identified as being “at risk” of frozen services) with Infrastructure Services (IS) as an input to their water main replacement and rehabilitation plans. However, the audit also identified concerns regarding the integrity of this information and the value derived from sharing it with IS. The audit also noted that management did not conduct the analysis necessary to provide a view of the effectiveness or efficiency of efforts to manage the costs of frozen services.

In terms of the management and maintenance of City hydrants, we found that the City had established an effective hydrant maintenance program, which reflected appropriate standards and requirements. However, in recent years the frequency of hydrant maintenance activities has varied widely across the different regions of the City. Further, there were gaps in hydrant maintenance records and management is not conducting the analysis and reporting required to support the identification and mitigation of

² Water Services – Flusher Hydrant Program Review, Draft Version 2.1 - March 2017

problematic conditions or trends (e.g. wide discrepancies in the frequency of hydrant maintenance across the City that could increase the risk of inoperable or inaccessible hydrants).

Finally, regarding the Flusher Hydrant Program, the audit identified that PWESD had implemented some monitoring to mitigate risks related to the unauthorized or unreported use of water, improper usage of hydrants and contamination of the water system. However, we also noted concerns regarding training offered to permit holders and the sufficiency of documentation supporting the monitoring of flusher hydrants. We also identified potentially serious concerns regarding the extent to which monitoring activities reflected an efficient use of City resources. Finally, we noted that a commitment to develop a business case for Council regarding the long-term direction of the Flusher Hydrant Program had not been met resulting in the deferral of important decisions regarding the future of the program.

Potential savings

This audit identified a number of opportunities for potential savings. These include efficiencies that could be realized by improving the accuracy of “at risk” addresses included on frozen services notification list and enhancements to PWESD’s ability to assess the effectiveness and efficiency of frozen services prevention, monitoring and remediation activities. The audit also identified a need for PWESD to complete its review of the Flusher Hydrant Program that is intended to identify the strategic direction that will optimize the cost-efficiency of that Program. While such improvements would be expected to generate cost savings over time, the audit did not quantify these amounts due to lack of information.

Recommendations and responses

Recommendation #1

That the Water Services Branch collaborate with the Asset Management Branch on the frozen service information to communicate requirements and expectations.

Management response:

Management agrees with the recommendation.

PWESD and the Asset Management Branch will work together to strengthen the current information-sharing process between the two Service Areas, particularly

with respect to any capital replacement/rehabilitation work that may address prior frozen service issues on public property. This recommendation will be implemented by Q3 2019.

Recommendation #2

That PWESD formalize processes to update (add/delete) the notification lists based on relevant inputs (history of freezing incidents, First Response activities/input, AMB activities, etc.).

Management response:

Management agrees with the recommendation.

PWESD will work to review and formalize the existing process for updating the frozen service notification lists. This review will also examine and consider opportunities to remove properties from the list in instances where there has been water main replacement/rehabilitation work completed along properties with a history of frozen services on public property. This recommendation will be implemented by Q3 2019.

Recommendation #3

That PWESD develop and implement a strategy and related tools to identify, track and assess the effectiveness and efficiency of PWESD's efforts to prevent, monitor and remediate frozen services.

Management response:

Management agrees with the recommendation.

PWESD will review and make improvements (where feasible) to the existing tools and processes for monitoring the effectiveness and efficiency of its frozen services activities. PWESD will also examine the possibility of making an amendment to the *Water By-law* that would allow the City to charge property owners for non-compliance with a Let Water Run notification in instances where remediation work is required. This recommendation will be implemented by Q2 2020.

Recommendation #4

That PWESD establish, track and enforce minimum standards for hydrant winter maintenance and for completion/entry of documentation.

Management response:

Management agrees with the recommendation, and it is currently being implemented.

PWESD staff is in the process of reviewing and revising the existing hydrant winter maintenance standards.

PWESD is also working on the PWESD Mobility Project for all Service Areas. In the interim, until a mobile solution is developed and deployed for Water Services – the Service Area will work with data entry staff to establish appropriate standards for completion/entry of data, based on available resources. This recommendation will be implemented by Q3 2019.

Recommendation #5

That PWESD take action to expedite the implementation of a mobile solution for purposes of supporting effective completion and documentation of hydrant management and maintenance.

Management response:

Management agrees with the recommendation, and it is currently being implemented.

The PWESD Mobility Project deployed Samsung tablets in November 2018 to the Wastewater Collection's Linear Unit. These tablets utilize a mobile app solution to assist with work planning and scheduling activities. The tablets allow access to real-time data and information regarding our City's Wastewater Collection assets. The group has also modified their business processes to move away from a paper-based work management solution to an automated mobile solution, allowing staff to receive and manage work electronically. Once the Mobility Project Team is finished working with the Linear Unit, the Project will be expanded to Water Distribution's Hydrants Unit beginning in April 2019, with a go-live target date of November 2019. This recommendation will be implemented by Q4 2019.

Recommendation #6

That PWESD perform analysis (trends, KPIs, etc.) related to hydrant maintenance.

Management response:

Management agrees with the recommendation.

Water Services will review its Key Performance Indicators (KPIs) for hydrant maintenance with a focus on internal continuous improvement. This recommendation will be implemented by Q4 2019.

