2018 Annual and Summary Report

January 1 to December 31, 2018

Guelph Drinking Water System

Corporation of the City of Guelph

Gazer Mooney Subdivision Distribution System

Township of Guelph/Eramosa

Water Services

Environmental Services Department

Last Revision: January 28, 2019

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TTY: 519-837-5688/text 226-821-2132

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Executive Summary

The purpose of this report is to provide information to system owners and stakeholders to satisfy the regulatory requirements of the Safe Drinking Water Act (SDWA) including the Drinking Water Quality Management Standard (DWQMS); Section 81 of the Clean Water Act (CWA); and regulatory reporting required under O. Reg. 170/03 (Section 11 and Schedule 22). The report is a compilation of information that helps to demonstrate the ongoing provision of a safe, consistent supply of high quality drinking water to customers located within the City of Guelph and the Gazer Mooney Subdivision (located in the Township of Guelph/Eramosa).

Water Services is a municipally-owned and operated water utility established in 1879. The Guelph DWS is composed of water supply and treatment facilities and a water distribution system. The Guelph Drinking Water System (Guelph DWS) was a Class IV Water Distribution and Supply Subsystem and was re-classified by the MECP on December 20, 2018. The Guelph Drinking Water System is now classified as a Class II Water Treatment Subsystem and Class IV Water Distribution Subsystem. This re-classification was based on the new water treatment facility installed at Burke Well to be commissioned in the spring of 2019.

The Gazer Mooney Subdivision Distribution System (Gazer Mooney SDS) is a Class I Distribution System supplied with water from the Guelph DWS.

Both the Guelph DWS and the Gazer Mooney SDS are required to comply with the Safe Drinking Water Act (SDWA) and other regulations as well as requirements contained in Permits to Take Water (PTTW), Municipal Drinking Water Licences (MDWL), and Drinking Water Works Permits (DWWP). Having met the quality management system requirements of the SDWA, Guelph Water Services is an accredited Operating Authority with an up-to-date Operational Plan (OP). The OP is available upon request from Guelph Water Services.

Source

The source of Guelph's drinking water is a series of 21 operational groundwater wells and a shallow groundwater collector system; this system consists primarily of true groundwater sources, with some "groundwater under the direct influence of surface water with effective filtration" (GUDI-WEF) sources (Carter Well Field, Arkell 1, Arkell 15 and the Arkell Spring Grounds Collector System).

The City of Guelph has approximately 44,000 fully metered water service connections, 555 kilometres of underground watermains, and a population of approximately 135,000. The Gazer

Mooney Subdivision has approximately 72 fully metered water service connections, 2 kilometres of underground watermains, and an approximate population of 200 people.

As the Operating Authority for both the Guelph DWS and Gazer Mooney SDS, Guelph Water Services is annually inspected by the Ministry of the Environment, Conservation and Parks (MECP) for compliance with regulatory requirements. There were no known incidents of non-compliance associated with the Guelph DWS and the Gazer Mooney SDS in 2018. The 2017-2018 MECP inspection report and results are still pending. This Annual and Summary Report will be updated when the MECP inspection report is obtained from the MECP.

In 2018, Guelph Water Services reported two Adverse Water Quality Incidents (AWQIs) in the Guelph Drinking Water System – please refer to section b) Adverse Water Quality Incidents, 2018.

There were no AWQI's in the Gazer Mooney Subdivision Distribution System in 2018. In conjunction with the Wellington-Dufferin-Guelph Public Health and the MECP, all appropriate corrective actions and required reporting were completed with no health-based issues for both AQWIs.

Water Services' risk assessment updates, emergency response testing, internal and external audits help facilitate continual improvement of Water Services' processes and programs through implementation of corrective actions.

The water system is operated to meet daily, seasonal, and other operational demands (including fire demands) with various combinations of supply sources in operation at any given time. A total of 17,319,049 cubic meters (17.3 billion litres) of water was treated and pumped to the system in 2018. The average daily water demand was 47,449 cubic metres (47.4 million litres). The maximum day production of water in 2018 was 56,909 cubic metres (56.9 million litres) and occurred on July 11, 2018. The minimum day production of water in the same time period was 33,872 cubic metres (33.8 million litres) and occurred on December 26, 2018.

All water provided to the Guelph Drinking Water System and the Gazer Mooney Subdivision Distribution System was treated with sodium hypochlorite (for chlorine disinfection) with some sources also using UV treatment and two sites using sodium silicate for dissolved iron and manganese sequestering. All supplied water was continually tested and met all regulatory standards.

City of Guelph Water Services maintained the drinking water system in a fit state of repair and followed best industry practices during the repair and maintenance of the system.

Details of ongoing and emerging water quality, supply, and distribution initiatives are outlined in section i) of this report and include successful programs related to: water conservation and efficiency, Arkell Springs forest stewardship, source water protection, lead reduction and frozen services prevention and monitoring.

Water Services continues to implement:

- Recommendations of the 2016 Water Efficiency Strategy.
- Source water protection based on a MECP approved Source Water Protection Plan.
- Arkell Springs Forest Stewardship Project investments (to protect the Arkell Wellfield's source water quality).
- The Lead Reduction Plan in accordance with the regulatory relief provisions of the SDWA.
- Facility asset management and infrastructure reviews to optimize priority projects.
- A robust backflow prevention program overseeing 2,860 properties with 6,525 backflow prevention devices installed. There were no reported backflow incidents.

The City has completed this Annual & Summary Report to satisfy the regulatory requirements of the Safe Drinking Water Act, O. Reg. 170/03 (Section 11 and Schedule 22). For more information please review the online report at guelph.ca/water or contact Guelph Water Services at (519) 837-5627 or waterservices@guelph.ca.

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Purpose

The purpose of this report is to provide information to several stakeholders and to satisfy the regulatory requirements of the Safe Drinking Water Act (SDWA) including the Drinking Water Quality Management Standard (DWQMS), Clean Water Act (CWA) and regulatory reporting required under O. Reg. 170/03 (Section 11 and Schedule 22). The report is a compilation of information that helps to demonstrate the ongoing provision of a safe, consistent supply of high quality drinking water to customers located within the City of Guelph and the Gazer Mooney Subdivision (located in the Township of Guelph/Eramosa).

Scope

This Water Services Annual and Summary Report includes information from both the **Guelph Drinking Water System** and the **Gazer Mooney Subdivision Distribution System** for the period of January 1 to December 31, 2018 (unless otherwise noted). The information is required to be reported to the following:

- the Drinking Water System Owners:
    - Guelph City Council, Chief Administrative Officer (CAO) and Deputy CAO – Infrastructure, Development and Enterprise;
    - Township of Guelph Eramosa Council and CAO);
- Senior officials of Guelph Water Services and Township of Guelph/Eramosa; and
- the general public and interested stakeholders.

This report satisfies the requirements of both the Safe Drinking Water Act (SDWA) and Ontario Regulation 170/03:

Section 11, Annual Reports which includes:

- a brief description of the drinking water systems;
- a list of water treatment chemicals used;
- a summary of the most recent water test results required under O. Reg. 170/03 or an approval, Municipal Drinking Water Licence (MDWL) or order;
- a summary of adverse test results and other issues reported to the Ministry of the Environment, Conservation and Parks (MECP) including corrective actions taken;
- a description of major expenses incurred to install, repair or replace required equipment; and
- the locations where this report is available for inspection.

Schedule 22, Summary Report which includes:

- list the requirements of the Safe Drinking Water Act, the regulations, the system's approval, Drinking Water Works Permit (DWWP), MDWL, and any orders applicable to the system that were not met at any time during the period covered by the report;
- for each requirement that was not met, the duration of the failure and the measures that were taken to correct the failure;
- a summary of the quantities and flow rates of the water supplied during the period covered by the report, including monthly average and maximum daily flows; and
- a comparison of this information to the rated capacity and flow rates approved in the system's approval, DWWP and/or MDWL.

This report satisfies applicable requirements for both the Guelph Drinking Water System and the Gazer Mooney Subdivision Distribution System.

A copy of this report is available for viewing at:

- **City of Guelph Water Services**, 29 Waterworks Place, Guelph;
- **Township of Guelph/Eramosa**, 8348 Wellington Rd. 124, Rockwood; and
- **Online** at guelph.ca/water.

Any inquiries can be made to:

- City of Guelph Water Services by e-mailing waterservices@guelph.ca or by calling 519-837-5627.
- Township of Guelph/Eramosa Public Works – Water / Wastewater by e-mailing general@get.on.ca or by calling 519-856-9596.

Notice

Please note that every reasonable effort is made to ensure the accuracy of this report. This report is published with the best available information at the time of publication. In the event that errors or omissions occur, the online report will be updated. Please refer to the online version of the report for the most current version.

Please note that some hyperlinks in the document are linked to Guelph's electronic document management system (EDMS). Note: EDMS is available for internal use only.

Systems Overview

Guelph Drinking Water System

The City of Guelph is committed to providing consumers with a safe, consistent supply of high quality drinking water while meeting or exceeding, and continually improving on legal, operational and quality management system requirements. Therefore, Water Services strives to provide reliable, cost-effective systems for the safe production and delivery of consistently high quality water and is a municipally-owned and operated water utility, established in 1879.

The Guelph Drinking Water System was a Class IV Water Distribution and Supply Subsystem. The Guelph Drinking Water System was re-classified by the MECP on December 20, 2018. This re-classification is based on the new water treatment facility installed at Burke Well to be commissioned in the spring of 2019. The Guelph Drinking Water System is now classified as a Class II Water Treatment and Class IV Water Distribution Subsystem.

All necessary licences have been obtained by staff to operate the newly reclassified Guelph Drinking Water System. As of December 31, 2018 thirty-seven team members (28 operators, 1 manager, 4 supervisors, and 4 technical staff) held drinking water certificates to operate and maintain the water systems.

In 2018, Water Services maintained full scope accreditation to the Drinking Water Quality Management Standard (DWQMS) Version 2.0 after a successful on-site audit, conducted by the third-party accreditation body - NSF International Strategic Registrations. This full accreditation satisfies part of the requirements under the Municipal Drinking Water Licensing Program.

The distribution system (including watermains, valves, fire hydrants, services, and meters) serves a population of approximately 135,000 within the City of Guelph. All new system components meet NSF 61[1] requirements or approved equivalents and are installed and maintained in accordance with approved industry standards. Water system customers are fully metered and billed in accordance with the Water and Wastewater Customer Accounts by-law.

The Guelph Drinking Water System distribution system is comprised of the following infrastructure:

- 6.38 kilometres of 900-1,050 mm diameter water supply aqueduct;
- five underground storage reservoirs with a combined approximate capacity of 48,000 cubic metres (48 million litres);

[1] NSF/ANSI Standard 61: Drinking Water System Components -- Health Effects

- three water towers with a combined approximate capacity of 11,200 cubic metres (11.2 million litres);
- 556.7 kilometres of buried watermain with a diameter < 900 mm;
- 4,245 watermain valves;
- 2,798 fire hydrants; and
- approximately 44,000 water services and water meters.

The source of Guelph's drinking water is a series of 21 operational groundwater wells and a shallow groundwater collector system. The drinking water sources consist primarily of true groundwater, with some "groundwater under the direct influence of surface water with effective filtration" (GUDI-WEF) sources. The GUDI-WEF sources include: Carter Well 1 and 2; Arkell 1; Arkell 15; and the Arkell Springs Collector System.

The Guelph Drinking Water System uses 12 per cent Sodium Hypochlorite (that is NSF 60[2] certified) for primary disinfection for the following 10 sources:

- Downey Well
- Burke Well
- Park Well 1 and 2
- Emma Well
- Dean Well
- University Well
- Queensdale Well
- Helmar Well
- Calico Well

12 per cent Sodium Hypochlorite along with ultraviolet light treatment is used as part of a multi-barrier primary disinfection for the following 11 sources:

- Arkell Wells 1, 6, 7, 8, 14 and 15
- Arkell Springs Collector System
- Carter Wells 1 and 2
- Membro Well
- Water Street Well

12 per cent Sodium Hypochlorite along with NSF 60-certified Sodium Silicate (used for aesthetic purposes to sequester dissolved iron and manganese) is used at the following two locations:

- Helmar Well

[2] NSF/ANSI Standard 60: Drinking Water Treatment Chemicals - Health Effects

- Queensdale Well

In total, Water Services operates and maintains 31 facilities.

The replacement cost of the entire system (excluding Gazer Mooney Subdivision Distribution System) is estimated to be $615.5 million or approximately $4,663 per capita (2017). The Guelph Drinking Water System operations are funded directly from the sale of water, with minor additional funding through government grant programs. Property taxes are not used to fund operation, maintenance or capital renewal of the system.

A total of 17,319,049 cubic meters (17.3 billion litres) of water was treated and pumped to the system in 2018. The average daily water demand was 47,449 cubic metres (47.4 million litres). The maximum day production of water in 2018 was 56,909 cubic metres (56.9 million litres) and occurred on July 11, 2018. The minimum day production of water in the same time period was 33,872 cubic metres (33.8 million litres) and occurred on December 26, 2018.

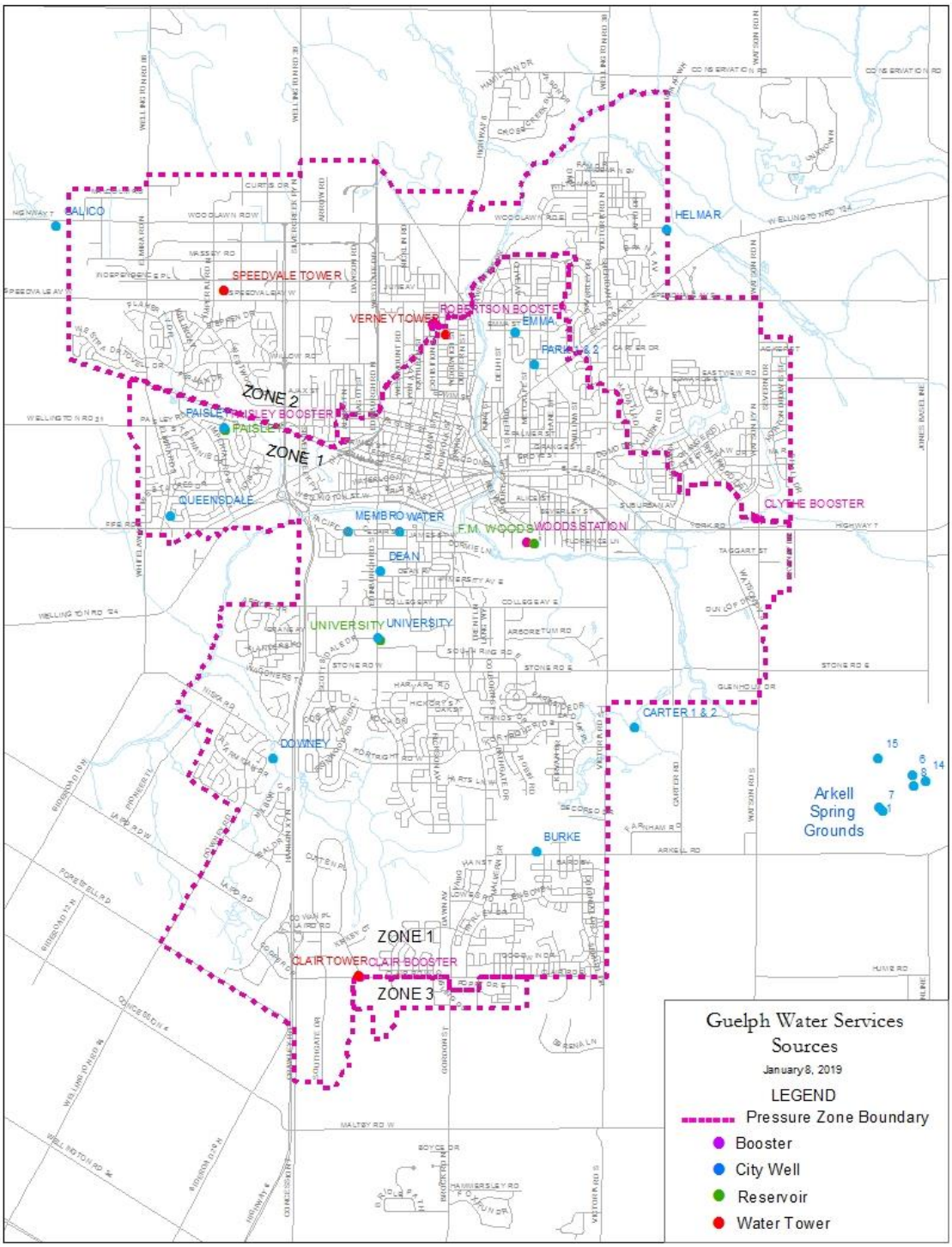
In 2018, all regulatory microbiological and chemical quality samples were taken by certified operators and tests on water samples collected throughout the drinking water system were performed by accredited, licensed laboratories. These tests include both regulatory and operational testing – in most cases only regulatory reporting is included in this report. In all cases, the drinking water supplied to all customers was confirmed safe and the water was of higher quality than all Ontario and Canadian health-related guidelines.

The Guelph Drinking Water System is defined as a large residential system operated under the regulatory requirements of the Safe Drinking Water Act and the Ontario Water Resources Act (accessed at Ontario e-laws). In 2018, the Guelph Drinking Water System operated under Municipal Drinking Water Licence (MDWL) 017-101 (Issue number 11) and the Drinking Water Works Permit (DWWP) 017-201 (Issue number 7).

The MDWL and the DWWP describe system-specific requirements that are supplementary to provincial regulations and act as licences for water supply and distribution operations. These documents outline specific conditions and requirements regarding operation, maintenance and upgrades that are required by the system and are considered regulatory in nature. These documents are available by request for viewing at 29 Waterworks Place, Guelph, ON.

Figure 1: Guelph Drinking Water System shows the locations of the Guelph Drinking Water System facilities that were active in 2018.

Figure 1: Guelph Drinking Water System



Gazer Mooney Subdivision Distribution System

The Gazer Mooney Subdivision Distribution System is a Class 1 Distribution Subsystem that serves approximately 200 people, and is owned by the Township of Guelph/Eramosa. The system is operated by Guelph Water Services through a legal agreement that was last signed by representatives of the City of Guelph and the Township of Guelph/Eramosa on July 30, 2009. The terms of the agreement apply until May 31, 2019. The agreement is currently being updated and will be presented to Council for approval in March 2019.

All of the water for the Gazer Mooney Subdivision Distribution System is supplied from the Guelph Drinking Water System. All water is treated to provincial standards in the Guelph Drinking Water System and no further treatment chemicals are added to the Gazer Mooney Subdivision Distribution System.

All new distribution infrastructure components meet NSF 61 requirements or approved equivalents and are installed and maintained in accordance with approved industry standards. The system is fully metered.