Recommendation #7

That PWESD implement a training program for permit holders and address gaps in Flusher Hydrant Program monitoring, including mandatory documentation of monitoring activities/results.

Management response:

Management agrees with the recommendation.

Water Services is currently making program changes to the Flusher Hydrant Program, which are expected to be completed by Q4 2019. Once the program changes are finalized, training materials will be developed and delivered to permit holders. This recommendation will be implemented by Q2 2020.

Recommendation #8

That PWESD take steps to complete the Flusher Hydrant Program review and provide the resulting report to Committee and Council.

Management response:

Management agrees with the recommendation, and it is currently being implemented.

PWESD is finalizing the Flusher Hydrant Program Business Case, which is expected to be complete by Q2 2019. Once completed, external consultation with industry proponents and Ottawa Fire Services may be required. In light of this, it is anticipated that a report with any proposed program changes will be brought forward to Committee and Council by Q4 2019.

Detailed audit report

Audit of Public Works and Environmental Services Department – Frozen Services and Hydrant Management and Maintenance

Introduction

The Audit of Environmental Services (Part II) – Operational Review, subsequently renamed Audit of Public Works and Environmental Services Department (PWESD), was included in the 2017 Audit Plan of the Office of the Auditor General, approved by City Council on December 14, 2016. This audit of Frozen Services and Hydrant Management and Maintenance, along with an audit of PWESD’s contract management activities, were completed in accordance with the 2017 Audit Plan.

Background and context

In July 2016, as a result of a corporate reorganization at the City of Ottawa, the Public Works Department and the Environmental Services Department were consolidated into the Public Works and Environmental Services Department (PWESD).

Under the leadership of the General Manager, PWESD is responsible for ensuring that the municipal infrastructure is properly operated and maintained. This includes overseeing drinking water production and distribution; wastewater collection and treatment; surface water management; solid waste collection, processing and disposal; roads, parks and forestry maintenance; and parking development and operations. PWESD was created to be an exclusively operational department with a focus on the delivery of front-line services.

Management of costs associated with frozen water services

Ottawa’s climate frequently experiences severe and uninterrupted cold, which can result in frost depths that cause water service pipes to freeze, preventing water from reaching the homes of impacted residents and businesses. Every property that receives water from one of the City of Ottawa’s municipal drinking water systems has water service that runs underground connecting the building’s plumbing to a City water main. Water main replacement and rehabilitation, which are the responsibility of Infrastructure Services,

can mitigate the risk to water service pipes, if for instance the pipes are lowered or insulated as a result of such activities. These have the potential to lower the costs to the City associated with their frozen water service pipe prevention and response activities. As part of its prevention activities, PWESD is responsible to maintain a multi-phased notification system which includes a list of “at risk” properties for purposes of providing the owners with information about mitigation methods and associated costs. Where the risk of freezing is on public property, the City will cover the property owner’s cost to run water³ up to April 15, or earlier if advised by the PWESD. Similarly, should a section of the pipe freeze on public property, the City will cover the associated cost of remediation. PWESD tracks all incidents of freezing to inform its list of “at risk” properties and maintains first response capabilities for remediation activities. Finally, the costs of remediating frozen pipe incidents can be significant which means that aligning construction activities (such as the replacement or rehabilitation of water mains) to address the causes of frozen pipes has the potential to cut costs for the City.

Management and maintenance of hydrants

The City of Ottawa maintains approximately 22,000 fire hydrants to ensure that Ottawa Fire Services is equipped in the event of an emergency. The Water Distribution unit within PWESD is responsible for maintaining these hydrants, which includes routinely performing inspections, undertaking repairs and other general maintenance activities (e.g. painting, thawing, etc.). Maintaining the hydrants to a given standard suitable to the uses of Ottawa Fire Services requires properly trained mobile crews and adequate tools, supplies and maintenance and life-cycle tracking. Further, there are assigned supervisors and dedicated planners who are responsible for scheduling maintenance activities and supporting efficient use of City resources. Regular environmental weathering, accidents, vandalism and improper usage can all impact a hydrant’s ability to function correctly.

Some City hydrants are also designated as “flusher hydrants.” As part of its Flusher Hydrant Program, the City of Ottawa issues permits to businesses requiring non-potable water for services such as street cleaning or pool filling. Businesses looking to use City water from flusher hydrants must obtain a permit per vehicle and report their usage. Unauthorized use of a fire hydrant can result in fines. On an annual basis, or when a business applies for a flusher permit, the City of Ottawa provides a map and a list of the

³ Even at a slow rate, moving water is less prone to freezing compared to still water.

designated flusher hydrant locations. The use of hydrants for the purpose of bulk water dispensing is located in areas of the distribution system where the steady state operating pressures are moderate and client demand warrants. Only those hydrants identified on the map are allowed to be accessed as a flusher hydrant. Flushers hydrants are identified on site by a painted blue band around the base of the hydrant, an H₂O water sign and/or a permanent marker.

Audit objectives and criteria

There were two objectives associated with this audit as follows:

Objective #1

Assess the extent to which PWESD is supporting effective and efficient management of costs associated with frozen water services through prevention, monitoring and remediation.

Criteria:

- Efficient coordination of construction activities is supported by clear roles and responsibilities as well as effective policies/procedures for sharing frozen services related information with Infrastructure Services
- An effective program to track, monitor and report on relevant statistics is in place to support the timely and effective notification of home/business owners that are at risk of frozen services
- There are mechanisms to identify, track and assess the effectiveness and efficiency of activities associated with prevention, monitoring and remediation of frozen services

Objective #2

Assess the extent to which PWESD is effectively and efficiently managing and maintaining City hydrants in support of their availability and functionality, while protecting the water supply from theft and contamination.

Criteria:

- PWESD's approach to the management and maintenance of City hydrants is based on an appropriate standard that utilizes resources efficiently, and supports compliance with by-laws, clear accountabilities and continuous improvement
- Formal policies and procedures, including clear roles/responsibilities, monitoring and training programs have been established to support the efficient use of City resources and effective hydrant maintenance activities
- Roles, responsibilities and accountabilities of relevant parties, including permit holders under the Flusher Hydrant Program, are clear, effectively communicated and supplemented with effective training
- Effective practices have been established to identify and mitigate risks associated with improper/non-compliant use of hydrants and theft due to unauthorized or unreported access

Scope

The scope of this audit focused on PWESD's responsibilities related to frozen services, and the management and maintenance of fire hydrants. In conducting the audit, frozen services history and activities for the period 2008 and 2017 were examined. Hydrant inspection and maintenance activities occurring between January 1, 2014 and December 31, 2017 were examined.

The audit fieldwork was conducted from March to June 2018

Audit approach and methodology

The audit work in this report was conducted in accordance with the OAG Audit Standards. While the OAG adopts these standards as the minimum requirement for our audits, we also draw upon the standards and practices of the Institute of Internal Auditors.

As part of our regular audit process, we obtained management's agreement with the findings in this report.

The audit methodology included the following activities:

- Interviews with staff members of:
 - Public Works and Environmental Services Department including:
 - Water Services, including the Director, and staff from the Water Distribution Inspections and Maintenance Planning section and the Water Distribution Branch; and
 - Technology, Innovation and Engineering Support, including the Director.
 - Other City departments such as Planning, Infrastructure and Economic Development (Infrastructure Renewal, Water mains); Corporate Services (Supply Services and Revenue Service Branches); and Emergency and Protective Services (Ottawa Fire Services);
- Reviews of relevant documentation such as Standard Operating Procedures, American Water Works Association Manual, maps of frozen service pipes, frozen service notices, etc.;
- Testing of records (e.g. to identify evidence of hydrant inspections, flusher hydrant monitoring, etc.);
- Analysis of data maintained within relevant information systems (e.g. Maximo® Enterprise Asset Management Software); and
- Other audit techniques as required.

Audit observations and recommendations

Area 1: Frozen water services

1. Impact of frozen service history on water main replacement and rehabilitation

Each year, the City's Infrastructure Services (IS) undertakes water main replacement and rehabilitation (e.g. a lowering the service, insulating the pipe, etc.). While some of this work is unplanned (i.e. required due to breaks that require immediate attention), IS' Asset Management Branch (AMB) also develops an annual plan that requires prioritizing this work. In developing the plan, priorities can be based on a number of factors, with the most important factor being the age of the water main. This is because age of the water main is a reliable predictor of its ongoing viability, with older water

mains generally taking precedence over newer ones. Besides age, the history of frozen water services is another factor in prioritizing water main replacement and rehabilitation. Information on frozen services is the responsibility of PWESD. It is important that the history of frozen services is considered since replacement or remediation would greatly reduce or eliminate the risk of the City incurring costs associated with frozen service incidents in the future.

Given the opportunity for cost savings associated with preventing incidents of frozen services through water main replacement or remediation, the audit expected to find that PWESD had an effective and efficient process for sharing frozen services history information with the AMB. Further, it was expected that PWESD would consider the impact of water main replacement and remediation on its own frozen service prevention activities and programs.

The audit found that PWESD's Technology, Innovation and Engineering Support (TIES) group maintains a list of addresses deemed "at-risk" to experience frozen services. This is known as the notification list. While this audit identified some concerns regarding this list, as described later in this report, audit procedures confirmed that notification lists have been provided to the AMB. While there was no formally agreed schedule for providing this list to the AMB, it was generally provided once per year upon request from the AMB.

While frozen services information is being shared with the AMB, the audit also determined that frozen service history is not a significant factor in the prioritization of planned water main replacement or rehabilitation. A water main could be attributed a maximum of two points depending upon the notification list it resided on (specifically, two points if the address is on the Private or Public 1 lists⁴, and one point if the address is on Public 2 list), which is relatively low in comparison to the weighting of other factors such as number of breaks (two points per break with no maximum), age (four points maximum if older than 80 years), and water quality issues (10 points maximum if any known issues). In reviewing a sample of water mains that the AMB had identified as having "high needs" for its 2018 construction season, the audit team noted that there were few projects identified where the water main received points related to frozen

⁴ Addresses at risk of freezing are classified according to whether the risk is on private property, or within public infrastructure and exposure at pre-determined frost depth levels (the threshold for the Public 1 list is 48 inches, and 60 inches for the Public 2 list).

services. Further, in these few instances, if these potential projects had the frozen services points removed, the impacted water main would still be considered having “high needs” (i.e. over 10 points). Further, the audit team identified examples where water main work was completed along a street where frozen services were known to occur, yet the water main work did not extend to the “at risk” addresses. The audit team also identified examples of frozen services along streets following water main rehabilitation. While PWESD does not control how AMB chooses to allocate water main priorities, it is unclear what (if any) value or efficiencies are being gained, or even expected, in sharing frozen services information. Moreover, and as further identified later in this report, there does not appear to be a clear process whereby PWESD updates its notification lists based on completion of water main replacement or rehabilitation. This means that the notification lists may continue to reflect addresses that are no longer at risk because of completed water main work.