The Gazer Mooney Subdivision Distribution System is comprised of the following infrastructure:

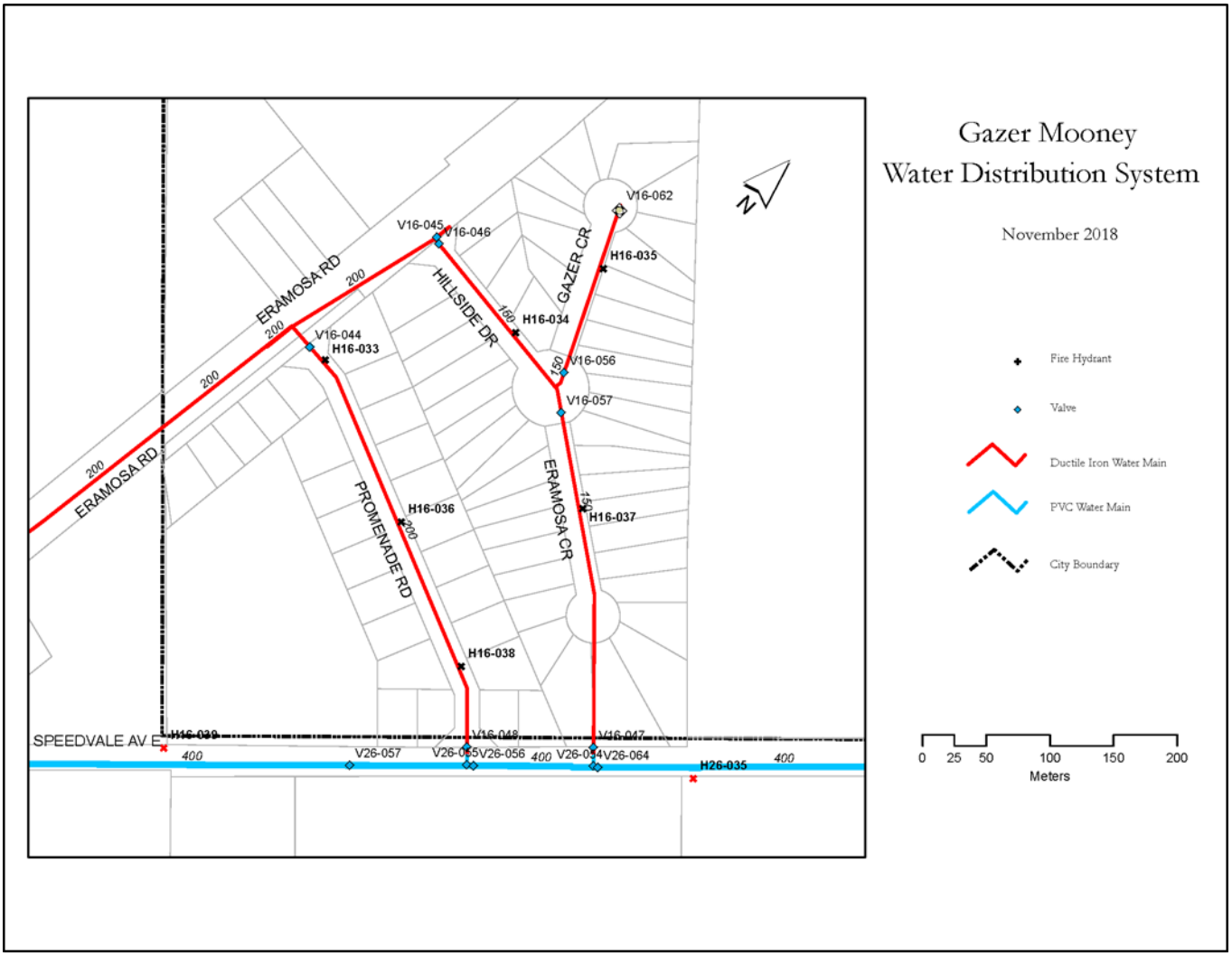
- approximately two kilometres of buried watermain with a diameter < 900 mm;
- six watermain valves;
- six fire hydrants; and
- approximately 72 water services and water meters.
- The cost of construction of the Gazer Mooney Subdivision Distribution System was listed as $197,933 in 1980.

The Gazer Mooney Subdivision Distribution System is considered a small residential system and is operated under the regulatory requirements of the Safe Drinking Water Act and the Ontario Water Resources Act which may be found at Ontario e-laws.

In 2018, the Gazer Mooney Subdivision Distribution System operated under Municipal Drinking Water Licence No. 104-103 (issue number 2), and Drinking Water Works Permit No. 104-203 (issue number 2). These documents are available by request for viewing at 29 Waterworks Place, Guelph and at the Township of Guelph/Eramosa, 8348 Wellington Rd. 124, Rockwood.

Figure 2: Gazer Mooney Water Distribution System shows the location of the Gazer Mooney Subdivision Distribution System.

Figure 2: Gazer Mooney Water Distribution System



Water Services' Annual and Summary Report

a) Incidents of Regulatory Non-Compliance

This section describes all incidents of non-compliance.

Guelph Drinking Water System

There were no incidents of non-compliance associated with the Guelph Drinking Water System in 2018.

A score of 100% was achieved in the 2016-2017 Ministry of the Environment, Conservation and Parks Annual Inspection Report for the Guelph Drinking Water System. The results of the 2017-2018 Annual Inspection Report are pending.

Gazer Mooney Subdivision Distribution System

There were no incidents of non-compliance associated with the Gazer Mooney Subdivision Distribution System in 2018.

A score of 100% was achieved in the 2016-2017 Ministry of the Environment, Conservation and Parks Annual Inspection Report for the Guelph Drinking Water System. The results of the 2017-2018 Annual Inspection Report are pending.

b) Adverse Water Quality Incidents

This section describes all Adverse Water Quality Incidents (AWQI's). This term refers to any unusual test result from treated water that does not meet a provincial water quality standard, or a situation where disinfection of the water may be compromised. An adverse water quality incident indicates that on at least one occasion and at a certain instance in time, a water quality standard was not met. On average, the Guelph Drinking Water System processes four to five AWQI's annually.

Many AWQI's have proven to be the result of water sampling and testing problems rather than poor water quality. False positive results can be caused by: contaminated sampling containers and equipment; improper sampling technique; handling and transportation; and sampling analysis errors. In all AWQI's in 2018, mandatory follow-up sampling was done and analysis confirmed that contaminants were not present in the water provided to customers.

Please note: The City was granted regulatory relief from Schedule 15.1 of O. Reg. 170/03 in favour of a Guelph specific Lead Reduction Plan (LRP). Residential sample results collected under the LRP that have lead concentrations above 10 µg/L, are tracked and reported to Wellington-Dufferin-Guelph Public Health, the Ministry of the Environment, Conservation and Parks (as per MDWL 017-101, Schedule D) and the customer. See Section i) for more information on the Lead Reduction Plan.

Guelph Drinking Water System

In 2018, there were two adverse water quality incidents (AWQI's #141299, and #141494) and a summary of these are as follows.

Adverse Water Quality Incidents, 2018

Number 1

- July 31, Adverse Water Quality Incidents 141299 at Waterloo Sample Station (D0248) Total Coliform (TC) result of 2 at D0248
- Corrective Action - Wellington-Dufferin-Guelph Public Health (WDGPH), MECP, and Spills Action Centre (SAC) were notified. Re-samples showed non-detect results for Total Coliforms (TC) at D0248 plus upstream and downstream locations (S051 and D218 respectively).
- Re-sample Results Good – Yes
- Deviation from Critical Control Point[3] - No

Number 2

- August 08, Adverse Water Quality Incidents 141494 at Orin Reid Sample Station (D0250) Total Coliform (TC) result of 1 at D0250
- Corrective Action - Wellington-Dufferin-Guelph Public Health (WDGPH), MECP, and Spills Action Centre (SAC) were notified. Re-sample showed non-detect results for Total Coliforms (TC) at D0250 plus upstream and downstream locations (S051 and D0282 respectively).
- Re-sample Results Good – Yes
- Deviation from Critical Control Point[3] – No

[3] Please see Section c) **Error! Reference source not found.** of this report for a description of "critical control points".

Gazer Mooney Subdivision Distribution System

There were no adverse water quality incidents in the Gazer Mooney Subdivision Distribution System in 2018.

c) Deviations from Critical Control Point (CCP) Limits and Response Actions

Any deviations from the CCPs are reported to both the Owners and Top Management, and are summarized in Section b) Adverse Water Quality Incidents in this report. There were no deviations from the Critical Control Points in 2018.

A critical control point in the drinking water system is where control can be applied to prevent or eliminate a drinking water hazard, or to reduce it to an acceptable level. Water Services has identified three Critical Control Points (CCP) in the drinking water system:

1. Multi-Barrier Primary Disinfection - To remove or inactivate pathogens potentially present in the source water.
2. Secondary Disinfection Secondary Disinfection - To ensure the maintenance of a disinfectant residual throughout the distribution system.
3. Backflow Prevention - To prevent cross-contamination that can result from the flowing back of or reversal of the normal direction of flow of water.

Additional information (e.g. critical control limits and response actions) is included in Appendix A: Summary of Critical Control Points and Critical Control Limits.

d) The Effectiveness of the Risk Assessment Process

This section confirms the occurrence of reviews of the risk assessment process. The risk assessment process determines the effectiveness of identifying and appropriately assessing the risk of hazards and hazardous events to the drinking water system. It also identifies the appropriate control measures; critical control points (CCPs); and related critical control limits (CCLs) related to the hazards and hazardous events. A description of the CCPs and CCLs are included in Appendix A: Summary of Critical Control Points and Critical Control Limits.

The annual risk assessment review was conducted by Water Services over several meetings between September 14 and September 25, 2018. The updated risk assessment outcomes was subsequently approved at a Management Review Meeting on October 17, 2018. The results of

the Risk Assessment are not made available to the public, but are made available to internal staff and the Guelph DWS Owners.

Through the risk assessment process, the following Water Services program or process aspects were added:

- Insufficient fuel supply during a power outage
- Isolation of a private watermain break on private property
- District Metered Areas (DMAs)
- Frozen water services
- Inaccurate infrastructure locates

The following Water Services program or process aspects were removed:

- Water Meter Inaccuracy

e) Internal and Third-Party Audit Results

Internal auditing and third-party auditing is performed to fulfill the mandatory requirements of the Drinking Water Quality Management Standard (DWQMS). The internal audit is completed using trained internal Water Services staff as auditors. The purpose of audits are to evaluate the level of conformance of Water Services to the DWQMS. Audits identify both conformance and non-conformance with the Standard, as well as, opportunities for improvement. Appendix B: Summary of Internal and External Audit Plans includes the past two years' internal and external audit plans and the plan for the upcoming year.

2018 Internal Audit

The internal audit was completed between May 28 to June 1, 2018 and looked at 27 processes at Water Services. Many strengths were identified during the internal audit, including a sense of pride, ownership and commitment to the DWQMS and processes outlined in the Operational Plan. Participating staff at all levels are knowledgeable and aware of their duties as it relates to providing safe drinking water to the water consumers.

Three minor non-conformities were identified during these internal audits. Two of the minor non-conformances relate to Document and Records Control (DWQMS 5) and one minor non-conformance related to Sampling, Testing and Monitoring (DWQMS 16). Water Services staff have worked to correct these non-conformances by improving on processes and procedures.

Various opportunities for improvement (such as improved document and records control, training, communications, essential services, staffing levels, risk assessments, and standard

operating procedure creation) were also noted in the internal audit report. Water Services strives to promptly address issues identified in internal audits as part of continuous improvement of its procedures and processes. The next scheduled internal audit will take place between April 1 and April 5, 2019.

2018 External Audit

The third-party external on-site audit was completed between November 7 and November 9, 2018 by NSF International Strategic Registrations and looked at 25 processes at Water Services. There were no nonconformities identified during this audit and accreditation to DWQMS version 2.0 was achieved. The auditor noted that there continues to be strong evidence of ongoing commitment to the DWQMS at Water Services. There were numerous system strengths observed during the audit including:

- Leadership of staff
- DWQMS documentation
- Culture of continual improvement
- Internal communication and participation
- External communication
- Risk assessment processes
- Internal audit processes
- Emergency planning/testing processes
- Document management system (EDMS)
- Freeze prevention program
- Asset management program (Engineering
- Overall staff competencies

Noted opportunities for improvement by the auditor were related to improving the following processes:

- Document and Records Control (DWQMS 5)
- Risk Assessment Outcomes (DWQMS 8)
- Essential Supplies and Services (DWQMS 13)
- Management Review (DWQMS 20)

Water Services maintains a culture of continual improvement and works towards implementing improvements suggested by the external auditor. The opportunities for improvement will be reviewed by the external auditor at the next on-site audit, scheduled between November 6 and 8, 2019.

f) Results of Emergency Response Testing

Emergency response testing is regularly completed as part of the Water Services' Quality Management System (QMS) to ensure that Water Services maintains a reasonable readiness to deal with emergencies and abnormal events. The ability to properly manage emergencies and unplanned failures is critical in demonstrating that Water Services has taken a diligent approach in its operations.

Water Services' last emergency test exercise involved a mock scenario where a large watermain break occurred on an easement, which resulted in low pressure throughout the distribution system, low water storage levels and a subsequent backflow event. The emergency test exercise was held on November 23, 2018 and included representatives from the Ministry of the Environment, Conservation and Parks (Inspector and District Office Manager) and representatives from Wellington-Dufferin-Guelph Public Health (WDGPH) as well as Water Services and other City staff. All other Water Services' staff participated in sessions that took place between November 28 and 30, 2018.

Feedback from emergency testing and from actual events is gathered during debriefing sessions throughout the emergency test exercises and improvement items are incorporated into the Emergency Plan, standard operating procedures and/or daily operations.

Table 1 includes the dates of Completed Emergency Response Tests for the past three years and planned tests for 2019.

Table 1: Emergency Response Tests

Hazardous Event / Hazard[4]	2016	2017	2018	2019
Long-term impacts of climate change	Summer (drought)	Dec. 8, 13 (2017 test)	Jan. 26 (2017 test)	
Source water supply shortfall	Dec. 13 (2016 test)	Jan. 20 (2016 test)		Planned test
Extreme weather events (e.g. tornado, ice storm, flood)	Mar. 23-25, 2016 (ice storm)	Dec. 8, 13 (2017 test)	Jan. 26 (2017 test)	

[4] The Hazardous Event / Hazard list reflects the MECP's mandated "Potential Hazardous Events for Municipal Residential Drinking Water Systems to Consider in the Risk Assessment" document.

Hazardous Event / Hazard[4]	2016	2017	2018	2019
Sustained extreme temperatures (e.g. heat wave, deep freeze)		Dec. 8, 13 (2017 test)	Jan. 26 (2017 test)	
Chemical spill impacting source water				Planned test
Sustained pressure loss	Jan. 7 (2016 test)		Nov. 23, 28-30 (2018 test)	
Backflow / Cross-connection			Nov. 23, 28-30 (2018 test)	
Terrorist threat				Planned test
Vandalism				
Sudden changes to raw water characteristics (e.g. turbidity, pH)	Improvements: Membro Well / Carter Wells	Dec. 8, 13 (2017 test)	Jan. 26 (2017 test)	Planned test
Failure of equipment or process associated with primary disinfection (e.g. UV, chlorination)				
Failure of equipment or process associated with secondary disinfection (e.g. chlorination)				
Loss or contamination of treated water supply	Jan. 7 (2016 test)		Nov. 23, 28-30 (2018 test)	
Loss of monitoring system	Jan. 14, 2016 (fibre network failure)			

g) Operational Performance and Statistics

The following section describes Operational performance statistics within Water Services that includes:

- 2018 Totalized Pumpages as per the Municipal Drinking Water Licence and Permits to Take Water;
- 2018 Instantaneous Flows as per Permit to Take Water requirements;
- Water Production and Population;
- 2018 Collector Flows;
- Water Supply Capacity; and
- System Maintenance and Updates.

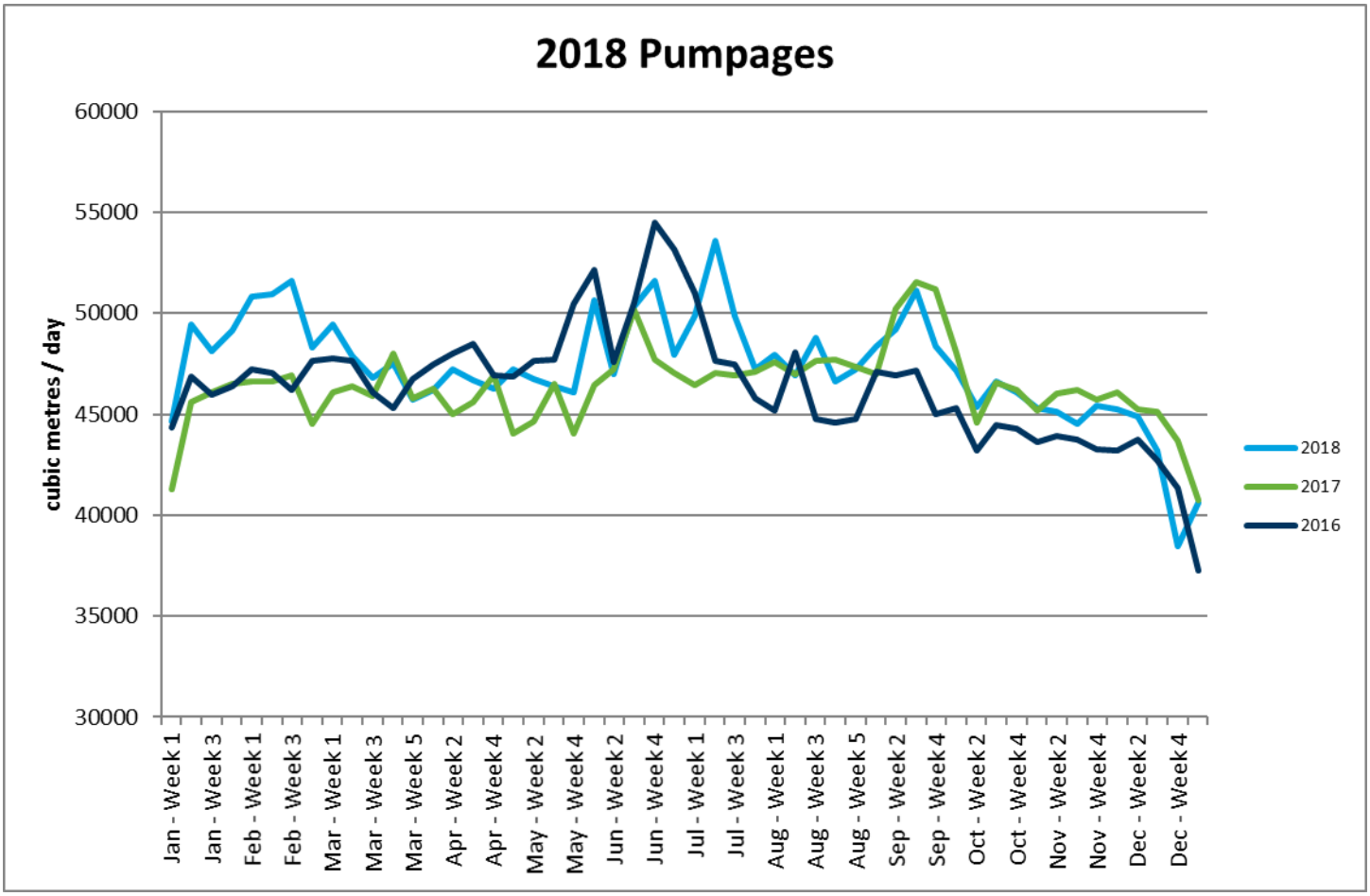
2018 Totalized Pumpages and Instantaneous Flows

The Safe Drinking Water Act and the Ontario Water Resources Act each require that operating authorities record and report both water takings as governed by Permits-to-Take-Water, and water being supplied to the City of Guelph.

Summaries of total water pumped, instantaneous flows and capacity (flows and volumes compared to rated capacities) by the City of Guelph can be found in Appendix C: Total Water Pumped and Instantaneous Flows.

Figure 3 below, depicts the water pumpage rate in cubic metres per day (m^3/day) that is averaged each week.

Figure 3: Totalized Pumpages, 2018



Water Services processed 17,319,049 cubic metres (17.3 billion litres) of water to the distribution system in 2018, equivalent to 6,928 Olympic-sized swimming pools. This represents 2.3 per cent more water being supplied to the distribution system in 2018 as compared to the same time period in 2017 and 2.5 per cent more water than in 2016.

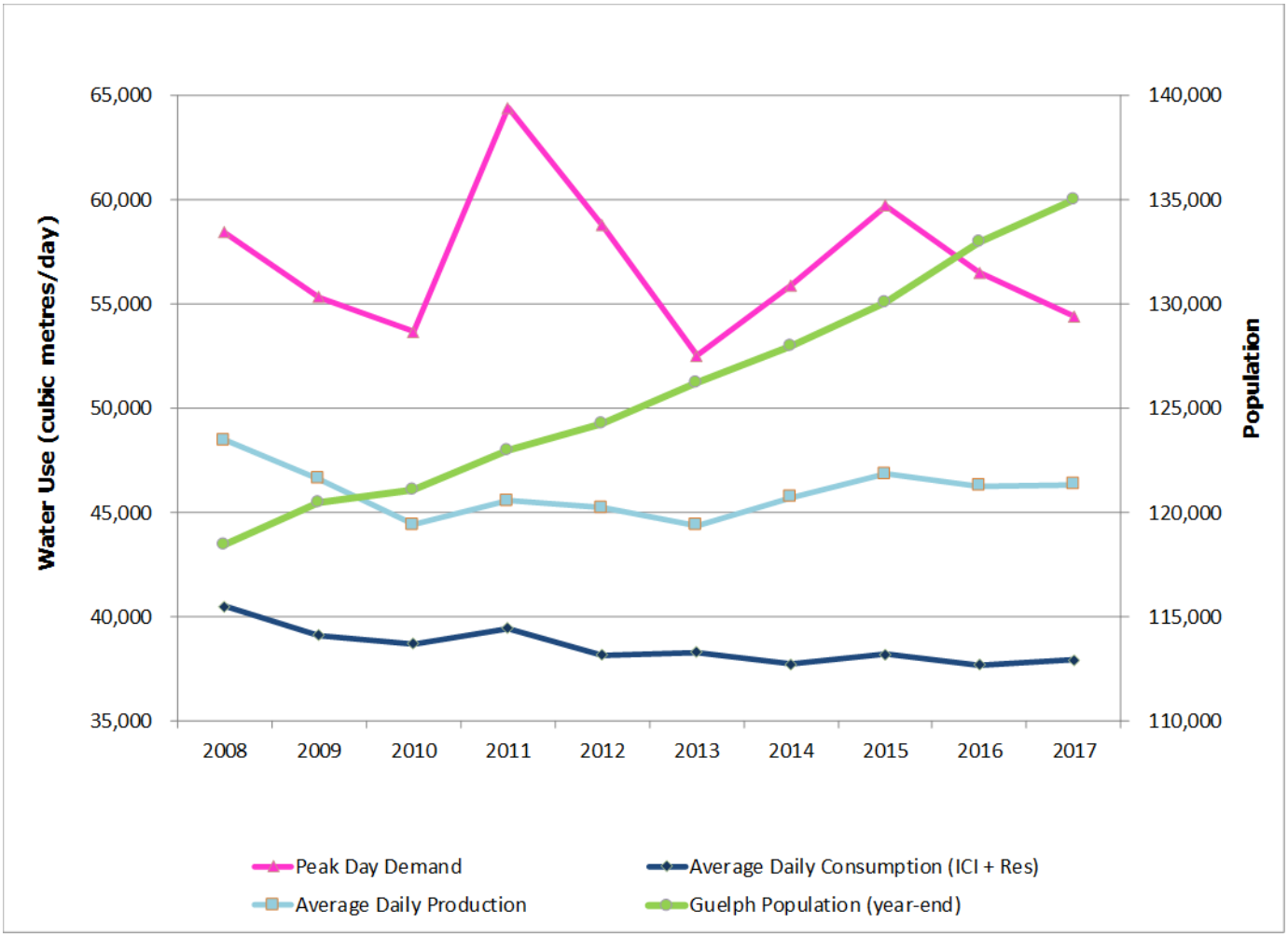
The average daily water demand was 47,449 cubic metres (47.4 million litres). The maximum day production of water in 2018 was 56,909 cubic metres (56.9 million litres) and occurred on July 11, 2018. The minimum day production of water in the same time period was 33,872 cubic metres (33.9 million litres) and occurred on December 26, 2018.