Without establishing clear expectations related to the rationale and objective of sharing frozen services information, there is a risk that opportunities to coordinate water main construction activities will be missed and result in additional costs and/or lost opportunities for efficiency.

Recommendation #1

That the Water Services Branch collaborate with the Asset Management Branch on the frozen service information to communicate requirements and expectations.

Management response:

Management agrees with the recommendation.

PWESD and the Asset Management Branch will work together to strengthen the current information-sharing process between the two Service Areas, particularly with respect to any capital replacement/rehabilitation work that may address prior frozen service issues on public property. This recommendation will be implemented by Q3 2019.

2. Timely and effective notifications to homes and businesses at risk

The likelihood of experiencing a frozen water service is dependent upon a number of variables including the frost depth, the location, depth and composition of the water line, proximity to a catch basin, and whether the water is moving or still. Irrespective of the cause, remediating a frozen services incident involves a cost. When the incident occurs

on public property (i.e. within a water main or the City's water service pipe) the cost of the remediation falls directly to the City, while incidents on the "private" side (i.e. within the pipe on private property that connects the property to the public infrastructure) are the responsibility of the home/business owner. While some variables such as frost depth (which is dependent upon temperature), snow cover, and depth of existing water lines cannot be controlled, a proven way to help prevent a freezing incident is to keep the water moving by running it. Even at a slow rate, moving water is less prone to freezing compared to still water. In light of this proven mitigation measure, PWESD has developed a frozen water service pipe prevention program known as the "Let Water Run" program. This program involves notifying owners of "at risk" addresses about their risk of a freezing event and providing them with information about how to mitigate the likelihood of such an event. Under this program, property owners are requested to run their water to reduce the likelihood of freezing. Where the risk of freezing is on public property, the City covers the property owner cost to run water from the time of notification to April 15. Where the risk of freezing is on private property, the property owner is provided with a notification, however – they are responsible for covering the cost of running water.

Addresses that are identified as "at risk" are captured on a notification list, which is maintained by PWESD. This list is intended to be updated on an ongoing basis based on history of frozen services incidents at various frost depth levels, as well as demolition and other activities. The notification list contained 2,091 addresses for winter 2017/2018 (488 on the Private list, 101 on the Public 1 list, and 1,502 on the Public 2 list), which are classified according to freezing exposure at pre-determined frost depth levels (i.e. 48 inches for the Private and Public 1 lists, and 60 inches for the Public 2 list). Should the frost depth in Ottawa reach one of the threshold depths, the property owners on that part of the list are notified by mail that they are at risk. While not a guarantee of avoiding a frozen services incident, the Let Water Run program is designed to help prevent such incidents on both public and privately-owned water lines.

As prevention of frozen services events is more cost-effective and efficient for both the City and private property owners compared to repair/remediation after-the-fact, the audit expected that the Let Water Run program would be supported by effective processes and practices. These include tracking, monitoring and reporting of relevant statistics to support the timely and effective notification of property owners that are at risk of frozen services. Moreover, the audit expected that PWESD would have developed an effective

way to identify, track and assess the effectiveness and efficiency of activities associated with prevention, monitoring and remediation of frozen services.

The audit identified that, while there is a necessary element of judgement required when considering weather forecasts, PWESD has developed standard operating procedures to support the timely communication with at risk property owners. The notification letters sent to property owners is based on whether a property is on the “notification list”. By monitoring the City’s actual frost depth throughout the winter, PWESD determines when letters are sent (i.e. once the frost reaches near a certain depth, notification letters will be sent). Audit examination revealed that the notification list was being updated from year to year; however, the rationale for the updates was not clearly established. Specifically, PWESD did not have a clear process to assess if incidents of frozen services were being appropriately considered to help ensure all at risk addresses were on the notification list nor that addresses were classified correctly (e.g. Public 1 or Public 2). Audit interviews revealed concerns that the First Response team (i.e. the team deployed in response to notifications of frozen services) may advise a property owner to run their water, but that there was no mechanism for this to result in an update to the list. This was identified as one of the reasons for substantial fluctuations in the cost of the Let Water Run program (see Appendix A for selected statistics). As noted earlier in this report, there was also no evidence that the list was being updated for water main remediation or replacement activities. Audit testing yielded examples of addresses experiencing frozen services four or more times in the last 10 years, but that were not on the list. Auditors also noted that nearly all addresses that were removed from the list were due to demolition and not as a result of rehabilitation activities. To the extent the list includes properties that are not actually “at risk”, it represents an unnecessary water cost to either the City (if risk is on public side) or the property owner (if risk is on private side). On the other hand, to the extent the list is missing properties, there is a risk of a potentially preventable frozen incident resulting in additional costs for remediation, to either the City or the property owner.