Water Production, Consumption and Population

Figure 4 below shows the City of Guelph's annual average daily water production, annual average daily consumption, annual peak day demand, and population from 2008 to 2017. The

City of Guelph's total population increased 14 per cent from 2008 to 2017 (1,807 people per year based on a linear regression model with a correlation coefficient of R2=0.9843). During the same timeframe average daily water consumption decreased 6 per cent (85,924m3 per year based on a linear regression model with a correlation coefficient of R2=0.73).

Figure 4: Guelph Water Production, Water Consumption, Population



Arkell Springs Collector System Source Water

The Arkell Springs Collector System (Collectors), one of Guelph's many water sources, consists of a gravity-fed, under-drain system that collects shallow overburden groundwater. This system has been in use since the early 1900's and can represent as much as 40 per cent of the total city-wide daily water production when in operation. When the output of this source is reduced, Water Services is required to make up the difference from other water supplies. Throughout the

year, the production from this water supply varies from an approximate low of 4,000 cubic metres (4 million litres) up to an approximate high of 20,000 cubic metres (20 million litres) per day.

Seasonally, between April 15 and November 15, the City has a Permit-to-Take-Water that allows water to be pumped from the Eramosa River to a pond and trench-based Recharge System. In the Recharge System, the river water enters the trench where it filters through the ground and is later captured in the Arkell Springs Collector System.

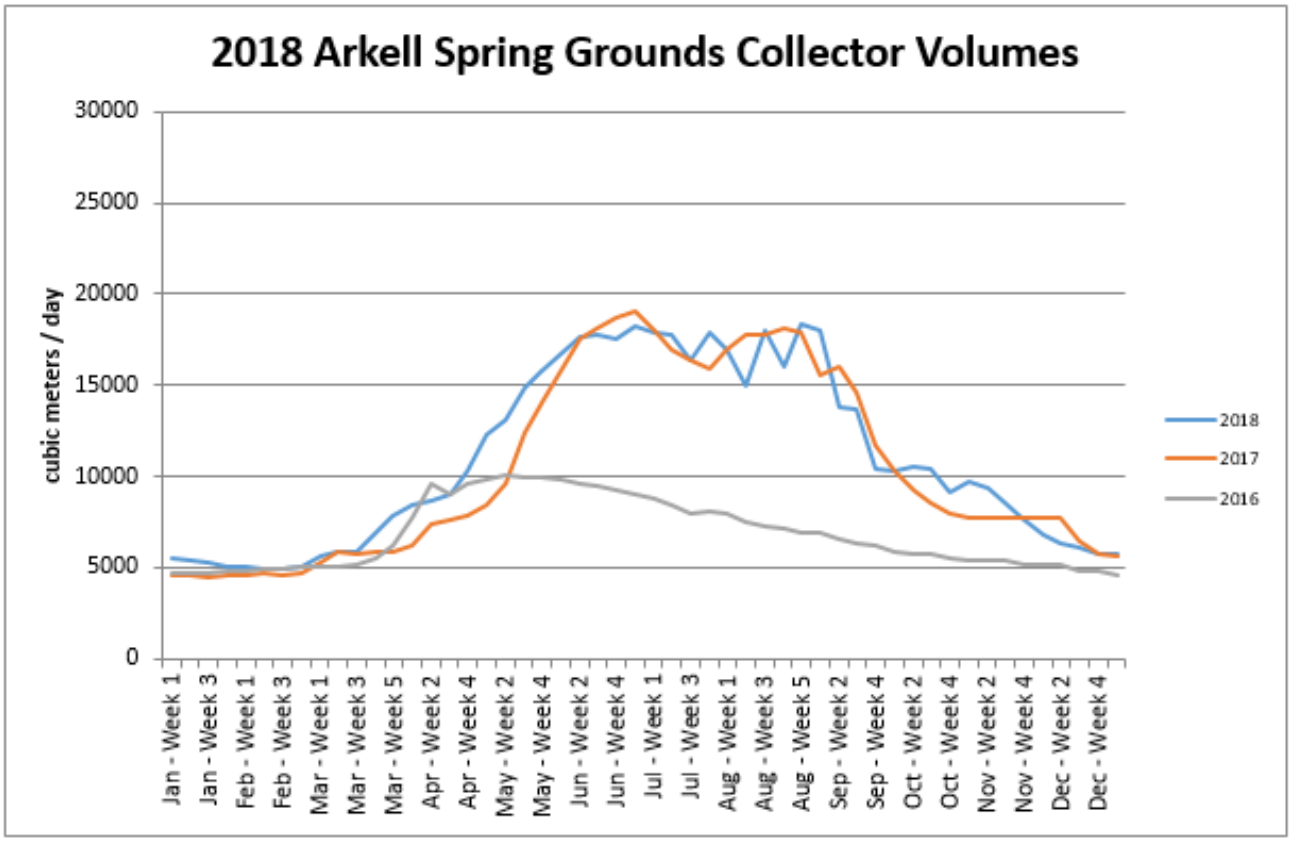
In 2016, the Recharge System was out of service to accommodate infrastructure improvements including an extension of the trench system in an effort to capture more water in the Collectors. The Recharge System was returned to service in May 2017 and tested during 2017 and 2018 to determine the impact of the extended trench on the Collector flows. In 2018, 1,368,766 m3 of raw water was pumped from the Eramosa River (from April through November) and 1,119,787 m3 of raw water was pumped from Arkell Well 7 (from March through September) to the Recharge System as part of a Collector System capacity test. Recent modelling showed that approximately 52 per cent of this volume was captured in the Collector system.

The productivity of the Collectors can be used as one of many predictive tools. If the production volume from the Collectors is low, then it can be assumed that other water supplies would be needed to make up the difference. This may alter how regular maintenance is performed as well as the urgency with which repairs are made to supplies that unexpectedly go off-line as they may be needed to supplement overall production for the City when the Collector System is unable to produce a sufficient supply.

The Collectors have produced 4,016,633 cubic metres (4.0 billion litres) of water in 2018, which is approximately 23 per cent of Guelph's total water production. This represents 5.4 per cent more water as compared to the same time period in 2017 and 38.4 per cent more water than in 2016.

For a visual representation, please refer to **Error! Reference source not found.**, which depicts the Arkell Spring Grounds Collector flow volumes in cubic metres per day (m^3/day) that is averaged each week.

Figure 5: 2018 Arkell Spring Grounds Collector System Volumes



Please note: Arkell Well 7 contributed 1,119,787 m^3 to the Recharge System (from March through September 2018) with approximately half (560,000 m3) captured in the Collector flow post filtration through the ground. The Collector flow was not augmented by the addition of recharge water from the Eramosa River in 2016.

Water Supply Capacity

Pumping stations are typically rated on their firm capacity, which is defined by the Ministry of Environment, Conservation and Parks (MECP) Design Guidelines for the Design of Drinking Water Distribution Systems (2008) by the following criteria:

- Capacity of the pumping station with the largest unit out of service if the station supplies a pressure zone with adequate storage available for fire protection and balancing;
- Capacity of the pumping station with the two largest units out of service if the pumping station serves a pressure zone that does not have adequate floating storage available and is the sole source of supply in the area.

This approach however, does not address the "system" firm capacity. Neither is it directly applicable to a groundwater system with many sources. Firm Capacity assessment of a water supply system is essentially an exercise in risk assessment, such that a municipality will incorporate measures or strategies to minimize the risk of certain aspects of the system being off-line, and will accept a level of risk that a portion of the system will not be available due to maintenance, water quality issues or other.

A proposed approach to more accurately reflect system conditions for the City considers equipment reliability (i.e. assumptions for per cent wells or pumps inoperable) and also potential future contamination issues. This will also take into consideration wells that are presently shut down for water quality reasons and whether it would be acceptable to bring these sources back online in emergency conditions.

Historically, City staff have assessed a safe, sustainable yield of existing groundwater supplies through hydrogeological assessments conducted mainly through quadrant studies, subsequent pumping tests and operational data. The groundwater flow model has also been used to confirm sustainable capacity, however both of these methods reflect permitted capacities, either takings allowed in the Permit to Take Water (PTTW) or those included in Environmental Certificates of Approval (ECA) for each well or pumping station.

In order to more accurately address the questions of system firm capacity, Water Services staff annually review the operational water demand data for water supply facilities under maximum demands. Values used for permitted pumping rate and firm capacity calculations by well are provided in Table 2. The permitted pumping rate is the rate of pumping allowed as identified in the Permits to Take Water. The firm capacity rate is the actual rate of pumping that can be achieved at each well.

Table 2: Permitted Rates and Point of Entry Firm Capacities of Water Supply Wells

Well Name	Permitted Rate (m^3/day)	Permitted Rate (L/s)	Point of Entry Production (m^3/day)	Point of Entry Production (L/s)
Arkell 1	**3,273**	**37.9**	**1,640**	**19.0**
Arkell Springs Wellfield[5]	**28,800**	**333.3**	**28,800**	**333.3**
Burke	**6,546**	**75.8**	**5,790**	**67.0**
Carter 1 and Carter 2	**7,855**	**75.8**	**5,184**	**60.0**
Membro	**6,050**	**70.0**	**3,200**	**37.0**
Water St.	**3,400**	**39.4**	**2,500**	**28.9**
Dean	**2,300**	**26.6**	**1,500**	**17.4**
University	**3,300**	**38.2**	**2,400**	**27.8**
Downey	**5,237**	**60.6**	**5,000**	**57.9**
Park 1 and Park 2	**10,300**	**119.2**	**9,500**	**110.0**
Emma	**3,100**	**35.9**	**2,330**	**27.0**
Helmar	**3,273**	**37.9**	**1,300**	**15.0**
Paisley	**3,200**	**37.0**	**1,300**	**15.0**
Calico	**5,237**	**60.6**	**1,040**	**12.0**
Queensdale	**5,237**	**60.6**	**1,210**	**14.0**

Water Services staff use the calculated firm capacity values in order to aid planning of scheduled shutdowns and maintenance of the water supply wells. Staff hold monthly meetings to review project statuses that affect firm capacity. At the meetings there are discussions related to the progress of maintenance and upgrade operations. The purpose of the monthly meeting is to

[5] The Arkell Springs Wellfield consists of five (5) municipal drinking water production wells: Arkell 6, Arkell 7, Arkell 8, Arkell 14 and Arkell 15. All of the aforementioned Arkell Wells are contained within the same Permit to Take Water (No. 5061-9ZKKWV).

ensure adequate servicing capacity is available to meet the City's water demands while maintenance and capital upgrades are undertaken to maintain the system in a fit state of repair.

System Maintenance and Updates

The table that follow summarize Water Services' maintenance work – for Distribution (Table 3) and for Water Supply below.

Table 3: Distribution Maintenance Activity

Job Type	2016 Total	2017 Total	2018 Q1&2	2018 Q3&4	2018 Total
Acoustic Leak – Dry	**4**	**1**	0	0	**0**
Blow Off Install	**0**	**0**	0	0	**0**
Dig to find leak	**2**	**0**	0	0	**0**
Hi/Low Jumper Install	**0**	**0**	0	0	**0**
Hydrant Install (WW)	**0**	**0**	0	0	**0**
Hydrant Remove	**1**	**0**	0	0	**0**
Hydrant Repair	**30**	**35**	2	4	**6**
Hydrant Repair Hit	**1**	**2**	3	4	**7**
Hydrant Replace (WW)	**8**	**2**	1	1	**2**
Hydrant Replace Hit	**0**	**2**	1	0	**1**
Main Break	**53**	**47**	45	27	**72**
Other (e.g. exploratory excavations, miscellaneous repairs, etc.)	**3**	**2**	11	0	**11**
Re-route Watermain	**0**	**0**	0	0	**0**
Sample Station Install	**1**	**17**	0	1	**1**
Sample Station Replace	**4**	**10**	0	0	**0**
Service Cut Off	**5**	**3**	2	3	**5**

Job Type	2016 Total	2017 Total	2018 Q1&2	2018 Q3&4	2018 Total
Service Lowered	**0**	**0**	0	0	**0**
Service New Install	**0**	**0**	2	0	**2**
Service Repair	**144**	**91**	34	65	**99**
Service Replace	**16**	**7**	4	7	**11**
Trench Repair	**1**	**0**	0	0	**0**
Valve Install (WW)	**0**	**1**	0	4	**4**
Valve Remove	**0**	**0**	0	0	**0**
Valve Repair	**8**	**7**	1	6	**7**
Valve Replace (WW)	**8**	**22**	15	10	**25**
Meters New	**613**	**487**	139	176	**315**
Meters Exchanged	**532**	**712**	315	635	**950**
Total City Hydrants	**2,763**	**2,783**	-	-	**2,798**
Total City Main Valves	**4,184**	**4263**	-	-	**4,245**
Total Watermains Excluding Aqueduct (km)	**550.8**	**555.4**	-	-	**556.7**
Watermains Cleaned (km)	**231.4**	**150.65**	-	-	**225**
Watermains Re-lined (m)	**0**	**171**	-	-	**0**

The following includes Water Supply-related maintenance activities and expenditures (may include programs that have a series of projects).

Water Supply Maintenance Activity

Maintenance Activity	Location
Asset inventory and Condition Assessments	Various Sites
Below Grade Well Inspections	Helmar, Clythe, Calico, Arkell 14, Burke and Edinburgh
Chlorine analyzer installation	Speedvale Tower, Gazer Mooney and Clair Tower
Electrical and Instrumentation Upgrades	Various Sites
Facility Ambient Temperature Monitoring	Various Sites
Facility Repairs and Maintenance	Various Sites
Fencing and Security Upgrades	Arkell, Logan, Clythe (New property)
Hypo system upgrades	Paisley, Clythe, Queensdale and Dean
Process and Monitoring Equipment Upgrades	Various Sites
Process Piping Upgrades	Calico Well, Helmar Well and F.M. Woods
Refurbishment of Elevated Tank	Verney
Standby Power Generator Installation	Arkell Well 14
Well Pump Discharge Pressure Transmitters	Various Sites
Well Rehabilitations	Helmar, Clythe and Burke

SCADA System Improvements

The Supervisory Control and Data Acquisitions (SCADA) system is the computerized control system that monitors and automatically controls the pumps, valves, water towers and online instrumentation at the 24 water facilities located throughout the City and 7 water facilities located in the Arkell Springs well field.

The SCADA system also performs the vital role of monitoring/logging process data to ensure regulatory compliance, and providing tools to the Operations team that enables them to run the City’s water system in a consistent manner. Furthermore, the SCADA system is also configured

to automatically shut down facilities and/or notify an on-call operator in the case of abnormal process conditions. The SCADA system also monitors the security systems at all water facilities.

In 2018, SCADA system uptime was over 99.95 per cent, due to SCADA network upgrades that were undertaken in 2017 to add redundant auto-failover backup SCADA network links to all facilities.

Upgrades to the SCADA system in 2018 were focused around updating SCADA system programming standards, modernizing control system programming, and updating backup systems. In addition to incremental updates, all-new SCADA code and screens were deployed at 5 facilities in conjunction with capital projects.

The information below, provides a summary of improvements to SCADA and Security undertaken in 2018.

SCADA / Security Maintenance & Improvement Activities	Location(s)
Additional Operator interface terminal displays and SCADA view nodes	Various Sites
Additional SCADA data-logging redundancy (with secondary data-loggers)	Various Sites
Enhancements to security system monitoring	All Sites
Equipment layout drawings updates	All Sites
New Automated Electricity Usage Reports	All Sites
New Computerized Bulk Water Truck-Fill terminal	Clair Tower
New Facility Monitoring PLCs deployed	Various sites
Process flow diagrams and piping & instrumentation diagrams (P&ID's) update	All Sites
SCADA backup server upgrades	Various sites
SCADA Input / Output Lists and standardized connection diagram updates	Various Sites
SCADA programming standards updates	All Sites

SCADA software code updates (multi-year program)	Various sites
Security systems upgrades	All Sites
Updates to Process Control Narratives (PCN's) that document SCADA programming	Various Sites

Form 1s and Form 2s

Form 1s and 2s are required by the MECP to document significant changes to the drinking water system. Engineering Services staff complete the Form 1 – Record of Watermains Authorized as a Future Alteration and retain copies in applicable project files. Water Services staff complete the Form 2- Record of Minor Modification or Replacements to the Drinking Water System and are retained by the Water Compliance Specialist.

Below is a summary of Form 1's and Form 2's completed over the course of 2018.

Form Type	Total Number of Completed Forms
Form 1 – Record of Watermains Authorized as a Future Alteration	4
Form 2 – Record of Minor Modification or Replacements to the Drinking Water System	17

Water Distribution Locates

In 2014, The City of Guelph registered its utility infrastructure with ON1Call, as mandated by the Ontario Underground Infrastructure Notification System Act, 2012.

Since registering, the City experienced a significant increase in locate request volumes. This increase in volume ensures that Water Services is notified of and attends all locate requests for every excavation in proximity to water infrastructure. This prevents damage to City infrastructure and protects the City's water quality and quantity.

In order to provide efficient locate services across the corporation, the City has transitioned all infrastructure locates into one corporate group which is housed at Water Services. This includes water, sanitary and storm sewers, traffic signals, and fibre optics. Utility locators now locate all infrastructure in one site visit rather than each department individually. Table 4 includes all

water locate requests received and responded to in 2018 with a year to year comparison below in Table 5.

Table 4: Water Distribution Locates Requested and Responded to in 2018

Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
243	207	446	1,082	1,328	1,069	898	947	772	675	423	193

Table 5: Historical Locate Requests Received

Year	Total
2018	8,275
2017	8,622
2016	7,979
2015	9,255
2014	8,943

h) Raw and Treated Water Quality and Drinking Water Quality Trends

Guelph Drinking Water System

This section describes the water quality monitoring, both regulatory and operational, that has been completed in 2018.

Water Quality Review – Guelph Drinking Water System

Under the Safe Drinking Water Act, municipalities are required to monitor both the raw and treated quality of the source water supplied. This monitoring is performed for both regulatory compliance and due diligence and is expected to identify any changes within the treated water, as well as, in raw source waters.

A note about all tables included in this section

1. All regulated chemicals detected in the City of Guelph's treated water sources that are above the lab's MDL (minimum detection limit) are underlined indicating a hyperlink to an

Excel Workbook in Guelph's electronic document management system (EDMS). The workbook contains a definition of the parameter and an Excel worksheet for each treated source where the parameter has been detected with values for all sample results from January 1, 2007 to December 31, 2018. This database is used to closely track the instances of the identified chemical parameters and therefore provide time for planning and budgeting if treatment or an alternative supply is eventually required due to the presence of a given parameter. The database is updated annually.

2. Tabulated data is from the best available information at the time of table creation.
3. If sampling for a particular schedule's parameters (e.g. Schedule 23 and 24) did not occur within the calendar year of the report, then the most recent values are included in the report for reference.
4. All acronyms and initials included in tables are described in Appendix L: Glossary.
5. Please note that some hyperlinks in the tables are linked to Guelph's electronic document management system (EDMS). Note: EDMS is available for internal use only.