Further, the audit noted issues regarding PWESD’s ability to assess the effectiveness or efficiency of their prevention, monitoring and remediation activities. PWESD and Revenue Service maintains information on costs (e.g. first response to a frozen incident, “Let Water Run” costs) within Maximo and SAP (see Appendix A). However, PWESD does not appear to use this information for analysis and decision-making purposes. Specifically, there was no evidence of analysis either at the micro level (e.g. statistics

regarding the number of notified property owners that actually run their water) or the macro level (e.g. comparison of prevention costs relative to the costs of remediating frozen services on public property).

Recommendation #2

That PWESD formalize processes to update (add/delete) the notification lists based on relevant inputs (history of freezing incidents, First Response activities/input, AMB activities, etc.).

Management response:

Management agrees with the recommendation.

PWESD will work to review and formalize the existing process for updating the frozen service notification lists. This review will also examine and consider opportunities to remove properties from the list in instances where there has been water main replacement/rehabilitation work completed along properties with a history of frozen services on public property. This recommendation will be implemented by Q3 2019.

Recommendation #3

That PWESD develop and implement a strategy and related tools to identify, track and assess the effectiveness and efficiency of PWESD's efforts to prevent, monitor and remediate frozen services.

Management response:

Management agrees with the recommendation.

PWESD will review and make improvements (where feasible) to the existing tools and processes for monitoring the effectiveness and efficiency of its frozen services activities. PWESD will also examine the possibility of making an amendment to the *Water By-law* that would allow the City to charge property owners for non-compliance with a Let Water Run notification in instances where remediation work is required. This recommendation will be implemented by Q2 2020.

Area 2: Management and maintenance of City hydrants

3. Management and maintenance of hydrants

The Water Distribution unit within PWESD have dedicated staff responsible for maintaining over 22,000 fire hydrants that can be accessed by Ottawa Fire Services in the event of an emergency. As there is a wide range of factors impacting functionality of a hydrant (snow cover, accidents, improper usage, aging components, etc.), it is imperative that inspection and maintenance of these hydrants is both timely and completed to a high standard. By-law 2018-167 (regulating the municipal water supply) states that flow tests on hydrants are to be conducted between April 1 and October 31 each year, or as indicated by the General Manager of PWESD.

Fire hydrant maintenance involves scheduled technical inspections, comprised of an Annual Flow Inspection and a Fall Preparation Inspection, and routine maintenance activities such as snow removal, freeze testing for hydrants identified as prone to same, and painting. The technical inspections require trained inspectors, as they help to ensure that hydrants requiring repair are properly identified so that they are capable of delivering the designated flow rate.

The costs of hydrant management and maintenance vary from year to year, based on a number of factors including the amount of snowfall. A table is provided in Appendix B.

Given the serious implications of malfunctioning or inadequate hydrants in the event of an emergency, the audit expected PWESD to have adopted formal hydrant management and maintenance activities that were based on an appropriate standard and in compliance with the by-law. Further, that there would be clear accountabilities and effective training associated with these activities.

The audit also expected to identify evidence of monitoring, reporting and analysis to support assessment of the effectiveness and efficiency of hydrant management and maintenance.

The audit identified that PWESD has adopted the American Water Works Association (AWWA) Practices for hydrant maintenance. The AWWA is a non-profit organization, founded in 1881, that is the largest organization of water supply professionals in the world, and is focused on providing standards, practices, solutions, and education for the

water and wastewater community⁵. With respect to inspection activities, the AWWA practices state:

*All hydrants should be inspected regularly, at least once a year, to ensure their satisfactory operation. In freezing climates, dry-barrel hydrants may require two inspections per year. A common technique is to perform one inspection in the fall and another in the spring. In severe freezing conditions, periodic winter inspections may also be required.*⁶

Further, PWESD has developed Standard Operating Procedures and formal roles and responsibilities regarding hydrant inspections and maintenance.

Interviews with representatives from Water Services identified that a re-organization of PWESD in 2016 resulted in changes in the accountabilities related to hydrant management and maintenance. Prior to the re-organization, responsibility resided with a single supervisor and a dedicated hydrant group. Following the re-organization, ongoing inspections, maintenance and other activities (repairs, thawing, installation, etc.) were distributed to seven functional groups (Hydrants, Inspections, Locates, Valves, CR1, CR2, and CR3) each with its own supervisor who is responsible for specific geographic sections of the city, each of which is known as a “beat”. While the audit identified the existence of formal roles and responsibilities and delivery of relevant training to all groups prior to scheduled inspections, interviews identified concerns regarding inconsistencies among the responsible groups. Specifically, the audit team learned that the priority placed on hydrant work and related capacity varied across the groups and that this has led to inconsistencies in the frequency of inspection activities from beat to beat. These concerns were confirmed by audit testing which revealed that the number of winter inspections varied drastically. Of the 200 hydrants tested, 13 were subject to between 7 to 9 inspections, 81 to between 4 and 6 inspections, 96 to between 1 and 3 inspections, and 5 hydrants were not inspected (4 hydrants were not yet installed as of 2016 and 1 hydrant was decommissioned in 2015). Further, the average number of winter inspections per hydrant within the test sample for 2016 was 3.64, which was a decrease from 2014 (when all maintenance activities resided with the Hydrant group) when the average was 5.66 inspections per hydrant. The inherent inequality associated