The following section summarizes daily (January 1 to December 31, 2018) Distribution free chlorine residual test results required by O. Reg. 170/03 Schedule 7-2 where secondary disinfection is provided. The Clair Tower sample point is used to represent the water quality provided by the Zone One distribution system pressure; the Speedvale Tower sample point represents the water quality in Zone Two and the chlorine analyzer at Clair Booster Station monitors the water quality in Zone 3 for the purposes of the regulation.

Please note that the City of Guelph takes additional operational daily Distribution samples and tests for free chlorine residual in order to better monitor the free residual in the Distribution System and respond accordingly. There was no instance of an adverse result in 2018 associated with these sampling sites, as presented in Table 6.

Table 6: O. Reg. 170/03 Schedule 7-2, City of Guelph - Distribution Manual Free Chlorine Residual Summary, 2018

Parameter	ODWQS Criteria	Total Analyses	Total Samples above Detection Limit	Total Outside ODWQS Criteria	Range (mg/L)
Free Chlorine Residual – Zone One	0.05 – 4.0	365	365	0	0.67 – 1.20
Free Chlorine Residual – Zone Two	0.05 – 4.0	52	365	0	0.53 – 1.08

Parameter	ODWQS Criteria	Total Analyses	Total Samples above Detection Limit	Total Outside ODWQS Criteria	Range (mg/L)
Free Chlorine Residual – Zone Three	0.05 – 4.0	SCADA[6]	n/a	0	0.54 – 1.26

Table 7 below summarizes raw bacteriological sampling and test results required by O. Reg. 170/03 Schedule 10-4 including investigative re-sampling for the period of January 1 to December 31, 2018. There were a total of 949 raw samples taken and 2,847 raw analyses conducted.

Table 7: O. Reg. 170/03 Schedule 10-4, City of Guelph - Raw Bacteriological Sampling Summary, 2018

Parameter	ODWQS Criteria	Total Analyses	Total Outside ODWQS Criteria	Range (cfu/100 mL)
Raw - E. coli	n/a	949	n/a	0 - 2
Raw - Total Coliform	n/a	949	n/a	0 - 53
Raw - Background	n/a	949	n/a	0 – 610

Table 8 summarizes treated bacteriological sampling and test results required by O. Reg. 170/03 Schedule 10-3 and 6-3 including investigative re-sampling for 2018.

- Number of POE[7] samples taken: 552
- Number of POE analyses: 2,748
- Number of Distribution samples taken: 1,534
- Number of Distribution analyses: 7,693

[6] Through the SCADA system, data is taken from an online chlorine analyzer and values are recorded electronically every thirty seconds.

[7] Point of Entry - the point at or near which treated water enters the distribution system.

Table 8: O. Reg. 170/03 Schedule 10-2, 10-3 and 6-3, City of Guelph - Treated Bacteriological Sampling Summary, 2018

Parameter	ODWQS Criteria	Total Analyses	Total Outside ODWQS Criteria	Range	Units
POE - E. coli	0	552	0	0	cfu /100 mL
POE - Total Coliform	0	552	0	0	cfu /100 mL
POE – HPC	n/a	551	n/a	0 – 68	cfu /mL
POE – Background	n/a	552	n/a	0 – 30	cfu /100 mL
POE – Free Chlorine Residual	0.05 - 4.0	541[8]	0	0.50 – 1.48	mg/L
Distribution - E. coli	0	1,534	0	0	cfu /100 mL
Distribution - Total Coliform	0	1,534	2[9]	0 – 2	cfu /100 mL
Distribution – HPC	n/a	695	n/a	0 – 91	cfu /mL
Distribution – Background	n/a	1,534	n/a	0 – 980	cfu /100 mL
Distribution – Free Chlorine Residual	0.05 - 4.0	2,395	0	0.26 – 1.67	mg/L

Table 9 summarizes raw source turbidity sampling and test results required by O. Reg. 170/03 Schedule 7-3 for the period of January 1 to December 31, 2018. Schedule 7-3 requires monthly raw source turbidity sampling, but the City of Guelph samples all raw sources and tests for turbidity on a weekly basis to better monitor this aspect of raw water quality.

[8] Total number of samples used specifically to satisfy the requirements of O. Reg. 170/03 Schedule 10-3 and 6-3 (Treated Source samples taken for Operational purposes are not included).

[9] Reported as AWQI ##141299, and #141494

Table 9: O. Reg. 170/03 Schedule 7-3, City of Guelph - Raw Source Turbidity Sampling Summary, 2018

Parameter	ODWQS Criteria	Total Analyses	Total Samples above Detection Limit	Total Outside ODWQS Criteria	Range (ntu)
Raw Source Turbidity	n/a	1001	1001	n/a	0.01– 0.67

Table 10 summarizes raw source Ultraviolet Transmittance (UVT) sampling and test results required by the City's Municipal Drinking Water Licence (MDWL), where UV for primary disinfection is used for the period of January 1 to December 31, 2018. The MDWL requires a UVT test to be conducted and recorded on a weekly sampling schedule.

Table 10: O. Reg. 170/03 Schedule 7-3, City of Guelph - Raw Ultraviolet Transmittance Sampling Summary, 2018

Parameter	MDWL Criteria (% UVT)	Total Analyses	Total Samples above Detection Limit	Total Outside MDWL Criteria	Range (% UVT)
Raw UVT F.M. Woods Station	93.5	SCADA[10]	n/a	0	93.5 - 99.8
Raw UVT Emma Well	90.0	38	38	0	91.8 – 100.0
Raw UVT Membro Well	90.0	22	22	0	89.8 – 100.0
Raw UVT Water St. Well	87.0	39	39	0	91.0 – 96.8

[10] Through the SCADA system, data is taken from an UVT analyzer and values are recorded electronically every thirty seconds.

Microparticulate and Laser Particle Counting Sampling

As a part of the Guelph Drinking Water System's Municipal Drinking Water Licence, Guelph Water Services is required, twice annually, to assess the Arkell Collector System which is characterized as groundwater under the influence of surface water with effective in situ filtration (GUDI-WEF). The purpose of the assessment is to ensure that the source continues to meet the GUDI-WEF source water characteristics as outlined by the MECP. Sampling was performed on this water source in the spring and fall of 2018. The source continues to meet the GUDI-WEF source water characteristics.

Treated Water Quality Statistics – Guelph Drinking Water System

O. Reg. 170/03 Schedule 6-5 - Continuous Monitoring Results Summary

Water Services utilizes over twenty regulatory and operational continuous monitoring devices to measure water quality. Each regulatory device has controls associated with it such that in the event that the device detects that a measured value is outside the acceptable parameters for that location, the device causes an alarm to be sent to an Operator for immediate response (24 hours per day, seven days per week) and either automatically shuts down the station or activates a second alarm for immediate Operator response.

Both the minimum allowable levels (if applicable) and the target values for Water Services regulatory continuous monitoring devices are listed in Table 11. The target values represent a safety margin to ensure that regulatory requirements are satisfied at all times. Please note that, continuous monitoring values all fell within acceptable regulatory standards in 2018.

Table 11: O. Reg. 170/03 Schedule 6-5, Continuous Monitoring Results Summary, 2018

Parameter	ODWQS or Regulatory Minimum	Target Range	Units
Point of Entry Free Chlorine Residual	0.05 mg/L	Greater than 0.4	mg/L
UV Dose F.M. Woods Station	24 mJ/cm^2	Greater than 40	mJ/cm^2

Parameter	ODWQS or Regulatory Minimum	Target Range	Units
UV Dose Emma and Water St. Wells	40 mJ/cm^2	Greater than 45	mJ/cm^2
UV Dose Membro Well	20 mJ/cm^2	Greater than 40	mJ/cm^2

O. Reg. 170/03 Schedule 13-6 and 13-7, "Three Month" Sampling Results Summary

In 2018, all operational Treated Sources were sampled and analyzed for Schedule 13-6, 13-16.1 and 13-7 parameters as per O. Reg. 170/03.

Regulation 170/03, Schedule 13-6 requires a minimum of one distribution sample taken from the Distribution System where THM's (trihalomethanes) are most likely to develop (locations with high retention times). Water Services uses the Speedvale, Clair and Verney Elevated Tanks for this purpose in the Guelph Drinking Water System. The Maximum Allowable Concentration (MAC) for THM's is 0.1 mg/L. However, for this parameter, the MAC uses a running annual average of quarterly samples.

The results of the running annual average value for THMs for all related Distribution System samples in each quarter of 2018 (Jan. 01 to Dec. 31) is below the half of the maximum allowable concentration (½ MAC): Q1 = 0.033 mg/L; Q2 = 0.030 mg/L; Q3 = 0.027 mg/L and Q4 = 0.025 mg/L.

Regulation 170/03, Schedule 13-6.1 requires a minimum of one distribution sample taken from the Distribution System where HAAs (haloacetic acids) are most likely to develop. Water Services uses Woods Sample Station, Ptarmigan Sample Station, Clair Tower Sample Tap and Edinburgh South Sample Station for this purpose in the Guelph Drinking Water System. The Maximum Allowable Concentration (MAC) for HAAs is 0.08 mg/L. However, for this parameter, the MAC uses a running annual average of quarterly samples.

The results of the running annual average value for HAAs for all related Distribution System samples in each quarter of 2018 (Jan. 01 to Dec. 31) is below the half of the maximum allowable concentration (½ MAC): Q1 = 0.024 mg/L; Q2 = 0.025 mg/L; Q3 = 0.021 mg/L and Q4 = 0.020 mg/L.

All operational Treated Sources were sampled and analyzed for Nitrates and Nitrites as per Regulation 170/03, Schedule 13-7. There was no instance of an adverse result in 2018. Raw sampling results are also presented in Table 12.

Table 12: O. Reg. 170/03 Schedule 13-6 and 13-7, City of Guelph – "Three Month" Sampling Results Summary, 2018

Parameter	ODWQS MAC	½ MAC	Total Samples	Samples Above MDL	Total Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average[11] (mg/L)
Trihalomethanes	0.100[12]	n/a	15	15	0	0.0135	0.0417	0.0258
Haloacetic Acids	0.08[10]	n/a	16	1	0	< 0.05	.020	0.020
Nitrate + Nitrite (as nitrogen)	10	5	41	29	0	< 0.10	1.92	0.70
Nitrate + Nitrite (as nitrogen) – Woods' Raw Sources (Operational Sampling)	n/a	n/a	35	35	n/a	0.30	3.63	1.28

[11] This is the average of values above the lab detection limit.
[12] This standard is expressed as a running annual average.

Parameter	ODWQS MAC	½ MAC	Total Samples	Samples Above MDL	Total Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average[11] (mg/L)
Nitrate + Nitrite (as nitrogen) – University Raw Source (MDWL Sampling)	10	5	5	5	0	0.29	0.43	0.35
Nitrate + Nitrite (as nitrogen) – Paisley Raw Source (MDWL Sampling)	10	5	5	5	0	1.90	2.09	2.01

Operational VOC Scan Results Summary

Please note that Schedule 13-6, 13-6.1 and Schedule 24 parameters are also part of the "Operational VOC Sampling Regime" and therefore the values in the "Operational VOC Scan Results Summary" in Appendix D: Treated Water Quality Statistics include a repetition of the relevant data from the Schedule 13-6, 13-6.1 and Schedule 24 tables. The "Operational VOC Scan Results Summary" lists the total number of samples analyzed for these parameters in 2018 (January 1 to December 31, 2018). Table 13 (below), highlights specific VOC parameters due to their presence / significance within the water supply. There was no instance of an adverse result in 2018.

Table 13: City of Guelph Operational VOC Scan Selected Results Summary, 2018

Parameter	ODWQS MAC	½ MAC	Total Samples	Samples Above MDL	Total Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Trichloroethylene	0.005	0.0025	148	55	0	< 0.0001	0.00154	0.00051
Trihalomethanes (TTHMs)	0.100[8]	n/a	147	48	0	< 0.0002	0.0274	0.00858

O. Reg. 170/03 Schedule 23 Results Summary

In 2016, all operational treated sources were sampled and analyzed for Schedule 23 parameters as per O. Reg. 170/03. All of the City of Guelph's treated ground water sources are on a three year sampling schedule. F.M. Woods' Station is the exception and is sampled on the annual surface water schedule due to the fact that five of the nine sources that supply F.M. Woods are GUDI-WEF sources (the Carter Well 1 and 2, Arkell 1, Arkell 15 and the Arkell Glen Collectors).

The results of the Schedule 23 inorganic parameter analysis in 2016 were all under the half of the maximum allowable concentration (½ MAC) and the majority were under the laboratory's MDL (minimum detection level). Please refer to the section titled "O. Reg. 170/03 Schedule 23

Results Summary" included in Appendix D: Treated Water Quality Statistics for more information.

The next scheduled "Three Year" Schedule 23 sampling event takes place in the third quarter of 2019.

The results of the Annual Schedule 23 inorganic parameter analysis in 2018 for F.M. Woods' Station were all under the ½ MAC and the majority were under the laboratory's MDL (minimum detection level) as presented in Table 14.

Table 14: O. Reg. 170/03 Schedule 23, 13-2a, City of Guelph - Annual Schedule 23 Sampling Results Summary, 2018

Parameter	ODWQS MAC	½ MAC	Total Samples	Samples Above MDL	Total Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Antimony	0.014	0.007	12	3	0	< 0.0005	0.00097	0.00083
Arsenic	0.025	0.0125	12	2	0	< 0.001	0.0024	0.0017
Barium	1.0	0.5	12	12	0	0.034	0.082	0.063
Boron	5.0	2.5	12	11	0	< 0.01	0.048	0.031
Cadmium	0.005	0.0025	12	1	0	< 0.00010	0.00014	0.00014
Chromium	0.05	0.025	12	0	0	< 0.005	< 0.005	n/a
Mercury	0.001	0.0005	1	0	0	< 0.0001	< 0.0001	n/a
Selenium	0.01	0.005	12	0	0	< 0.002	< 0.002	n/a
Uranium	0.02	0.01	12	11	0	< 0.00010	0.0019	0.00112

O. Reg. 170/03 Schedule 24 Results Summary

In 2016, all operational Treated Sources were sampled and analyzed for Schedule 24 parameters as per O. Reg. 170/03. All of the City of Guelph's treated ground water sources are on a three year sampling schedule. F.M. Woods' Station is the exception and is sampled on the annual surface water schedule due to the fact that five of the nine sources that supply F.M. Woods' are GUDI-WEF sources (the Carter Well field, Arkell 1, Arkell 14 and the Glen Collectors).

The results of the Schedule 24 organic parameter analysis in 2016 were all under half of the maximum allowable concentration (½ MAC) and the majority were under the laboratory's MDL (minimum detection level). Please refer to the section entitled "O. Reg. 170/03 Schedule 24 Results Summary" included in Appendix D: Treated Water Quality Statistics for more information.

It should be noted that, before 2012, values for TCE (trichloroethylene) at Membro and Emma occasionally crested the ½ MAC value of 0.0025 mg/L and as a result Water Services moved to an "Increased Frequency Sampling Plan" as required by Regulation 170/03 - 13-5 which requires that sampling for this parameter be sampled every "three months" until two consecutive sample results are below the ½ MAC value. As a precautionary measure, Water Services samples both raw and treated water sources on a monthly schedule at Membro and Emma wells. All other sources, both raw and treated, are sampled annually (minimally) for VOC's (Volatile Organic Carbons) through a "Guelph VOC Scan" in order to better track parameters such as TCE via more data. Currently, TCE is above the MDL but below the ½ MAC at Membro, Water Street and Park treated water samples.

The next scheduled "Three Year" Schedule 24 sampling event takes place in 2019.

The results of the Annual Schedule 24 organic parameter analysis in 2018 for F.M. Woods Station and Dean Well (not operational in 2016) were all under the half of the maximum allowable concentration (½ MAC) and the laboratory's MDL (minimum detection level), as presented in Table 15.

Table 15: O. Reg. 170/03 Schedule 24, 13-4a, City of Guelph - Annual Schedule 24 Sampling Results Summary, 2018

Parameter	ODWQS MAC	½ MAC	Total Samples	Samples Above MDL	Total Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Alachlor	0.005	0.0025	1	0	0	< 0.0005	< 0.0005	n/a
Atrazine + N-dealkylated metabolites	0.005	0.0025	1	0	0	< 0.001	< 0.001	n/a
Azinphos-methyl	0.02	0.01	1	0	0	< 0.002	< 0.002	n/a
Benzene	0.005	0.0025	60	0	0	< 0.0001	< 0.0001	n/a
Benzo(a)pyrene	0.00001	0.000005	1	0	0	< 0.000009	< 0.000009	n/a
Bromoxynil	0.005	0.0025	1	0	0	< 0.0005	< 0.0005	n/a
Carbaryl	0.09	0.045	1	0	0	< 0.005	< 0.005	n/a
Carbofuran	0.09	0.045	1	0	0	< 0.005	< 0.005	n/a
Carbon Tetrachloride	0.005	0.0025	60	0	0	< 0.0001	< 0.0001	n/a
Chlorpyrifos	0.09	0.045	1	0	0	< 0.0001	< 0.0001	n/a

Parameter	ODWQS MAC	½ MAC	Total Samples	Samples Above MDL	Total Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Diazinon	0.02	0.01	1	0	0	< 0.001	< 0.001	n/a
Dicamba	0.12	0.06	1	0	0	< 0.001	< 0.001	n/a
1,2-Dichlorobenzene	0.2	0.1	60	0	0	< 0.0002	< 0.0002	n/a
1,4-Dichlorobenzene	0.005	0.0025	60	0	0	< 0.0002	< 0.0002	n/a
1,2-Dichloroethane	0.005	0.0025	60	0	0	< 0.0002	< 0.0002	n/a
1,1-Dichloroethylene (vinylidene chloride)	0.014	0.007	60	0	0	< 0.0001	< 0.0001	n/a
Dichloromethane	0.05	0.025	60	0	0	< 0.0005	< 0.0005	n/a
2,4-Dichlorophenol	0.9	0.45	1	0	0	< 0.00025	< 0.00025	n/a
2,4-Dichlorophenoxy acetic acid (2,4-D)	0.1	0.05	1	0	0	< 0.0001	< 0.0001	n/a
Diclofop-methyl	0.009	0.0045	1	0	0	< 0.0009	< 0.0009	n/a
Dimethoate	0.02	0.01	1	0	0	< 0.0025	< 0.0025	n/a
Diquat	0.07	0.0035	1	0	0	< 0.007	< 0.007	n/a

Parameter	ODWQS MAC	½ MAC	Total Samples	Samples Above MDL	Total Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Diuron	0.15	0.075	1	0	0	< 0.01	< 0.01	n/a
Glyphosate	0.28	0.14	1	0	0	< 0.01	< 0.01	n/a
Malathion	0.19	0.095	1	0	0	< 0.005	< 0.005	n/a
2-Methyl-4-chlorophenoxyacetic acid	0.1	0.05	1	0	0	< 0.00012	< 0.00012	n/a
Metolachlor	0.05	0.025	1	0	0	< 0.0005	< 0.0005	n/a
Metribuzin	0.08	0.04	1	0	0	< 0.005	< 0.005	n/a
Chlorobenzene	0.08	0.04	60	0	0	< 0.0001	< 0.0001	n/a
Paraquat	0.01	0.005	1	0	0	< 0.001	< 0.001	n/a
Pentachlorophenol (PCP)	0.06	0.03	1	0	0	< 0.0005	< 0.0005	n/a
Phorate	0.002	0.001	1	0	0	< 0.0005	< 0.0005	n/a
Picloram	0.19	0.095	1	0	0	< 0.005	< 0.005	n/a

Parameter	ODWQS MAC	½ MAC	Total Samples	Samples Above MDL	Total Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Polychlorinated Biphenyls (PCB)	0.003	0.0015	3	0	0	< 0.00005	< 0.00005	n/a
Prometryn	0.001	0.0005	1	0	0	< 0.00025	< 0.00025	n/a
Simazine	0.01	0.005	1	0	0	< 0.001	< 0.001	n/a
Terbufos	0.001	0.0005	1	0	0	< 0.0005	< 0.0005	n/a
Tetrachloroethylene (PCE)	0.03	0.015	60	0	0	< 0.0001	< 0.0001	n/a
2,3,4,6-Tetrachlorophenol	0.1	0.05	1	0	0	< 0.0005	< 0.0005	n/a
Triallate	0.23	0.115	1	0	0	< 0.001	< 0.001	n/a
Trichloroethylene	0.005	0.0025	60	24	0	< 0.0001	0.00137	0.00048
2,4,6-Trichlorophenol	0.005	0.0025	1	0	0	< 0.0005	< 0.0005	n/a
Trifluralin	0.045	0.0225	1	0	0	< 0.001	< 0.001	n/a
Vinyl Chloride	0.002	0.001	60	0	0	< 0.0002	< 0.0002	n/a

O. Reg. 170/03 Schedule 13-8 and 13-9, "Five Year" Sampling Results Summary

In 2014, all operational Treated Sources were sampled and analyzed for the Schedule 13-9 Fluoride parameter as per O. Reg. 170/03. In 2014, Fluoride (naturally present and not added as part of the treatment process) was detected at all treated sources; the analytical results were all under the maximum allowable concentration (MAC). The values in Table 16 reflect the 2014, Schedule 13-9 sampling regime.

Sodium, however, is sampled on a more frequent basis (annually) than the Schedule 13-8 requirement. Due to the fact that at every treated source, sodium levels are above the lower reportable limit of 20 mg/L.

The increased frequency of sampling provides more data in order to better establish sodium value trends. Sodium results for 2014 can be referenced in Table 16. This data is provided to Wellington-Dufferin-Guelph Public Health, as required.

Table 16: O. Reg. 170/03 Schedule 13-8 and 13-9, City of Guelph – "Five Year" Sampling Results Summary

Parameter	ODWQS MAC	½ MAC	Total Samples	Samples Above MDL	Total Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Sodium	20 and 200[13]	n/a	27	27	27	24	150	73.6
Fluoride	1.5 and 2.4[14]	n/a	20	20	0	0.13	0.77	0.292

[13] The aesthetic objective for sodium in drinking water is 200 mg/L. The local Medical Officer of Health should be notified when the sodium concentration exceeds 20 mg/L so that this information may be communicated to local physicians for their use with patients on sodium restricted diets.

[14] Where supplies contain naturally occurring fluoride at levels higher than 1.5 mg/L but less than 2.4 mg/L, the Ministry of Health and Long Term Care recommends an approach through local boards of health to raise public and professional awareness to control excessive exposure to fluoride from other sources.

General Chemistry Results Summary

Water Services has initiated an "Annual General Chemistry" sampling event through RCAp (Rapid Chemical Analysis Package). This body of data can be used to answer customer inquiries, as well as, inquiries from Water Services staff and consultants in terms of treatment upgrades.

Please note that Schedule 23 parameters are also part of the "Annual General Chemistry Sampling Regime" and therefore the values in the "General Chemistry Results Summary" section in Appendix D: Treated Water Quality Statistics include a repetition of the relevant data from the Schedule 23 Table. The "General Chemistry Results Summary" lists the total number of samples analyzed for these parameters in 2018.

In 2018, all operational Treated Sources were sampled and analyzed for general chemistry parameters. Please refer to the "General Chemistry Results Summary" in Appendix D: Treated Water Quality Statistics for the full list of parameters.

Table 17 highlights specific parameters due to their presence / significance within the water supply.

Table 17: City of Guelph General Chemistry Selected Results Summary, 2018

Parameter	ODWQS MAC	ODWQS AO	ODWQS OG	Total Samples	Samples Above MDL	Total Above Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Ammonia-N	n/a	n/a	n/a	12	1	n/a	< 0.05	0.11	0.11
Chloride	n/a	250	n/a	12	12	n/a	41	310	162
Hardness (Calculated as CaCO3)	n/a	n/a	80-100	12	12	12	320	560	448
Iron	n/a	0.3	n/a	12	3	2	< 0.1	0.46	0.34
Lead	0.01	n/a	n/a	12	0	0	<0.0005	<0.0005	n/a
Manganese	n/a	0.05	n/a	12	10	0	<0.002	0.021	0.0095
Sodium	n/a	20 and 200	n/a	12	12	12	22	160	86

Gazer Mooney Subdivision Distribution System

This section describes the regulatory water quality monitoring that has been collected in the Gazer Mooney Subdivision Distribution System in 2018. For regulatory sampling schedules that do not occur in 2018 related to the Gazer Mooney System, the most recent historical data is listed.

Water Quality Review - Gazer Mooney Subdivision Distribution System

Under the Safe Drinking Water Act, municipalities are required to monitor both the raw and treated quality of the source water supplied. This monitoring is performed for both regulatory compliance and due diligence and is expected to identify any changes within the treated water as well as in the raw source waters.

A note about all tables included in this section

1. All regulated chemical parameters where values above the lab's MDL (minimum detection limit) have been detected in the City of Guelph's treated water sources are underlined indicating a hyperlink to an Excel Workbook in Guelph's EDMS. The workbook contains a definition of the parameter, an Excel worksheet for each treated source where the parameter has been detected with values for all sample results from January 1, 2007 to December 31, 2018. This database is used to closely track the instances of the identified chemical parameters and therefore provide time for planning and budgeting if treatment or an alternative supply is eventually required due to the presence of a given parameter. The database is updated quarterly.
2. Tabulated values are from best available information at the time of table creation. While the values documented here satisfy the regulatory minimum regulatory requirements, Water Services performs many additional operational tests not listed in this report.
3. All acronyms and initialisms included in tables are described in Appendix L: Glossary.
4. Please note that some hyperlinks in the tables are linked to Guelph's electronic document management system (EDMS). Note: EDMS is available for internal use only.

Table 18 summarizes daily Distribution free chlorine residual test results required by O. Reg. 170/03 Schedule 7-2 for the period of January 1 to December 31, 2018. There was no instance of an adverse result in 2018.

Table 18: O. Reg. 170/03 Schedule 7-2, Gazer Mooney - Distribution Manual Free Chlorine Residual Summary, 2018

Parameter	ODWQS Range	Total Samples	Total Samples Outside of ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Free Chlorine Residual	0.05 – 4.0	365	0	0.60	1.32	0.91

Table 19 summarizes bacteriological sampling and test results required by O. Reg. 170/03 Schedule 10 for the period of January 1 to December 31, 2018. There was no instance of an exceedance for a Regulatory microbiological parameter in 2018. There were 52 Distribution samples taken and 573 Distribution analyses completed in 2018

Table 19: O. Reg. 170/03 Schedule 10-2, Gazer Mooney Treated Bacteriological Sampling Summary, 2018

Parameter	ODWQS Criteria	Total Analyses	Total Outside ODWQS Criteria	Range	Units
Distribution - E. coli	0	53	0	0	cfu/100 mL
Distribution - Total Coliform	0	53	0	0	cfu/100 mL
Distribution – HPC	n/a	53	n/a	0 - 2	cfu/mL
Distribution – Background	n/a	53	n/a	0 - 2	cfu/100 mL
Distribution– Free Chlorine Residual	0.05 – 4.0	365	0	0.60 – 1.32	mg/L

Treated Water Quality Statistics – Gazer Mooney Subdivision Distribution System

O. Reg. 170/03 Schedule 13-6, "Three Month" Sampling Results Summary

In 2018, Gazer Mooney Subdivision Distribution System was sampled and analyzed for Schedule 13-6 and 13-6.1 parameters as per O. Reg. 170/03. Regulation 170/03, Schedule 13-6 requires a minimum of one distribution sample taken from the Distribution System where THMs (trihalomethanes) are most likely to develop (points with high retention times). The MAC for THMs is 0.1 mg/L. However, for this parameter the MAC uses a running annual average of quarterly samples. These results are presented in Table 20.

The results of the running annual average value for THMs in the Gazer Mooney Subdivision Distribution System samples in 2018 were below the half maximum allowable concentration (½ MAC): Q1 = 0.017 mg/L; Q2 = 0.019 mg/L; Q3 = 0.020 mg/L and Q4 = 0.020 mg/L.

Regulation 170/03, Schedule 13-6.1 requires a minimum of one distribution sample taken from the Distribution System where HAAs (haloacetic acids) are most likely to develop. The MAC for HAAs is 0.08 mg/L. However, for this parameter the MAC uses a running annual average of quarterly samples.

The results of the running annual average value for HAAs in the Gazer Mooney Subdivision Distribution System samples in 2018 is below the half maximum allowable concentration (½ MAC): Q1 = not detected; Q2 = not detected; Q3 = not detected and Q4 = not detected.

Table 20: O. Reg. 170/03 Schedule 13-6, Gazer Mooney - "Three Month" Sampling Results Summary, 2018

Parameter	ODWQS MAC mg/L	½ MAC mg/L	Total Samples	Samples Above MDL	# Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Trihalomethanes	0.100[15]	n/a	4	4	0	0.0168	0.0233	0.0200

[15] This standard is expressed as a running annual average.

Parameter	ODWQS MAC mg/L	½ MAC mg/L	Total Samples	Samples Above MDL	# Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Haloacetic Acids	0.08[8]	n/a	4	0	0	<0.005	<0.005	n/a

General Chemistry Results Summary

In addition to the regulatory sampling and analysis required for the operation of the Gazer Mooney Subdivision, Water Services samples for parameters as listed in Table 21 in order to gather additional data and answer common inquiries from the public.

Table 21: Gazer Mooney General Chemistry Results Summary, 2018

Parameter	ODWQS MAC mg/L	ODWQS AO	½ MAC mg/L	Total Samples	Samples Above MDL	Total Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Sodium	20 and 200[16]	n/a	n/a	1	1	1	35	35	35
Chloride	n/a	250	n/a	1	1	0	66	66	66

i) Status of Ongoing and Emerging Water Quality, Supply and Distribution Initiatives

This includes summaries and updates related to the implementation of the:

- 2016 Water Efficiency Strategy;
- Arkell Springs Forest Stewardship Project,
- Source Water Protection Plan;

[16] The aesthetic objective for sodium in drinking water is 200 mg/L. The local Medical Officer of Health should be notified when the sodium concentration exceeds 20 mg/L so that this information may be communicated to local physicians for their use with patients on sodium restricted diets.

- Lead Reduction Plan; and
- Frozen Services Monitoring Program.

Water Efficiency Strategy

The City of Guelph strives to be a leader in water conservation and efficiency. As one of Canada's largest communities reliant on a finite groundwater source for our drinking water supply, our ability to reclaim water and wastewater serving capacity through conservation and efficiency initiatives offers numerous benefits to our community and local ecosystem. Water Services continues to promote the ongoing sustainability of our finite water resources through active water conservation and efficiency programming to meet the water reduction targets as outlined in the 2014 Water Supply Master Plan.

Appendix I: Water Conservation and Efficiency Program presents the 2018 Annual Progress Report and includes a highlight of the progress made for the period of January 1 to December 31, 2018 in the implementation of the 2016 Water Efficiency Strategy.

Source Water Protection Plan

The City of Guelph is committed to drinking water source protection and in 2016, Council appointed risk management staff to implement the Source Water Protection program.

The City of Guelph falls under the Grand River Source Protection Plan, which was approved by the MECP and became effective on July 1, 2016. Of the 72 policies identified in the Grand River Source Protection Plan, the City of Guelph is the primary implementing body for 48 of the 72 policies, with the remaining policies to be implemented by provincial ministries. As of February 1, 2019, 28 of the 48 policies have been fully implemented, based on priority basis or deadline.

Appendix K: Source Water Protection includes a highlight of the progress made for the period of January 1 to December 31, 2018 in the implementation of the City of Guelph's Source Water Protection program. This second annual report summarizes information requested from the Risk Management Official by the Source Protection Authorities, as required under section 81 of the Clean Water Act, 2006 (CWA).

For more information on Guelph's Source Water Protection Program, visit guelph.ca/sourcewater.

Arkell Springs Forest Stewardship Project

The Arkell Spring Grounds cover an area of 804 acres. The area is comprised of old and new forested areas. The objective of the Arkell Springs Forest Stewardship Project has been to

protect the drinking water source supply by managing past tree plantings, monitoring general forest health and enhancing fallow areas with new plantings.

Managed forest stands require continued maintenance and observation to ensure the health of the forest and prevent any unnecessary losses. The many benefits of this long-standing Stewardship Project include:

- the creation and maintenance of a diverse and functioning native forest cover;
- maintenance and re-generation of older forested areas on the property;
- protection and recharge of underground aquifers which supply our City's water;
- prevention of undesirable surface water runoff and flooding into local waterways;
- localized temperature stabilization;
- decrease in evaporative losses due to element exposure; and
- regulating water flow.

This property management approach results in the highest possible quality of water to supply Guelph's drinking water system.

To further enhance the site's fallow farm fields, a tree planting program has been ongoing since 2007. On a volunteer basis, the Community Environmental Leadership Program (CELP) with the Upper Grand District School Board has planted 26,500 trees on 18 acres, and Bartram Woodlands (on-site contractor) has planted 37,790 trees on another 16 acres. This number includes 9,550 trees that were planted into the rows removed from the 2017 commercial harvest.

In 2019, a five-year plan for forest management will be developed to identify priorities at the Arkell Spring Grounds. This plan will identify tree planting, maintenance and invasive vegetation removal to ensure the health of this site. This is in support of the Arkell and Carter Grounds Integrated Management Plan, commencing in January 2019.

Lead Reduction Plan

The City has been working proactively to address the presence of lead service lines (LSLs) in Guelph since 2007 through identification and replacement of both the private and public portions of LSLs. Full LSL replacement has demonstrated to be effective in reducing lead concentrations and achieving regulatory compliance as measured at the point to water consumption.

The City of Guelph's Lead Reduction Plan (LRP) was developed in lieu of a Corrosion Control Plan (as outlined in Ontario Regulation 170/03 Schedule 15.1) and was formally approved by the MECP on March 21, 2012. The LRP focuses on physical lead service line replacement through verification sampling, financial incentives and public outreach.

As per the City of Guelph MDWL 017-101 - Schedule D, the City is required to submit all lead sampling data every 6 months and an annual Evaluation Report to assess the effectiveness of the Lead Reduction Plan.

Lead Sampling in the Guelph Drinking Water System

The following table presents summary results for lead sampling in the Guelph Drinking Water System as per Schedule D for the period of January 1 to December 31, 2018.

Table 22: Lead Reduction Plan Lead Sampling - Guelph Drinking Water System, 2018[17]

Number of Locations	Location Type	Number of Samples	Lead Range (mg/L)
50	Plumbing that Serves Private Property	73	0.0000 – 0.08
14	Distribution System	30	< 0.0005

Lead Sampling in the Gazer Mooney Subdivision Distribution System

In the Gazer Mooney Subdivision Distribution System, all samples were below the Ontario Drinking Water Quality Standards (ODWQS) for lead of 0.01 mg/L, as presented in the following table.

Table 23: Lead Reduction Plan – Gazer Mooney Subdivision Distribution System, 2018

Number of Locations	Location Type	Number of Samples	Lead Range (mg/L)	pH Range	Alkalinity Range (mg/L)
1	Distribution	2	0.0030 – 0.0036	7.93 – 8.01	270 - 280

Lead Sampling

Nearly 5,000 homes/businesses have been sampled for lead to identify the presence of LSLs and to monitor lead levels following a LSL replacement. For the period of January 1 to December 31, 2018, 42 private plumbing locations were sampled for the purposes of verifying the presence of

[17] Includes all samples as required by the MDWL or Lead Reduction Plan.

a LSL. Of these locations, 6 locations were above 0.005 mg/L indicating presence of a lead service line and 4 also exceeded the ODWQS of 0.01 mg/L. Lead samples are collected before and after a LSL replacement has been undertaken. There were 8 locations resampled in order to monitor lead levels post-replacement. Based on sample results to date, regulatory compliance is expected at individual sites that have undergone a full LSL replacement or where there is no lead remaining in the service line.

Lead Service Line Replacements

Since 2007, there has been a total of 687 lead service lines replaced in the City. As a result, 91 per cent of these homes are now considered to be 'lead-free' service lines (i.e. either a full replacement or a partial replacement that connected to a non-lead material). There were 10 LSL replacements undertaken in the City between January 1 to December 31, 2018. Of these, there were 3 LSL replacements on City property that connected to a non-lead material on private property and 7 LSL replacements on the private property that connected to a non-lead material on City property.

Since 2010, the City initiated financial incentive programs to encourage replacement of privately-owned LSL by reducing the financial burden to property owners. The grants cover, on average, 75 per cent of the LSL replacement cost for homeowners. From 2010 to Dec. 31, 2018, 220 privately owned lead service lines were replaced through the grant program, as presented in Table 24.

Table 24: Private Lead Service Line Replacement Grant Programs (2010 – Dec. 31, 2018)

Grant Program	2010	2011	2012	2013	2014	2015	2016	2017	2018
Yearly Total	60	62	31	20	9	12	7	13	7
Cumulative Total	**60**	**122**	**153**	**173**	**182**	**194**	**200**	**213**	**220**

Targeted outreach regarding the Grant Programs is directed at all properties with known or suspected privately-owned LSLs. The main barriers to privately owned LSL replacement for homeowners include financial costs, disruption to property, rental properties and people who are unconcerned about the health risks of lead in drinking water. Direct communications continued to be been tailored to address these barriers.

Frozen Water Pipe Prevention and Monitoring Program

Water Services takes a proactive approach in monitoring and preventing frozen water pipes. The purpose of the 2015 Council-approved Frozen Water Pipe Policy is to prevent and manage interruptions to the City's supply of water, caused by the temporary freezing of City and/or customer water pipes, so that customers maintain reliable, continuous access to water.

Water Services monitors daily temperatures, frost levels, degree-days and water temperature in the water distribution system. When certain thresholds are reached, the freeze prevention program is initiated.

The Frozen Water Pipe Program requires customers to take specific actions to prevent the freezing of water pipes. Water Services has identified two tiers for their frozen water pipe prevention program. Tier 1 properties are most susceptible to freezing and have historically frozen every year. Tier 2 properties are also at risk for freezing and have had frozen pipes in the past during prolonged periods of severe winter temperatures. Through communication with these customers, Water Services works hard to ensure that frozen water pipes are prevented. The customers in both of these Tiers are registered in our notification program.

For more information on the Frozen Water Pipe Program, visit guelph.ca/frozenpipes.

2018 Frozen Water Pipe Program Statistics

The winter of 2017-2018 saw temperatures drop sharply at the end of 2017. This started to push the frost down into the ground, which created a scenario with high probability to cause frozen water pipes. With the addition in the cumulative mean daily temperature (i.e. greater the temperature, the quicker the approach to the cumulative temperature trigger) it was decided to initiate the freeze prevention program.

On January 29, 2018, Tier 1 customers began running water as per the actions set out in this program to prevent water pipes from freezing. As temperatures continued to drop, Tier 2 customers began running water on February 5, 2018. As temperatures warmed up in February, the frost level in the ground rose and forecasted temperatures saw no return to cooler temperatures. On February 23, 2018 all customers were told to stop running their water.

Summary of 2017/2018 Winter Statistics

- Temperature hit cumulative low trigger amount of -400°C: February 13, 2018.
- Lowest temperature recorded for the season was on Dec 30, 2017: -28.6°C.
- Lowest frost depth recorded for the season was four feet was on January 16, 2018.
- Number of frozen calls indicating some confirmed type of frozen water pipes:

    - Two service calls confirmed external issues (i.e. frozen water pipes on the City-service side).
- 49 service calls received were not external issues, thusly assumed internal issues (i.e. frozen pipes were on private property).

j) Follow-up on Action Items from Previous Management Reviews

A Management Review meeting was held on January 30, 2018 and on January 25, 2019. The following is a summary of results of the management review. Appendix F: Action Items from Management Review includes the action items from the meetings. Items 1-13 are from the January 30, 2018 Management Review meeting and items 14-25 are from the January 25, 2019 Management Review Meeting.

Results of the Management Review, the identified deficiencies, decisions and action items

The summary below includes identified deficiencies and decisions from the meeting held on January 25, 2019.

Deficiencies

- There were not any identified non-compliance issues in 2018.
- 2 AWQI's occurred in 2018 (both related to TC).
- There were not any non-conformance issues identified in the 2018 accreditation (external) audit.
- The two minor non-conformities from the 2017 external audit re: Sampling, Testing and Monitoring and Continual Improvement were found to be effectively resolved and implemented in the 2018 audit.

Decisions

- Refer to section d) The Effectiveness of the Risk Assessment Process regarding decisions made in the Risk Assessment process on October 17, 2018.
- For the 2018 Annual and Summary Report:
    - Include 2018 consumption data in Figure 4.
    - Consider well field permits for Arkell in Table 2 (as we often pump more than 66l/s).
    - Update Water Supply Maintenance Activity: remove Logan and change Speedvale to Verney.

    - Add Calico work to Section n).
    - Review if we should add information describing that the water quality values may be an average and can depend on the location of the sample.
    - Add Arkell 14 Generator to Section n).
    - Add information about the contact chamber work done at Water and Emma. Wells to the Infrastructure Section.
    - Add information about Energy work being done to next year's (2019) report.
    - Confirm that the numbers reported for Backflow are accurate.
    - Change the picture of the water wagon picture frame to one with people in the frame.
- The procedure for documenting calls needs to be reviewed as a lot of calls aren't getting logged properly.
- Add the Water Efficiency Communications Strategy to EDMS.

k) The Status of Management Action Items Identified Between Management Reviews

Water Services is very committed to continually improving the drinking water system, including improving related programs and processes. Throughout the year, continual improvement suggestions (management action items) can be presented throughout many different activities, such as: emergency tests, audits, staff suggestions, debrief sessions, root-cause analysis meetings, etc. These items are logged into Water Services' Continual Improvement Database and the appropriate teams meet every other month to update on the status of these items.