⁵ <https://www.awwa.org/about-us.aspx>

⁶ These standards are set out in *AWWA Manual M17 - Installation, Field Testing, and Maintenance of Fire Hydrants: Fourth Edition* (2006).

with inconsistent coverage of hydrants across the city result in a number of risks. Not only is there an increased risk that hydrants in one region of the city are less likely to be identified as non-functional or in-accessible compared to another region, there is also risk that inspection activities are not being conducted in an efficient manner (i.e. it is not clear how many inspections are actually required). This concern regarding weaknesses in hydrant inspection activities is consistent with the December 2016 OAG Audit of the Environmental Services Department which noted that departmental units lacked effective processes to schedule and monitor activities to ensure work is completed in a timely and efficient manner.

As part of this testing, the audit also assessed the extent to which documentation evidencing mandatory hydrant inspections were being captured and maintained by PWESD. The testing revealed that documentation evidencing the inspection of individual hydrants was being captured and maintained until late 2016, at which point PWESD discontinued use of the mobile devices that were used to capture and record these activities. PWESD management indicated that the handheld mobile devices were discontinued based on a number of technical difficulties and issues with using the devices in winter conditions. While Water Services has indicated that re-introduction of mobile devices is under consideration⁷, without these devices, documentation of inspections and maintenance became dependent on completing paper-based records that are then manually entered into the City's Maximo asset management software. This data entry is completed by administrative staff based on their availability and, therefore, may not be timely. Interviews also revealed concerns over inconsistent retention of paper records among supervisors. With this change, audit testing revealed that inspection records were being captured at the beat level but no longer at the hydrant level. Not only is this in contravention of AWWA practices⁸, it creates a potential risk in a scenario where the City cannot demonstrate inspection of a hydrant that is discovered to be inoperable or deficient in the event of an emergency. These gaps in records also impact management's ability to monitor and assess the effectiveness and efficiency of

⁷ Both the December 2016 OAG Audit of the Environmental Services Department and the November 2017 Audit of Road Services Branch included a recommendation that management consider implementation of mobile solutions such as Maximo Mobile.

⁸ Page 35 of the AWWA practices sets out record keeping requirements including the following "To carry out a meaningful inspection and maintenance program, it is essential to record the location, make, type, size and date of installation of each hydrant".

hydrant management and maintenance as described below. This observation is consistent with the November 2017 OAG Audit of Road Services Branch which raised concerns over missing information and errors associated with paper-based systems and included a recommendation for implementing a mobile system.

The audit examined PWESD's efforts to assess the effectiveness, efficiency and ongoing improvement of hydrant management and maintenance. This involved audit procedures to identify evidence of effective monitoring, reporting and analysis. Discussions with OFS indicated that fire hydrants were found to be functional when needed and that PWESD had taken steps to improve reporting; specifically related to notification of inoperable hydrants⁹. The audit also identified that the Maximo software offers considerable reporting functionality; however, there was little evidence that PWESD management was leveraging this functionality in support of the ongoing monitoring of hydrant management and maintenance. This observation was consistent with interview results that indicated that management reporting, including benchmarking, was less prevalent than in prior years. Interviews indicated that routine management reporting on hydrant-related metrics became more challenging since the re-organization and discontinuation of mobile devices. Further, it was noted that benchmarking was considered less valuable due to a perceived lack of comparability with other municipalities. In the absence of regular performance reporting and related analysis, management will be unable to reliably assess the effectiveness and efficiency of hydrant management and maintenance. As such, potentially problematic conditions or trends, including those indicating inconsistent hydrant coverage across the city, may not be identified and addressed in a timely manner.

Recommendation #4

That PWESD establish, track and enforce minimum standards for hydrant winter maintenance and for completion/entry of documentation.

⁹ There were 56 hydrants reported as inoperable as of February 2018.

Management response:

Management agrees with the recommendation, and it is currently being implemented.

PWESD staff is in the process of reviewing and revising the existing hydrant winter maintenance standards.

PWESD is also working on the PWESD Mobility Project for all Service Areas. In the interim, until a mobile solution is developed and deployed for Water Services – the Service Area will work with data entry staff to establish appropriate standards for completion/entry of data, based on available resources. This recommendation will be implemented by Q3 2019.

Recommendation #5

That PWESD take action to expedite the implementation of a mobile solution for purposes of supporting effective completion and documentation of hydrant management and maintenance.

Management response:

Management agrees with the recommendation, and it is currently being implemented.

The PWESD Mobility Project deployed Samsung tablets in November 2018 to the Wastewater Collection's Linear Unit. These tablets utilize a mobile app solution to assist with work planning and scheduling activities. The tablets allow access to real-time data and information regarding our City's Wastewater Collection assets. The group has also modified their business processes to move away from a paper-based work management solution to an automated mobile solution, allowing staff to receive and manage work electronically. Once the Mobility Project Team is finished working with the Linear Unit, the Project will be expanded to Water Distribution's Hydrants Unit beginning in April 2019, with a go-live target date of November 2019. This recommendation will be implemented by Q4 2019.