Appendix G: Status of Management Action Items Identified between Reviews is a list of continual improvement items identified in 2018 for management follow-up.

l) Changes that Could Affect the Drinking Water System and the Quality Management System

Appendix E: Legal and Other Requirements Table includes a summary of legislative and regulatory updates from January 1 to December 31, 2018 that could affect the Drinking Water System and/or the Quality Management System.

Changes Affecting the Drinking Water System (DWS) - Licence Approvals and Amendments

Municipal Drinking Water Licence (MDWL) Renewal

The current Municipal Drinking Water Licence expires in 2019. Table 25 below includes Licence documents' dates of issue and expiry. As part of the MDWL renewal, the updated Financial Plan will be submitted to Council for approval in March 2019. The Operational Plan was endorsed by Council in January 2019.

Table 25: Municipal Drinking Water Licensing Documents

Document (hyperlinked to the internal EDMS system)	Issue Date (yyyy-mm-dd)	Expiry (yyyy-mm-dd)
Municipal Drinking Water Licence (#017-101)	2017-04-21	2019-08-17
Drinking Water Works Permit (#017-201)	2017-04-21	2019-08-17
Municipal Long Range Financial Plan (#017-301)	2014-02-25	2019-08-17
DWQMS Certificate of Registration - Guelph Drinking Water System (017-OA1)	2018-12-20	2021-11-25
Operational Plan Re-endorsement Guelph Drinking Water System (resolution)	2019-01-14	2024-02-15
Agreement Regarding Water Services for the Gazer-Mooney Subdivision	2009-06-01	2019-05-31
Gazer Mooney Municipal Drinking Water Licence (#104-103)	2016-01-28	2021-01-26
Gazer Mooney Drinking Water Works Permit (#017-203)	2016-01-28	2021-01-26

Document (hyperlinked to the internal EDMS system)	Issue Date (yyyy-mm-dd)	Expiry (yyyy-mm-dd)
Operational Plan Re-endorsement Gazer Mooney Sub. Dist. System (resolution)	2015-07-14	2019-10-31
DWQMS Certificate of Registration - Gazer Mooney (104-OA2)	2018-12-20	2021-11-25

Permits to Take Water (PTTW) Renewals

The Water St. Wellfield (Water, Dean, University, Membro) PTTW (exp. 2016 -10-31) is still in the active renewal process as discussions continue between the MECP and the City. For the time period between the expiry date of a PTTW and the receipt of a renewal, the requirements of the last PTTW remain in force.

One PTTW is scheduled for renewal in 2019. The Downey PTTW expires on May 31, 2019.

Sentry Monitoring Wells

In order to help predict future TCE concentrations in our source water and allow for planning for the possible need for further treatment, sentry wells have been constructed in the vicinity of Emma and Membro Wells. TCE source sampling analysis indicates that TCE concentrations are stable or decreasing.

Carter Monitoring Program – Operational Testing

The Permit to Take Water for Carter Well 1 and 2 requires that the Carter Wells be operated at increased levels in conjunction with monitoring in the Torrence Creek Subwatershed. The purpose of the monitoring is to quantify impacts within this subwatershed.

Staff Certification

The following tables (Table 26, Table 27 and Table 28) describes all Operators and Management staff with various classes of provincial Drinking Water Operator Certificates and years' experience, as of December 31, 2018.

Table 26: Water Services Employees (Operators and Management Staff) with Drinking Water Operator Certificates

Certificate Class	Number of Certified Employees	Number of Certified Employees	Number of Certified Employees
Operator-In-Training	2	3	7
Class I	2	0	1
Class II	3	3	3
Class III	12	8	7
Class IV	12	19	19
Total Certified Employees	**31**	**33**	**37**

Table 27: Competency and Years of Experience for Certified Management Staff

Role	Minimum Competency Required[18]	Competency Achieved	Years' Experience
Manager of Operations / ORO -Overall Responsible Operator	Class IV Certificate	Class IV Certificate	30+
Supervisor of Distribution - Construction	Class I Certificate or higher	Class IV Certificate	21+
Supervisor of Distribution – Metering and Locates	Class I Certificate or higher	Class IV Certificate	17+

[18] Minimum competency includes the certification requirements listed here, plus the completion of ongoing training requirements of O. Reg. 128/04.

Role	Minimum Competency Required[18]	Competency Achieved	Years' Experience
Supervisor of Water Supply Operations	Class I Certificate or higher	Class IV Certificate	14+
Supervisor of Water Supply Maintenance	Class 1 Certificate or higher	Class IV Certificate	9+

Table 28: Years of Experience of Certified Operational Staff

Role	<5 years	5-9 years	10-14 years	15-19 years	20-24 years	25+ years
Distribution Operators	3	6	4	2	0	2
Supply Operators	4	0	3	3	0	1

Changes Affecting the Quality Management System (QMS)

Ontario's updated Drinking Water Quality Management Standard (DWQMS) Version 2.0

Guelph Water Services implemented the requirements of the updated DWQMS Version 2.0, released in February 2017, in its quality management system. Water Services was accredited to DWQMS Version 2.0 in the 2018 external audit.

Quality Management System Implementation

Guelph Water Services strives for continual improvement in all of its programs and processes. Improvements made to the drinking water system and its process are evaluated through: internal and external audits; staff suggestions; risk assessments; emergency training and testing; consumer feedback and through the management review process.

Water Services at the City of Guelph is committed to providing consumers with a safe, consistent supply of high quality drinking water while meeting or exceeding, and continually improving on legal, operational and quality management system requirements.

Throughout 2019, we will continue with a proactive approach to the DWQMS by:

- Maintaining accreditation to the DWQMS 2.0;
- Identifying ways to improve the drinking water system and its related processes;
- Expanding knowledge and involvement of staff for collaboration and integration of the quality management system;
- Ensuring that any deficiencies identified are responded to and corrected quickly and efforts are taken to ensure that the problem does not reoccur;
- Collaborating with other municipalities to ensure that we are enhancing our performance standards and operating practices; and
- Continuing advancements to emergency prevention and preparedness, including the risk assessment process.

m) Consumer Feedback

Table 29 below represents the number of all customer calls received, but do not necessarily reflect the number of individual issues (as more than one call could relate to a single issue).

Table 29: Number of Customer Calls Received, 2016-2018

Type of Call	# Calls 2016	# Calls 2017	# Calls 2018
Discoloured Water	185	106	116
Distribution	77	54	21
Flushing	33	13	5
Frozen	5	3	51
Hydrant - Accident Report	3	5	5
Hydrant – Investigation	39	35	25
Hydrant Out-of-Service	108	137	98
Leak	88	83	73
Meter	11	8	9
Other	53	33	43
Pressure	104	92	102
Private Issue	23	5	12
Service Box Repairs	205	194	212

Type of Call	# Calls 2016	# Calls 2017	# Calls 2018
Swabbing	59	16	39
Trench Investigation	6	4	9
Valve	46	19	28
Water Quality / Appearance	55	39	62
Watermain	5	6	5
Watermain Break Investigation	90	96	107
Well Interference Inquiries	4	3	5

n) The Resources Needed to Maintain the DWS and QMS

Water Services currently has one full-time Quality Management Specialist, who is also the Quality Management System Representative; one full-time Water Compliance Specialist; access to five Water Services Technicians; and a Customer Service Clerk to ensure that reporting and documentation requirements of the QMS are met.

Operational challenges in the drinking water system continue to drive the need for additional resources, such as:

- A changing staff profile, with experienced staff that have retired or are due to retire in the next few years;
- Aging city infrastructure requiring increased capital budget considerations;
- Potential source water supply shortfall (e.g. current supplies not meeting future demand, drought, contamination and demands of future growth) requiring increased capital project and budget considerations;
- Distribution system issues (e.g. dead ends in the distribution system, frozen city-side infrastructure, larger infrastructure failures and aging water meter infrastructure, watermains located on easements); and
- Private property issues (e.g. substandard water services).

o) Results of Infrastructure Review

The identification of water infrastructure requirements are achieved by reviewing the needs of existing and new infrastructure through the completion of asset management plans both at Water Services and corporately.

Distribution Infrastructure Needs

Distribution infrastructure needs are outlined in the corporate Asset Management Plan, which is developed using industry best management practices and completed by the Corporate Asset Management group in the Engineering and Transportation Service Division (Engineering Services). This linear plan is reviewed by Water Services who then assists in developing a priority sequence for project completion. In 2018, Water Services also completed a review of the distribution system with respect to critical water mains to aid in this discussion.

During the annual budget preparation process, Engineering and Water Services review infrastructure conditions, inventory age, CAPS (capital asset prioritisation system), and system criticality. From this evaluation, Engineering and Water Services finalize the list of priority projects that also considers the priorities of wastewater and road reconstruction projects so that these projects can share the costs of excavation and rehabilitation. New linear infrastructure reviews are primarily driven by Engineering Services.

Annual summaries of road reconstruction, sewer and watermain projects are identified on an infrastructure map that is released early spring each year.

Supply and Facilities Infrastructure Needs

On July 28, 2014 Guelph City Council unanimously approved the Water Supply Master Plan update, defining preferred water supply servicing alternatives in meeting the needs of existing customers and future community growth.

In concert with the Water Supply Master Plan Update, the City's Engineering Services completed an update to the linear water distribution network model as part of the 2014 Development Charges Background Study to define water distribution improvements needed for growth servicing.

As part of the above mentioned studies, a number of system upgrades have been identified including: additional water supply sources; new pumping stations; storage facilities; and new water distribution mains. To help integrate these complex works, the City completed the Pressure Zone 1 and 2 studies in 2015 and 2017, respectively. These studies support the

implementation of capital projects as outlined in the Water and Wastewater Capital Budget deliberations.

In 2017, Water Services completed the Water Facility and Property Asset Management Plan. This Plan identifies and prioritizes capital projects and land acquisitions required to maintain and renew its existing facility assets and associated operations over a 25 year planning horizon in accordance with asset management industry best management practices as well as current codes, guidelines and standards. A 10 year capital forecast for Facility and Water Plant Upgrades was presented to and endorsed by Council as part of the 2019 Capital Budget deliberations to address a backlog in infrastructure investment required to sustain operation of the City's critical water supply facilities and processes.

As a result of the above noted studies, key capital projects have been initiated/completed in 2018. The following provides the project name with a brief description of these key projects.

Paisley-Clythe Feedermain – Phase 2B

Phase 2B of the Paisley-Clythe Feedermain was installed and commissioned in 2018. This involved installing a 600mm diameter watermain from near the end of Boult Avenue easterly to Brockville Avenue, and up to York Road. This is part of a multi-year project to connect a new transmission main from Clythe Station in the east of the city to FM Woods Pumping Station, and on to Paisley Station in the west end of the city.

Burke Well Station Upgrades

Manganese concentrations in water from the Burke Well appear to be gradually increasing and are slightly above the MECP's Aesthetic Objective for manganese (0.05 mg/L). Upgrades to the Burke Well Station to improve the aesthetic quality (iron and manganese) of water from the Burke Well are ongoing and should be completed in early 2019. The upgrades include construction of a building to house a pressure filtration system. The upgrades resulted in a reclassification of the Water System by the MECP for both treatment and distribution on December 20, 2018. The Guelph Drinking Water System is now classified as a Class 2 Water Treatment System and a Class 4 Water Distribution System.

Clythe Well Treatment Upgrades

The Environmental Assessment (EA) was completed for the Clythe Well station in 2018. As a result, the City purchased a parcel of land in their preferred location, which will house the new Water Treatment Plant Design of this treatment plant is anticipated to be initiated in 2019.

Verney Elevated Tank Upgrades and Recoating

Key upgrades were completed in 2018 at the Verney Water Tower, which included ensuring the asset life of the elevated tank is sustained as well as provided key operational upgrades.

Paisley Pumping Station Upgrades

Upgrades to the Paisley pumping station were initiated in 2018 and will be completed in 2020 to ensure asset life is maintained, as well as redundancy for the water system in the west side of the City. Work is also being completed in preparation for the new Paisley Road Feeder Main Engineering Project.

Middle Reach of the Aqueduct

In 2018, preliminary projects were completed in preparation of the inspection and potential maintenance of the middle reach of the aqueduct. Studies included completion of an Environmental Impact Study and key contingency Planning for water quality. Meetings were also held with various stakeholders including the Township of Puslinch, site neighbours, the Health Unit and the MECP. It is anticipated inspection will occur in the fall of 2019.

Arkell 14 Standby Power

In 2018, a new 100kw standby generator was installed at Arkell 14. This generator is rated for 24+ hours of continuous run time under full load with a total diesel fuel capacity of almost 1000L of diesel. I installation of standby power increases redundancy and adds great operational flexibility.

Emma and Water Street Wells: Disinfection System Upgrades

UV disinfections systems at both well stations were replaced with chlorination disinfections systems which provide the required 4-log virus disinfection before water is pumped to the distribution system. To achieve this, the UV disinfection was taken off-line and two new chlorine contact chambers and additional chlorine residual monitoring was installed at each location.

Calico Well Upgrades

Calico well was taken out of service in August 2018 for scheduled contact chamber cleaning and inspection. During the cleaning process, the well casing that extends through the contact chamber was significantly damaged. The site remains non-operational as consultant reports and recommendations are being reviewed to determine the best approach to deal with several process and building related issues. As a result of this supply being off-line, the section of the feedermain between the station and the City’s distribution system has been deemed non-potable and distribution system residuals continue to be monitored in the area.

Backflow Prevention Program

Preservation of drinking water quality within Guelph's infrastructure is supported by the City of Guelph's Building Services and Guelph's Backflow Prevention Regulations (By-law Number (2016) - 20028). As per the By-law, Backflow means the flowing back of or reversal of the normal direction of flow of water. The By-law requires that no connections are made to the City's water supply without the installation of a backflow prevention device to isolate premises, sources, and zones to prevent cross-connections in every building or structure where a City water supply or other potable water supply exists.

Annually, Building Services provides a Backflow Report, included in Table 30 below, that tracks the number of letters sent out regarding annual testing and re-surveying requirements of the By-law.

Table 30: 2018 Backflow Report - Number of Letters Sent out for Annual Testing and Re-survey

Letter Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1st Letter Annual Testing	142	165	168	207	285	144	146	173	145	146	153	118	**1992**
2nd Letter Annual Testing	77	74	80	93	121	150	67	82	135	105	102	105	**1191**
Disconnect Letter Annual Testing	23	31	27	36	35	25	25	72	53	71	41	41	**480**
1st Letter re-survey	31	31	30	52	20	18	16	29	26	37	26	19	**335**
2nd Letter re-survey	20	24	22	24	29	8	29	12	28	24	24	22	**266**
Disconnect Letter re-survey	4	13	14	12	16	14	0	26	6	28	10	17	**160**
Water service disconnected	0	0	0	0	0	0	0	0	0	0	0	0	**0**

As presented in Table 31, the City of Guelph has a total of 2,860 properties (2,715 active and 145 inactive properties) that have a total of 6,525 backflow prevention devices installed. Of the total, 1,930 buildings have premise isolation and 1,013 buildings are without premise isolation (e.g. residential irrigation systems, plaza facility – plaza owner has premise isolation). From January 1 to December 31, 2018, of the 55 new properties that have a backflow prevention device, 13 are with premise and 42 are without premise isolation.

Table 31: Backflow Devices Installed by Type in 2018

Devices Installed by Type	# of Devices
New Backflow Permits	56
Total Number of New Devices Installed	**146**
New Properties	55
Active Properties	2,715
Inactive Properties	145
Total Properties with Backflow Prevention Devices	**2,860**
Active Buildings with Premise Isolation	1,930
Active Buildings without Premise Isolation	1,013
Total Active Backflow Prevention Devices	**6,525**

p) Operational Plan Currency, Content and Updates

On an ongoing basis, the Operational Plan is updated by the Quality Management Specialist with the help of additional Water Services Staff. Updates to the Operational Plan were communicated to Water Services management and staff via email on October 31, 2018. The Operational Plan was presented to Council on January 14, 2019 for endorsement.

Notable updates include:

- QMS 06 Drinking Water System: updated to include information regarding new treatment processes at Water Street Well and Emma Well.
- QMS 08 Risk Assessment Outcomes: updated after the risk assessment was completed.
- QMS 09 Organizational Chart: updated when changes are made to staff assignments.

- QMS 14 Review and Provision of Infrastructure: updated to include better clarification on the process to consider the risks identified in the annual risk assessment.
- QMS 17 Measurement and Recording Equipment Calibration and Maintenance: updated to reflect the schedule and resources used to perform required calibrations.
- QMS 21 Continual Improvement: updated to define a more robust Continual Improvement and Root Cause Analysis Procedure for Water Services.

See Section l) Changes that Could Affect the Drinking Water System and the Quality Management System for additional Operational Plan updates.

q) Staff Suggestions

Staff suggestions are identified during: staff and operational meetings; internal and external audits; debriefs and are taken into account during annual budget processes and continual improvement meetings. Appendix H: Summary of Staff Suggestions includes a listing of various improvement items that were presented by staff from January 1 to December 31, 2018.

r) New or Other Business

There is no further new or other business to report in 2018.

s) Next Meeting Dates

The Management Review Meeting scheduled to review the updated 2018 Annual and Summary Water Services Report was held on January 25, 2019. Review of the Internal Audit findings will take place in April 2019, review of the Risk Assessment outcomes in September 2019 and review of the External Audit findings in November 2019. Monthly QMS updates are scheduled with the management team and the Quality Management Specialist. Monthly QMS updates are communicated to all staff at scheduled staff meetings.

Appendix A: Summary of Critical Control Points and Critical Control Limits

Critical Control Point (CCP) - Multi-Barrier Primary Disinfection

- To remove or inactivate pathogens potentially present in the source water.

Hazard Description

Low Chlorine Dosage

- Chlorination system failure (e.g. pump, line, fitting, power, PLC, flow meter)
- Failure of analyzers (POE or process) to alarm
- Poor chemical quality

High Turbidity

- Sudden changes to raw water quality characteristics
- Failure of aqueduct infrastructure

Inadequate UV Dosage

- UV Treatment system failure (e.g. UV, UVT and Turbidity analyzers, high flow, reactor, PLC, power, flow meters)
- High turbidity event

Operating a Station in Manual

- Inadequate CT (Concentration x Time)
    - Low reservoir level
    - Insufficient chlorine residual
    - Low contact time due to POE pump flow rate

Critical Control Limit (CCL)

Free Chlorine

- Low Low and High High alarm limit range for all stations:
    - 0.40 to 1.9 mg/L
- Programmed Auto Shutdown range for all stations:
    - 0.40 to 2.5 mg/L

Turbidity

- Turbidity alarm ranges for all stations that monitor turbidity:

    - 0.3 to 0.8 ntu
- Auto diversion at the Glen Diversion Chamber based on turbidity
    - 0.2 ntu

UV Dose

UV Dose auto shutdown alarm setpoints:

- FM Woods
    - <30 mJ/cm2 (Trojan controller programmed low)
- Water Street well
    - <45 mJ/cm2 (Trojan controller programmed low)
    - 42 mJ/cm2 (redundant PLC programmed low)
- Membro
    - <25 mJ/cm2 (Trojan controller programmed low)
    - <22 mJ/cm2 (redundant PLC programmed)

CT Calculations

- Manual calculations must show that the minimum CT achieved is 4

Monitoring Process and/or Procedures

- Certified and competent operators
- Continuous monitoring of control limits through SCADA
- Daily operational sampling, testing and monitoring of control limits by Operators
- Redundancy of system components (including equipment) & monitoring (operators, instruments); stand-by power
- Monitoring and alarming of control limits
- Calibration, maintenance and preventive maintenance – equipment
- Robust communication systems
- Receiving process for chemicals
    - Certificates of Analysis required for essential chemicals
- Free Chlorine Analyzer auto well shut off limits:
    - Programmed low
    - Programmed high
    - Analog signal error
    - Power loss
    - Analyzer malfunction
- Chlorine Pump alarms
    - Tube leak detection
    - Low speed feedback

    - Motor run/fail
- Each station has the identified reservoir level, POE flow rate and minimum chlorine needed to meet CT
- Manual CT calculations

Response Procedures

- Supply Standard Operating Procedures
- Water Services Emergency Plan procedures
- Facility Setpoint Labels (identify specific ranges and shutdowns for each station)

Critical Control Point (CCP) - Secondary Disinfection

- To ensure the maintenance of a disinfectant residual throughout the distribution system

Hazard Description

Deterioration of Chlorine Residual

- Reduced water flows based on demand, pipe size, etc.
- Occurrence of dead ends and District Metered Areas
- Increased water temperature (temporary mains)
- Reaction with organic matter in watermains
- Water age in the distribution system
- Water age in storage facilities

Critical Control Limit (CCL)

Free Chlorine

Target Residual in the Distribution System:

- >0.20 mg/L (operational minimum)

Reportable under the SDWA:

- 0.05 mg/L

Customer Complaints

- Related to water quality characteristics (taste, odour, colour, other)

Monitoring Process and/or Procedures

- Certified and competent operators
- Sampling, testing and monitoring of control limits, as applicable
- Watermain flushing and swabbing programs

- Installation of blow-offs in dead ends
- Regular samples taken and analyzed for chlorine residual
- Rechlorination at booster stations
- Mixing systems in Speedvale and Clair Towers

Response Procedures

- Supply Standard Operating Procedures
- Distribution Standard Operating Procedures
- Response to customer calls
- Service Request tracking and monitoring
- Repair and system rehabilitation
- Use of appropriately certified and competent contractors and suppliers

Critical Control Point (CCP) - Backflow Prevention

- To prevent cross-contamination that can result from the flowing back of or reversal of the normal direction of flow of water.

Hazard Description

System contamination from negative or reduced pressure

- Lack of backflow prevention device
- Main breaks or blow-outs
- Large services
- Temporary connections
- Firefighting drawdown
- Depressurization from residential usage
- Pipe failure (deterioration)

Critical Control Limit (CCL)

System pressure - Alarm setpoint ranges for pressure:

- 210 to 900 kPa

Consumer complaints

- Related to system pressure or water characteristics (taste, odour, colour, other)

Monitoring Process and/or Procedures

- Backflow Prevention program
- Where possible, implementation of backflow prevention devices and small mains

- Proactive Watermain and substandard service replacement program
- Pressure monitoring though pressure transmitters on hydrants and at stations

Response Procedures

- Distribution Standard Operating Procedures
- Response to customer calls
- Service Request tracking and monitoring
- Water Services Emergency Plan procedures

Appendix B: Summary of Internal and External Audit Plans

Table 32: Summary of Internal and External Audit Plans, 2017-2019

Guelph Water Services Process or Program	2017 Audit Plan	2017 Audit Plan	2018 Audit Plan	2018 Audit Plan	2019 Audit Plan	2019 Audit Plan
Source Water – Source Water Protection Program		X			X	X
Source Water – Outdoor Water Use Program			X	X		
Source Water – Tap Water Promotion, Education & Outreach	X					X
Source Water – Water Smart Business Program				X		
Water Supply – Source & Treated Water Sampling, Testing, Monitoring	X	X	X	X		X
Water Supply – Operational Control: Disinfection, Minimum Storage, SCADA / Security	X	X	X		X	
Water Supply – SCADA Design, Maintenance & Upgrades	X			X		
Water Supply – Water Supply Master Plan Program (new water sources)					X	X
Maintenance – Instrumentation Calibration / Verification	X	X	X	X	X	X

[19] I = Internal Audit

[20] E = External Audit

Guelph Water Services Process or Program	2017 Audit Plan	2017 Audit Plan	2018 Audit Plan	2018 Audit Plan	2019 Audit Plan	2019 Audit Plan
Maintenance – Well Inspection & Rehabilitation Program			X	X		
Maintenance – Preventative & Reactive Maintenance Program	X	X			X	X
Maintenance – Infrastructure (facility and tower) Inspections Program	X			X		
Distribution Construction – Watermain Maintenance & Service Connections Improvement	X	X	X			X
Distribution Construction – Leak Detection & Water Loss Management			X			X
Distribution Construction – No Water Response (e.g. frozen pipes)				X		
Distribution Construction – New Watermain Construction & Reconstruction		X			X	X
Distribution Construction – Temporary Watermains & Service Connections			X	X		
Distribution Appurtenance Maintenance – Hydrant Inspection Program	X	X	X			X
Distribution Appurtenance Maintenance – Watermain Flushing & Swabbing Program	X	X	X	X		
Distribution Appurtenance Maintenance – Valve Turning Program	X				X	X
Distribution Appurtenance Maintenance – DMAs			X			X
Distribution Appurtenance Maintenance – Water Meter Program	X			X		

Guelph Water Services Process or Program	2017 Audit Plan	2017 Audit Plan	2018 Audit Plan	2018 Audit Plan	2019 Audit Plan	2019 Audit Plan
Distribution Appurtenance Maintenance – Infrastructure Locates Program	X	X			X	X
Infrastructure Programs – Tech Services: New Facility Construction			X	X		
Infrastructure Programs – Tech Services: Major Facility Upgrades			X	X		
Infrastructure Programs – Engineering: Infrastructure Planning			X			X
Infrastructure Programs – Engineering: Water Asset Planning & Condition Assessments				X		
Infrastructure Programs – Engineering/Water: Review of Infrastructure and Specifications	X		X			
Infrastructure Programs – Engineering: Infrastructure Reconstruction & Planning			X		X	X
Infrastructure Programs – Engineering: New Construction (new subdivisions)	X					X
Infrastructure Programs – Building Services: Backflow Prevention Program		X				
Management – Compliance Program				X		
Management – Certification Program		X	X			X
Management – Owner Standard of Care			X			X
Management – Customer Services (Administration, Distribution & Supply)		X			X	X

Guelph Water Services Process or Program	2017 Audit Plan	2017 Audit Plan	2018 Audit Plan	2018 Audit Plan	2019 Audit Plan	2019 Audit Plan
Management – Human Resources & Supplier		X		X		X
Management – Communications		X	X	X		X
Management – Review and Provision of Infrastructure		X	X	X		X
QMS – Internal Audit Program		X	X	X	X	X
QMS – Risk Assessments		X	X	X	X	X
QMS – Continual Improvement		X	X	X	X	X
QMS – Emergency Management		X	X	X	X	X
QMS – Management Review		X	X	X	X	X
QMS – Document & Records Control		X	X	X	X	X
QMS – Drinking Water System		X	X	X		

Appendix C: Total Water Pumped and Instantaneous Flows

This section summarizes the amount of water pumped and instantaneous flows in 2018.

Capacity is calculated by comparing the average pumped or flow value against the MDWL allowable volume or PTTW flow. Capacity is representative of the conditions of pumping for that year which may be influenced by other testing programs, maintenance or special operational conditions. Additionally, the actual capacity of the source may not be achievable with current infrastructure. Optimization efforts are included as a component of the Water Supply Master Plan with the intent to match the actual capacity of the water source with the appropriate infrastructure. Section g) Water Supply Capacity describes capacity in further detail.

City of Guelph Water Services – Pumpages to System, January 1 – December 31, 2018

Table 33 below shows the amount of water pumped to system from each facility in 2018 in cubic meters.

Table 33: Pumpages (Discharge) to System, January 1 to December 21, 2018

n/a	Facility Units Regulatory Limit	Burke m^3 6,546	Calico m^3 5,237	Dean m^3 2,300	Downey m^3 5,237	Emma m^3 3,100	Helmar m^3 3,273	Membro m^3 6,050	Paisley Net m^3 13,738	Park m^3 10,300	Queensdale m^3 5,273	University Net m^3 5,108	Water Street m^3 3,400	F.M. Woods m^3 65,000	Total System Discharge m^3 n/a
Jan	**Maximum**	4,985	880	1,507	4,567	2,483	878	0	858	6,439	2,195	2,045	0	34,014	53,613
	Average	4,135	845	1,495	3,767	2,362	845	0	833	3,068	108	1,215	0	29,508	48,182
	Total	**128,176**	**26,210**	**46,358**	**116,782**	**73,230**	**26,183**	**0**	**25,814**	**95,105**	**3,357**	**37,671**	**0**	**914,761**	**1,493,647**
Feb	**Maximum**	4,728	838	1,495	4,613	2,484	859	0	4,513	6,386	1,163	2,105	2,062	31,179	54,883
	Average	1,846	817	1,485	4,562	2,350	849	0	4,088	3,101	1,141	1,134	1,025	28,179	50,577
	Total	**51,687**	**22,877**	**41,577**	**127,741**	**65,801**	**23,781**	**0**	**114,476**	**86,818**	**31,935**	**31,746**	**28,710**	**789,017**	**1,416,165**
Mar	**Maximum**	0	835	1,487	4,598	2,677	855	0	856	8,579	1,183	2,102	2,071	32,003	50,298
	Average	0	776	1,475	4,568	2,407	841	0	820	4,717	1,082	1,364	2,018	26,964	47,032
	Total	**0**	**24,059**	**45,713**	**141,623**	**74,606**	**26,086**	**0**	**25,406**	**146,233**	**33,544**	**42,294**	**62,549**	**835,874**	**1,457,987**
Apr	**Maximum**	0	703	1,478	4,594	2,699	853	0	878	6,413	1,000	2,036	2,083	29,042	49,283
	Average	0	679	1,363	4,567	2,600	845	0	788	4,864	973	1,166	2,006	26,721	46,573
	Total	**0**	**20,370**	**40,900**	**137,010**	**78,013**	**25,364**	**0**	**23,641**	**145,905**	**29,196**	**34,969**	**60,186**	**801,630**	**1,397,184**
May	**Maximum**	0	666	1,472	4,597	2,719	876	1,138	866	9,793	1,024	2,247	2,083	34,353	54,630
	Average	0	661	1,048	4,508	2,638	312	37	855	5,155	966	1,213	1,912	28,211	47,516
	Total	**0**	**20,483**	**32,478**	**139,759**	**81,786**	**9,673**	**1,138**	**26,494**	**159,811**	**29,954**	**37,614**	**59,264**	**874,539**	**1,472,994**
Jun	**Maximum**	0	674	1,361	4,461	2,745	0	2,383	855	8,151	1,035	2,207	2,030	32,126	54,116
	Average	0	664	1,209	4,405	2,636	0	1,650	847	4,833	911	1,324	1,399	29,205	49,082
	Total	**0**	**19,909**	**36,278**	**132,143**	**79,067**	**0**	**49,497**	**25,400**	**145,004**	**27,332**	**39,722**	**41,966**	**876,139**	**1,472,458**
Jul	**Maximum**	0	737	1,358	4,587	2,754	874	2,221	873	8,127	976	2,243	1,947	34,034	56,909
	Average	0	659	1,328	4,303	2,597	393	2,111	712	4,645	919	1,495	1,367	29,193	49,723
	Total	**0**	**20,427**	**41,169**	**133,403**	**80,494**	**12,179**	**65,447**	**22,083**	**144,003**	**28,493**	**46,350**	**42,386**	**904,987**	**1,541,420**
Aug	**Maximum**	0	0	1,352	4,623	2,704	887	2,068	865	7,836	915	2,244	0	34,002	52,377

n/a	Facility Units Regulatory Limit	Burke m^3 6,546	Calico m^3 5,237	Dean m^3 2,300	Downey m^3 5,237	Emma m^3 3,100	Helmar m^3 3,273	Membro m^3 6,050	Paisley Net m^3 13,738	Park m^3 10,300	Queensdale m^3 5,273	University Net m^3 5,108	Water Street m^3 3,400	F.M. Woods m^3 65,000	Total System Discharge m^3 n/a
Aug	**Average**	0	0	1,309	4,560	2,486	796	168	838	5,271	220	1,564	0	30,514	47,727
	Total	**0**	**0**	**40,580**	**141,353**	**77,081**	**24,680**	**5,216**	**25,970**	**163,406**	**6,808**	**48,495**	**0**	**945,937**	**1,479,526**
Sept	**Maximum**	0	0	1,351	4,595	2,656	827	0	858	9,037	911	2,287	1,997	38,428	55,181
	Average	0	0	1,201	3,024	1,424	817	0	848	6,026	820	1,381	583	32,766	48,890
	Total	**0**	**0**	**36,022**	**90,717**	**42,726**	**24,513**	**0**	**25,434**	**180,776**	**24,601**	**41,425**	**17,497**	**982,983**	**1,466,695**
Oct	**Maximum**	0	0	1,348	4,660	0	827	0	851	6,558	959	2,296	2,000	36,854	50,827
	Average	0	0	1,276	3,368	0	817	0	847	4,882	892	1,704	1,918	30,553	46,256
	Total	**0**	**0**	**39,543**	**104,415**	**0**	**25,332**	**0**	**26,250**	**151,338**	**27,644**	**52,820**	**59,453**	**947,151**	**1,433,945**
Nov	**Maximum**	0	0	1,401	4,765	2,588	802	2,382	879	6,203	950	2,299	2,034	34,869	52,332
	Average	0	0	918	4,696	1,872	762	466	840	4,908	840	1,375	598	28,031	45,305
	Total	**0**	**0**	**27,544**	**140,869**	**56,169**	**22,859**	**13,975**	**25,192**	**147,250**	**25,204**	**41,242**	**17,933**	**840,926**	**1,359,163**
Dec	**Maximum**	0	0	1,351	4,704	2,550	796	2,241	866	4,864	837	2,310	1,960	27,777	47,528
	Average	0	0	1,348	4,641	2,404	756	2,163	859	3,782	791	372	1,888	23,830	42,833
	Total	**0**	**0**	**41,774**	**143,869**	**74,537**	**23,435**	**67,041**	**26,632**	**117,233**	**24,518**	**11,526**	**58,519**	**738,730**	**1,327,813**
2018 Year	**Maximum**	4,135	1,351	4,704	4,765	2,754	2,241	2,382	1,052	9,037	2,310	2,299	27,777	47,528	56,909
	Average	809	438	1,348	4,335	2,216	722	702	1,147	6,273	1,007	1,719	1,390	30,634	49,796
	Total	**179,862**	**154,335**	**469,935**	**1,549,684**	**783,511**	**244,085**	**202,314**	**392,792**	**1,682,880**	**292,587**	**465,873**	**448,463**	**10,452,676**	**17,318,997**
	Average Capacity	**8%**	**8%**	**56%**	**81%**	**69%**	**20%**	**9%**	**n/a**	**45%**	**15%**	**n/a**	**36%**	**44%**	**n/a**

City of Guelph Water Services – Permit to Take Water Pumpages, January 1 – December 31, 2018

Table 34 and Table 35 presented below, outline the Permit to Take Water Pumpages for 2018. Table 34 includes the following sources: Admiral Well, Arkell Well 1, Arkell Well 6, Arkell Well 7, Arkell Well 8, Arkell Well 14, Arkell Well 15, Arkell Recharge Pump, Arkell Glen Collector System, Burke Well, Calico Well, Carter Well 1 and 2 and Clythe Well. Table 35 includes the following sources: Dean Well, Downey Well, Edinburgh Well, Emma Well, Helmar Well, Membro Well, Paisley Well, Park Wells 1 and 2, Queensdale Well, Sacco Well, Smallfield Well, University Well and Water Street Well.

Table 34: City of Guelph Permit to Take Water Pumpages, 2018

	Facility	Admiral Well	Arkell Well #1	Arkell Well #6	Arkell Well #7	Arkell Well #8	Arkell Well #14	Arkell Well #15	Arkell Wellfield (#6,7,8,14,15) Total	Arkell - Recharge Pump	Arkell Glen Collector System	Burke Well	Calico Well	Carter Wells #1and #2	Clythe Well
	Units	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3
	Regulatory Limit	N/O[21]	3,273	9,600	9,600	9,600	9,600	9,600	28,800	9,092	25,000	6,546	5,237	6,547	N/O
Jan	Maximum	N/O	689	7,445	7,433	6,510	6,794	5,628	28,700	0	5,534	3,773	885	0	N/O
	Average	N/O	59	6,063	6,613	3,130	6,166	2,325	24,297	0	5,247	3,448	837	0	N/O
	Total	**N/O**	**1,818**	**187,963**	**205,002**	**97,019**	**191,150**	**72,066**	**753,199**	**0**	**162,644**	**106,893**	**25,956**	**0**	**N/O**
Feb	Maximum	N/O	255	7,534	7,746	3,685	7,574	6,253	26,218	0	5,681	4,662	827	2,831	N/O
	Average	N/O	22	6,216	6,382	1,652	5,950	2,895	23,093	0	5,045	1,815	801	101	N/O
	Total	**N/O**	**616**	**174,041**	**178,684**	**46,248**	**166,586**	**81,046**	**646,606**	**0**	**141,263**	**50,832**	**22,442**	**2,831**	**N/O**
Mar	Maximum	N/O	136	7,433	7,641	5,210	7,688	6,814	27,466	0	8,015	0	842	5,262	N/O
	Average	N/O	15	6,351	6,646	1,083	6,771	3,158	24,008	0	6,519	0	766	4,873	N/O
	Total	**N/O**	**475**	**196,868**	**206,021**	**33,574**	**209,898**	**97,883**	**744,244**	**0**	**202,088**	**0**	**23,760**	**151,066**	**N/O**
Apr	Maximum	N/O	746	6,909	6,612	1,276	7,842	5,676	25,962	8,443	12,117	0	715	5,216	N/O
	Average	N/O	56	5,336	6,144	248	7,621	4,239	23,588	1,812	9,284	0	687	4,282	N/O
	Total	**N/O**	**1,666**	**160,078**	**184,313**	**7,445**	**228,637**	**127,165**	**707,638**	**54,361**	**278,535**	**0**	**20,624**	**128,449**	**N/O**

[21] N/O – not operational

	Facility	Admiral Well	Arkell Well #1	Arkell Well #6	Arkell Well #7	Arkell Well #8	Arkell Well #14	Arkell Well #15	Arkell Wellfield (#6,7,8,14,15) Total	Arkell - Recharge Pump	Arkell Glen Collector System	Burke Well	Calico Well	Carter Wells #1and #2	Clythe Well
	Units	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3
	Regulatory Limit	N/O[21]	3,273	9,600	9,600	9,600	9,600	9,600	28,800	9,092	25,000	6,546	5,237	6,547	N/O
May	Maximum	N/O	575	6,054	6,660	2,808	7,864	3,771	23,485	8,529	16,876	0	681	6,415	N/O
	Average	N/O	41	4,287	6,458	128	7,541	1,625	20,039	8,090	14,549	0	669	4,430	N/O
	Total	**N/O**	**1,276**	**132,894**	**200,183**	**3,971**	**233,773**	**50,379**	**621,201**	**250,790**	**451,009**	**0**	**20,727**	**137,326**	**N/O**
Jun	Maximum	N/O	280	6,677	5,972	667	7,757	5,097	21,480	7,964	18,282	0	678	3,049.14	N/O
	Average	N/O	26	6,262	2,759	46	7,207	1,535	17,808	7,612	17,756	0	667	2,955.61	N/O
	Total	**N/O**	**773**	**187,874**	**82,765**	**1,369**	**216,195**	**46,041**	**534,245**	**228,361**	**532,692**	**0**	**20,007**	**88,668.38**	**N/O**
Jul	Maximum	N/O	272	7,643	6,529	1,479	7,713	4,133	22,658	7,775	18,225	0	742	6,091	N/O
	Average	N/O	36	3,126	6,200	221	6,896	1,579	18,023	6,719	17,440	0	657	1,789	N/O
	Total	**N/O**	**1,125**	**96,905**	**192,199**	**6,861**	**213,788**	**48,949**	**558,703**	**208,292**	**540,647**	**0**	**20,366**	**55,469**	**N/O**
Aug	Maximum	N/O	162	7,631	6,390	7,098	7,697	6,778	22,404	7,660	18,826	0	0	6,029	N/O
	Average	N/O	16	5,579	4,703	977	4,889	2,459	18,607	6,340	16,774	0	0	5,999	N/O
	Total	**N/O**	**501**	**172,946**	**145,786**	**30,294**	**151,571**	**76,220**	**576,818**	**196,530**	**519,991**	**0**	**0**	**185,963**	**N/O**
Sep	Maximum	N/O	689	7,639	7,354	6,740	5,839	7,407	27,478	7,549	18,621	0	0	5,972	N/O
	Average	N/O	61	6,926	5,953	1,656	2,424	5,861	22,821	5,453	14,007	0	0	4,180	N/O
	Total	**N/O**	**1,815**	**207,789**	**178,599**	**49,681**	**72,722**	**175,826**	**684,618**	**163,604**	**420,208**	**0**	**0**	**125,403**	**N/O**
Oct	Maximum	N/O	729	7,378	7,578	5,097	3,948	7,505	26,776	7,594	10,548	0	0	7,398	N/O
	Average	N/O	83	5,074	7,404	1,070	906	6,298	20,751	5,376	9,906	0	0	6,820	N/O