Recommendation #6

That PWESD perform analysis (trends, KPIs, etc.) related to hydrant maintenance.

Management response:

Management agrees with the recommendation.

Water Services will review its Key Performance Indicators (KPIs) for hydrant maintenance with a focus on internal continuous improvement. This recommendation will be implemented by Q4 2019.

4. Flusher Hydrant Program

Under the Flusher Hydrant Program, the City issues permits to businesses that require non-potable water for services such as street cleaning, road construction or pool filling. Businesses looking to use City water from flusher hydrants must obtain a permit on a per vehicle basis (e.g. a water truck or trailer with a specified capacity to haul water) and are required to report each draw of water to the City for tracking and invoicing purposes within 24 hours. Under this program, the City creates a list of hydrants (35 in the summer, and fewer in the winter) that are designated and marked as flusher hydrants¹⁰. Permit holders are required to obtain water only from designated flusher hydrants and any unauthorized use of a fire hydrant can result in fines.

Obtaining water from a flusher hydrant requires that the permit holder access and attach their equipment to the hydrant. This exposes the hydrant to damage through improper use (e.g. using incorrect tools or failure to follow required steps) and exposes the water supply insofar as any contaminants within the permit holder's tank may come in contact with the water supply.

Given the risks associated with theft, improper usage of the hydrants and contamination of the water system, the audit expected that program stakeholders are supported by clear and effectively communicated roles, responsibilities and accountabilities. This includes both permit holders and PWESD personnel responsible to monitor and track usage under the program. Further that there are effective practices, supported by training, to identify and mitigate risks associated with improper/non-compliant use of hydrants and theft due to unauthorized or unreported access.

¹⁰ By a painted blue band around the base of the hydrant/H₂O water sign and/or a permanent marker

While the audit identified that the City has no current ability to identify the quantity of unbilled water attributable to hydrants, there are activities and practices in place to prevent and detect unauthorized or improper use of hydrants. Specifically, PWESD implemented monitoring practices program that features one experienced employee who is assigned full-time responsibility to monitor the 35 flusher hydrants. This individual travels across the city to observe flusher hydrants and record detailed observations in a tracking sheet. These details include hydrant number (which corresponds to a specific location), date, time, vehicle number and other observations which are then reconciled with information submitted by the permit holder. This individual also observes the permit holder's use of the hydrant to ensure it reflects proper use and compliance with requirements (e.g. proper use of tools, backflow protection, leaving the hydrant in working order, etc.).

The audit team's review of tracking sheets and walkthrough of reconciliation processes indicate that the monitor's observations are an effective means to identify and prevent errors and to help ensure proper use of the hydrants. However, given the volume of hydrants, their geographic distribution and the frequency of tank fills, particularly at peak times such as during street sweeping season, it is not practical for one individual to observe all users of the flusher hydrants. To help increase coverage of monitoring activities, it was noted that other PWESD personnel were routinely tasked with monitoring flusher hydrants when their other workloads permit. However, examination of records indicated that details of the monitoring activities undertaken by these individuals were not being recorded in tracking sheets. In the absence of sufficient details, there is no basis to reconcile the observations of the monitor with the information submitted by the permit holders, thereby limiting the value of the monitoring activity. Moreover, a lack of detailed records increases the risk that time allocated to flusher hydrant monitoring may not be effective or reflect an efficient use of City resources. For example, audit testing revealed that a single flusher hydrant was identified as having 2,760.5 hours of monitoring time allocated to it during 2016 and 2017 compared to a total of 9,724.75 hours across all 35 flusher hydrants.

The audit identified that permit holders are provided with an information package on how to operate hydrants and on program requirements, which include mandatory usage reporting, backflow protection and location and identification of flusher hydrants. While efforts have been made to develop training materials for permit holders, no training is provided to that group. In the absence of training, there is an increased risk that permit

holders may unknowingly cause damage to a hydrant and/or expose the water supply to contaminants as a result of backflow. The audit also identified a concern related to the fact that permit holders are able to call in (and may leave a voice message) their reported usage rather than submit a formal form. This can contribute to gaps in the paper trails required to support of billing. Further, the audit interviews indicated that voicemails may not include (i.e. exclude key information such as company name, hydrant location, etc.) information required to ensure complete and accurate billing.

Finally, a review of documentation and correspondence with PWESD management also revealed a concern related to delays in finalizing a formal review initiated in response to a 2014 inquiry made through the City's Fraud and Waste Hotline. In addition to requiring that Water Services dedicate a resource to the monitoring of flusher hydrants (as described earlier in this section), the response to the inquiry included a commitment that the Environmental Services Department "...would develop a business case to review various technological and business practices available to sustain water revenue and reduce water theft while not exposing the City to undue risk and liability."¹¹

This business case was scheduled for presentation to the Environment and Climate Protection Committee and to Council in 2017 but it was deferred. At the time of our audit, the business case was in draft and not yet complete; moreover, the draft had not been updated since March 2017. This important document is intended to outline long-term options for the Flusher Hydrant Program (e.g. maintaining the current system or moving to bulk water filling stations at one or more key locations) and will identify the option, which is the most cost efficient, most effectively mitigates risks and provides the greatest level of service for the clients. As such, the delays in completing the business case may be delaying important strategic decisions impacting the entire Flusher Hydrant Program.

Recommendation #7

That PWESD implement a training program for permit holders and address gaps in Flusher Hydrant Program monitoring, including mandatory documentation of monitoring activities/results.

¹¹ Water Services – Flusher Hydrant Program Review, Draft Version 2.1 - March 2017

Management response:

Management agrees with the recommendation.

Water Services is currently making program changes to the Flusher Hydrant Program, which are expected to be completed by Q4 2019. Once the program changes are finalized, training materials will be developed and delivered to permit holders. This recommendation will be implemented by Q2 2020.

Recommendation #8

That PWESD take steps to complete the Flusher Hydrant Program review and provide the resulting report to Committee and Council.

Management response:

Management agrees with the recommendation, and it is currently being implemented.

PWESD is finalizing the Flusher Hydrant Program Business Case, which is expected to be complete by Q2 2019. Once completed, external consultation with industry proponents and Ottawa Fire Services may be required. In light of this, it is anticipated that a report with any proposed program changes will be brought forward to Committee and Council by Q4 2019.

Appendix A – Frozen services costs

The following table presents the number of incidents and costs associated with No Water/Poor Pressure (NWPP) investigations (caused by a frozen service) and Thaw Water Services (TWS) provided from 2008 to 2017. It also provided the total costs associated with responding to frozen incidents per year and average cost per incident.

Year	Number of NWPP investigations	NWPP costs	Number of frozen (TWS) incidents	TWS costs	Total frozen services costs	Average cost per incident
2008	8	\$975.05	15	\$10,057.72	\$11,032.77	\$735.52
2009	107	\$14,514.84	142	\$77,822.03	\$92,336.87	\$650.26
2010	5	\$703.52	9	\$2,645.69	\$3,349.21	\$372.13
2011	55	\$8,247.79	63	\$25,129.43	\$33,377.22	\$529.80
2012	8	\$1,335.16	10	\$5,109.78	\$6,444.95	\$644.49
2013	55	\$8,039.33	61	\$38,136.18	\$46,175.51	\$756.98
2014	110	\$10,386.93	128	\$65,539.42	\$75,926.35	\$593.17
2015	624	\$60,968.69	666	\$322,027.81	\$382,996.49	\$575.07
2016	27	\$3,599.70	35	\$14,701.39	\$18,301.09	\$522.89
2017	27	\$4,121.33	31	\$16,738.79	\$20,860.12	\$672.91
Totals	1026	\$112,892.33	1160	\$577,908.23	\$690,800.56	\$595.52

The following table presents the number of accounts affected and total costs incurred by the City associated with the Let Water Run program (as well as other associated with other select addressees advised to run water) between 2013 and 2017.

Year	Number of accounts	Total costs incurred	Average cost per account
2013	69	\$8,847.69	\$142.72
2014	1,232	\$179,678.41	\$145.84
2015	1,721	\$403,559.06	\$234.49
2016	229	\$8,997.58	\$39.29
2017	6	\$622.57	\$103.76
Totals	3,257	\$602,705.31	\$185.05

Appendix B – Hydrant maintenance costs

The following table presents the total costs associated with hydrant maintenance (by activity) between 2014 and 2017.

Maintenance activity	2014	2015	2016	2017	Totals
Fall prep	\$159,415.47	\$124,975.15	\$134,637.98	\$191,824.53	\$610,853.13
First Response - Flusher Monitoring	---	\$106,694.92	\$293,984.32	\$356,803.38	\$757,482.62
First Response - Investigation	---	\$1,961.87	\$7,521.51	\$11,471.12	\$20,954.51
Flusher Setup/ Maintenance	\$20,370.12	\$10,079.23	\$3,849.82	\$22,612.10	\$56,911.26
Full/Mini Flow and Inspection	\$384,233.73	\$398,438.08	\$210,957.45	\$184,336.90	\$1,177,966.17
Install/Relocate	\$159,033.15	\$261,903.23	\$192,274.60	\$208,297.17	\$821,508.15
Investigation/ Repair	\$856,468.50	\$697,274.43	\$869,490.95	\$1,198,848.97	\$3,622,082.86
Other	\$31,200.07	\$63,447.14	\$8,547.13	\$125,718.86	\$228,913.19
Painting	\$35,564.09	\$15,457.50	\$51,965.16	\$156,135.79	\$259,122.54
Snow Removal	\$13,117.01	\$89,681.39	\$210,630.95	\$3,483.31	\$316,912.66
Thaw/Pump	\$105,390.87	\$3,407.44	\$59,198.71	\$53,502.86	\$221,499.88
Winter Beat Inspections	\$897,497.19	\$768,220.50	\$1,433,615.47	\$337,496.03	\$3,436,829.20
Totals	\$2,662,290.20	\$2,541,540.88	\$3,476,674.05	\$2,850,531.03	\$11,531,036.15
Cost per Hydrant	\$128	\$122	\$167	\$137	---