	Facility	Admiral Well	Arkell Well #1	Arkell Well #6	Arkell Well #7	Arkell Well #8	Arkell Well #14	Arkell Well #15	Arkell Wellfield (#6,7,8,14,15) Total	Arkell - Recharge Pump	Arkell Glen Collector System	Burke Well	Calico Well	Carter Wells #1and #2	Clythe Well
	Units	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3
	Regulatory Limit	**N/O[21]**	**3,273**	**9,600**	**9,600**	**9,600**	**9,600**	**9,600**	**28,800**	**9,092**	**25,000**	**6,546**	**5,237**	**6,547**	**N/O**
	Total	**N/O**	**2,561**	**157,279**	**229,509**	**33,157**	**28,096**	**195,249**	**643,291**	**166,649**	**307,075**	**0**	**0**	**211,432**	**N/O**
	Maximum	N/O	313	6,829	7,918	5,041	0	7,174	25,697	7,824	9,956	0	0	7,711	N/O
Nov	**Average**	N/O	38	4,796	7,500	1,886	0	5,141	19,323	3,340	8,903	0	0	5,640	N/O
	Total	**N/O**	**1,131**	**143,893**	**224,992**	**56,568**	**0**	**154,230**	**579,684**	**100,202**	**267,079**	**0**	**0**	**169,197**	**N/O**
Dec	**Maximum**	N/O	346	4,984	7,585	3,311	0	7,372	21,393	0	7,053	0	0	0	N/O
	Average	N/O	68	3,614	7,532	869	0	6,127	18,143	0	5,696	0	0	0	N/O
	Total	**N/O**	**2,100**	**112,042**	**233,504**	**26,942**	**0**	**189,935**	**562,423**	**0**	**176,582**	**0**	**0**	**0**	**N/O**
2018 Year	**Maximum**	N/O	729	7,643	7,918	7,098	7,757	7,505	27,478	8,090	18,826	3,448	837	7,711	N/O
	Average	N/O	227	5,896	6,512	2,184	5,007	4,762	22,276	4,318	11,559	703	439	3,926	N/O
	Total	**N/O**	**15,857**	**1,930,572**	**2,261,559**	**393,131**	**1,712,418**	**1,314,989**	**7,612,668**	**1,368,789**	**3,999,810**	**157,725**	**153,881**	**1,255,805**	**N/O**
	Average Pumped	N/O	1%	55%	65%	11%	49%	39%	72%	13%	38%	7%	8%	53%	N/O

Table 35: City of Guelph Permit to Take Water Pumpages, 2018 - Continued

	Facility	Dean Well	Downey Well	Edinburgh Well	Emma Well	Helmar Well	Membro Well	Paisley Well	Park Wells #1 and #2	Queensdale Well	Sacco Well	Smallfield Well	University Well	Water Street Well
	Units	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3
	Regulatory Limit	2,300	5,273	N/O	3,100	3,273	6,050	3,200	10,300	5,237	N/O	N/O	3,300	3,400
Jan	Maximum	1,515	4,666	N/O	2,483	869	0	858	6,375	1,393	N/O	N/O	2,045	0
	Average	1,475	3,867	N/O	2,362	828	0	833	3,014	218	N/O	N/O	1,215	0
	Total	**45,715**	**119,873**	**N/O**	**73,230**	**25,660**	**0**	**25,814**	**93,440**	**6,757**	**N/O**	**N/O**	**37,671**	**0**
Feb	Maximum	1,512	4,715	N/O	2,484	839	0	857	6,261	1,215	N/O	N/O	2,105	2,062
	Average	1,468	4,662	N/O	2,350	832	0	849	3,031	1,152	N/O	N/O	1,134	1,025
	Total	**41,101**	**130,537**	**N/O**	**65,801**	**23,304**	**0**	**23,785**	**84,860**	**32,264**	**N/O**	**N/O**	**31,746**	**28,710**
Mar	Maximum	1,502	4,700	N/O	2,677	847	0	856	8,359	1,266	N/O	N/O	2,102	2,071
	Average	1,465	4,670	N/O	2,407	823	0	820	4,672	1,103	N/O	N/O	1,364	2,018
	Total	**45,424**	**144,774**	**N/O**	**74,606**	**25,522**	**0**	**25,406**	**144,825**	**34,194**	**N/O**	**N/O**	**42,294**	**62,549**
Apr	Maximum	1,422	4,698	N/O	2,699	838	248	878	6,356	1,046	N/O	N/O	2,036	2,083
	Average	1,288	4,669	N/O	2,600	826	8	788	4,804	990	N/O	N/O	1,166	2,006
	Total	**38,632**	**140,059**	**N/O**	**78,013**	**24,789**	**252**	**23,641**	**144,121**	**29,690**	**N/O**	**N/O**	**34,969**	**60,186**
May	Maximum	1,452	4,700	N/O	2,719	853	1,138	866	9,696	1,077	N/O	N/O	2,247	2,083
	Average	1,028	4,610	N/O	2,638	306	37	855	5,096	986	N/O	N/O	1,213	1,912
	Total	**31,867**	**142,923**	**N/O**	**81,786**	**9,474**	**1,138**	**26,494**	**157,989**	**30,565**	**N/O**	**N/O**	**37,614**	**59,264**
Jun	Maximum	1,383	4,564	N/O	2,745	0	2,343	855	8,027	1,059	N/O	N/O	2,207	2,030
	Average	1,210	4,508	N/O	2,636	0	1,630	847	4,785	918	N/O	N/O	1,324	1,399

	Facility	Dean Well	Downey Well	Edinburgh Well	Emma Well	Helmar Well	Membro Well	Paisley Well	Park Wells #1 and #2	Queensdale Well	Sacco Well	Smallfield Well	University Well	Water Street Well
	Units	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3
	Regulatory Limit	2,300	5,273	N/O	3,100	3,273	6,050	3,200	10,300	5,237	N/O	N/O	3,300	3,400
	Total	**36,300**	**135,231**	**N/O**	**79,067**	**0**	**48,905**	**25,400**	**143,538**	**27,530**	**N/O**	**N/O**	**39,722**	**41,966**
Jul	**Maximum**	1,384	4,690	N/O	2,754	872	2,206	873	7,956	1,011	N/O	N/O	2,243	1,947
	Average	1,326	4,406	N/O	2,597	392	2,082	712	4,474	892	N/O	N/O	1,495	1,367
	Total	**41,103**	**136,577**	**N/O**	**80,494**	**12,147**	**64,557**	**22,083**	**138,701**	**27,660**	**N/O**	**N/O**	**46,350**	**42,386**
Aug	**Maximum**	1,403	4,729	N/O	2,704	871	2,447	865	7,734	891	N/O	N/O	2,244	0
	Average	1,308	4,664	N/O	2,486	786	2,083	838	5,218	202	N/O	N/O	1,564	0
	Total	**40,536**	**144,585**	**N/O**	**77,081**	**24,352**	**64,564**	**25,970**	**161,761**	**6,261**	**N/O**	**N/O**	**48,495**	**0**
Sep	**Maximum**	1,381	4,702	N/O	2,656	818	2,404	858	8,891	928	N/O	N/O	2,287	1,997
	Average	1,188	3,093	N/O	1,424	798	522	848	5,962	801	N/O	N/O	1,381	583
	Total	**35,654**	**92,799**	**N/O**	**42,726**	**23,929**	**15,663**	**25,434**	**178,861**	**24,036**	**N/O**	**N/O**	**41,425**	**17,497**
Oct	**Maximum**	1,365	4,769	N/O	0	827	0	851	6,403	966	N/O	N/O	2,296	2,000
	Average	1,262	3,446	N/O	0	798	0	847	4,808	894	N/O	N/O	1,704	1,918
	Total	**39,129**	**106,837**	**N/O**	**0**	**24,746**	**0**	**26,250**	**149,056**	**27,701**	**N/O**	**N/O**	**52,820**	**59,453**
Nov	**Maximum**	1,396	4,732	N/O	2,588	784	2,358	879	6,497	939	N/O	N/O	2,299	2,034
	Average	916	4,806	N/O	1,872	745	757	840	4,931	835	N/O	N/O	1,375	598
	Total	**27,487**	**144,193**	**N/O**	**56,169**	**22,360**	**22,717**	**25,192**	**147,927**	**25,055**	**N/O**	**N/O**	**41,242**	**17,933**
Dec	**Maximum**	1,390	4,815	N/O	2,550	794	2,212	866	4,802	875	N/O	N/O	2,310	1,960

	Facility	Dean Well	Downey Well	Edinburgh Well	Emma Well	Helmar Well	Membro Well	Paisley Well	Park Wells #1 and #2	Queensdale Well	Sacco Well	Smallfield Well	University Well	Water Street Well
	Units	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3
	Regulatory Limit	2,300	5,273	N/O	3,100	3,273	6,050	3,200	10,300	5,237	N/O	N/O	3,300	3,400
	Average	1,348	4,751	N/O	2,404	741	2,134	859	3,747	795	N/O	N/O	372	1,888
	Total	**41,800**	**147,286**	**N/O**	**74,537**	**22,985**	**66,139**	**26,632**	**116,143**	**24,649**	**N/O**	**N/O**	**11,526**	**58,519**
2018 Year	**Maximum**	1,475	4,815	N/O	2,754	872	2,447	879	8,891	1,152	N/O	N/O	2,310	2,034
	Average	1,330	4,429	N/O	2,207	709	883	842	5,914	945	N/O	N/O	1,646	1,338
	Total	**464,748**	**1,585,674**	**N/O**	**783,511**	**239,268**	**283,936**	**302,100**	**1,661,223**	**296,363**	**N/O**	**N/O**	**465,873**	**448,463**
	Average Pumped	55%	83%	N/O	66%	20%	13%	26%	87%	16%	N/O	N/O	39%	36%

City of Guelph Water Services – Instantaneous Flows Summary (PTTW), January 1 – December 31, 2018

Table 36 and Table 37 presented below, outline the Instantaneous Flow Summary for 2018. Table 36 includes the following sources: Admiral Well, Arkell Well 1, Arkell Well 6, Arkell Well 7, Arkell Well 8, Arkell Well 14, Arkell Well 15, Arkell Recharge Pump, Arkell Glen Collector System, Burke Well, Calico Well, Carter Well 1 and 2 and Clythe Well. Table 37 includes the following sources: Dean Well, Downey Well, Edinburgh Well, Emma Well, Helmar Well, Membro Well, Paisley Well, Park Wells 1 and 2, Queensdale Well, Sacco Well, Smallfield Well, University Well and Water Street Well.

Table 36: City of Guelph - Instantaneous Flow Summary, 2018

	Facility	Admiral Well	Arkell Well #1	Arkell Well #6	Arkell Well #7	Arkell Well #8	Arkell Well #14	Arkell Well #15	Arkell Wellfield (#6,7,8,14,15) Total	Arkell - Recharge Pump	Arkell Glen Collector System	Burke Well	Calico Well	Carter Wells #1and #2	Clythe Well
	Units	L/s	L/s	L/s	L/s	L/s	L/s	L/s	L/s	L/s	L/s	L/s	L/s	L/s	L/s
	Regulatory Limit	néa	37.9	111.0	111.0	111.0	111.0	111.0	n/a	157.8	290.0	83.7	60.6	90.9	n/a
January	**Maximum**	N/O	0.7	70.2	76.7	36.3	71.4	26.9	282.0	0.0	60.8	47.1	9.8	0.0	N/O
	Average	N/O	12.6	89.4	90.8	82.1	90.7	85.3	450.8	0.0	64.1	66.0	12.2	0.0	N/O
February	**Maximum**	N/O	0.3	74.3	71.8	19.1	68.8	33.5	267.7	0.0	58.9	21.1	9.3	1.2	N/O
	Average	N/O	12.8	92.2	91.0	85.7	93.0	87.5	462.2	0.0	68.3	66.2	12.4	59.7	N/O
March	**Maximum**	N/O	0.2	73.5	77.1	12.6	78.5	36.6	278.3	0.0	74.0	47.1	9.8	56.5	N/O
	Average	N/O	13.0	90.3	93.2	83.1	92.9	91.9	464.4	0.0	97.3	66.0	12.2	61.2	N/O
April	**Maximum**	N/O	0.6	60.9	70.2	2.8	86.9	48.3	269.8	21.0	106.0	0.0	9.1	48.8	N/O
	Average	N/O	13.2	89.9	77.6	84.1	93.2	95.3	453.3	146.0	143.8	0.0	12.5	60.8	N/O
May	**Maximum**	N/O	0.5	74.8	49.8	1.5	87.3	18.8	232.6	93.7	172.1	0.0	8.9	51.3	N/O
	Average	N/O	13.2	78.6	90.9	86.3	92.4	95.1	456.5	99.4	204.9	0.0	12.5	74.7	N/O
June	**Maximum**	N/O	0.3	32.0	72.4	0.5	83.5	17.6	206.3	88.2	206.1	0.0	8.8	0.0	N/O
	Average	N/O	13.1	91.8	78.3	81.9	91.3	94.5	451.1	93.0	215.6	0.0	12.4	0.0	N/O
July	**Maximum**	N/O	0.4	36.3	71.8	2.5	79.8	18.3	209.1	77.7	203.1	0.0	8.8	17.0	N/O
	Average	N/O	13.2	89.9	76.5	81.7	91.0	93.7	445.9	90.6	221.6	0.0	17.9	71.1	N/O
August	**Maximum**	N/O	0.2	64.8	54.6	11.3	56.6	28.5	216.0	73.3	194.5	0.0	0.0	69.4	N/O

	Facility	Admiral Well	Arkell Well #1	Arkell Well #6	Arkell Well #7	Arkell Well #8	Arkell Well #14	Arkell Well #15	Arkell Wellfield (#6,7,8,14,15) Total	Arkell - Recharge Pump	Arkell Glen Collector System	Burke Well	Calico Well	Carter Wells #1and #2	Clythe Well
	Units	L/s	L/s	L/s	L/s	L/s	L/s	L/s	L/s	L/s	L/s	L/s	L/s	L/s	L/s
	Regulatory Limit	néa	37.9	111.0	111.0	111.0	111.0	111.0	n/a	157.8	290.0	83.7	60.6	90.9	n/a
	Average	N/O	14.3	90.8	78.0	84.4	91.0	94.2	452.6	89.4	221.4	0.0	0.0	69.9	N/O
September	**Maximum**	N/O	0.7	80.0	68.8	19.2	28.1	67.8	264.6	63.1	155.5	0.0	0.0	48.4	N/O
	Average	N/O	13.0	90.3	88.1	81.4	88.3	93.0	454.3	88.1	229.4	0.0	0.0	69.3	N/O
October	**Maximum**	N/O	1.0	58.7	85.5	12.3	10.5	72.9	241.0	62.2	113.9	0.0	0.0	79.0	N/O
	Average	N/O	13.0	89.9	88.7	82.0	88.0	92.6	454.1	88.7	124.8	0.0	0.0	88.0	N/O
November	**Maximum**	N/O	0.4	55.6	86.7	21.8	0.0	59.4	224.0	38.6	101.3	0.0	0.0	65.1	N/O
	Average	N/O	13.2	90.5	89.2	84.6	0.0	94.1	371.6	89.2	117.3	0.0	0.0	86.1	N/O
December	**Maximum**	N/O	0.8	41.7	87.3	10.1	0.0	70.9	210.8	0.0	65.9	0.0	0.0	0.0	N/O
	Average	N/O	13.1	90.6	89.3	86.8	0.0	93.6	373.4	0.0	83.5	0.0	0.0	0.0	N/O

Table 37: Instantaneous Flow Summary, 2018 - Continued

	Facility Units Regulatory Limit	Dean Well L/s 39.9	Downey Well L/s 90.9	Edinburgh Well L/s n/a	Emma Well L/s 40.9	Helmar Well L/s 37.9	Membro Well L/s 105.0	Paisley Well L/s 42.0	Park Wells #1 and #2 L/s 127.2	Queensdale Well L/s 60.6	Sacco Well L/s n/a	Smallfield Well L/s n/a	University Well L/s 57.3	Water Street Well L/s 59.0
January	**Maximum**	17.0	30.6	N/O	30.6	9.7	0.0	9.6	34.9	2.0	N/O	N/O	14.1	0.0
	Average	20.8	59.7	N/O	59.7	13.9	0.0	10.6	110.3	19.6	N/O	N/O	25.0	0.0
February	**Maximum**	16.9	45.2	N/O	27.3	9.8	0.0	9.8	35.1	13.3	N/O	N/O	13.1	11.9
	Average	20.2	57.1	N/O	37.5	14.0	0.0	10.0	111.3	17.6	N/O	N/O	25.5	32.4
March	**Maximum**	17.0	30.6	N/O	30.6	9.7	0.0	9.6	34.9	2.0	N/O	N/O	14.1	0.0
	Average	20.8	59.7	N/O	59.7	13.9	0.0	10.6	110.3	19.6	N/O	N/O	25.0	0.0
April	**Maximum**	14.9	55.0	N/O	30.1	9.7	0.1	9.1	42.4	13.1	N/O	N/O	13.1	22.9
	Average	26.3	57.3	N/O	33.0	13.9	32.1	10.8	122.2	14.9	N/O	N/O	27.0	33.6
May	**Maximum**	8.3	54.3	N/O	30.5	3.6	0.5	9.9	60.3	13.1	N/O	N/O	14.0	22.1
	Average	31.8	57.4	N/O	32.0	14.1	33.1	10.7	123.7	15.8	N/O	N/O	27.1	37.6
June	**Maximum**	13.9	53.1	N/O	30.5	0.0	18.8	9.8	55.4	12.4	N/O	N/O	15.3	16.2
	Average	20.4	55.3	N/O	32.8	0.0	30.9	10.9	123.1	16.9	N/O	N/O	27.2	31.8
July	**Maximum**	15.3	51.9	N/O	30.0	4.6	24.1	8.3	53.3	12.0	N/O	N/O	17.3	15.8
	Average	20.3	60.4	N/O	33.2	15.6	29.5	10.4	117.9	15.4	N/O	N/O	27.5	30.1
August	**Maximum**	15.1	55.0	N/O	28.9	9.2	24.1	9.7	60.2	2.7	N/O	N/O	18.1	0.0
	Average	20.3	57.1	N/O	32.2	14.4	30.2	10.4	115.3	19.7	N/O	N/O	27.2	0.0
September	**Maximum**	14.3	36.5	N/O	16.6	9.4	6.0	9.8	68.8	10.8	N/O	N/O	16.0	6.8
	Average	18.9	58.6	N/O	30.8	12.6	27.9	10.0	113.1	15.9	N/O	N/O	27.4	30.0
October	**Maximum**	14.0	40.6	N/O	0.0	9.4	0.0	9.8	55.7	12.0	N/O	N/O	19.7	22.2

	Facility Units Regulatory Limit	Dean Well L/s 39.9	Downey Well L/s 90.9	Edinburgh Well L/s n/a	Emma Well L/s 40.9	Helmar Well L/s 37.9	Membro Well L/s 105.0	Paisley Well L/s 42.0	Park Wells #1 and #2 L/s 127.2	Queensdale Well L/s 60.6	Sacco Well L/s n/a	Smallfield Well L/s n/a	University Well L/s 57.3	Water Street Well L/s 59.0
	Average	19.7	58.1	N/O	31.6	12.3	0.0	10.4	116.7	14.5	N/O	N/O	27.4	30.4
November	**Maximum**	7.8	56.6	N/O	21.7	8.7	8.8	9.7	56.1	11.3	N/O	N/O	15.9	6.8
	Average	19.7	58.8	N/O	32.1	12.1	32.0	10.3	106.5	14.6	N/O	N/O	27.7	28.7
December	**Maximum**	15.5	56.2	N/O	27.9	8.7	24.7	9.9	43.6	11.1	N/O	N/O	4.3	22.0
	Average	19.7	59.5	N/O	31.3	15.2	30.3	11.3	61.6	15.2	N/O	N/O	36.3	30.9

Appendix D: Treated Water Quality Statistics

O. Reg. 170/03 Schedule 23, 13-2b – "Three Year" Results Summary (Jan. 1 – Dec. 31, 2016)

Table 38: O. Reg. 170/03 Schedule 23, 13-2b - "Three Year" Results Summary

Parameter	ODWQS MAC mg/L	½ MAC mg/L	Total Samples	Samples Above MDL	# Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Antimony	0.014	0.007	26	10	0	< 0.0005	0.0013	0.00085
Arsenic	0.025	0.0125	26	6	0	< 0.001	0.0033	0.0022
Barium	1.0	0.5	26	26	0	0.035	0.096	0.066
Boron	5.0	2.5	26	26	0	0.013	0.048	0.030
Cadmium	0.005	0.0025	26	6	0	< 0.0001	0.00016	0.00013
Chromium	0.05	0.025	26	0	0	< 0.005	< 0.005	n/a
Mercury	0.001	0.0005	13	0	0	< 0.0001	< 0.0001	n/a
Selenium	0.01	0.005	26	0	0	< 0.002	< 0.002	n/a
Uranium	0.02	0.01	26	24	0	< 0.0001	0.0024	0.00124

O. Reg. 170/03 Schedule 24, 13-4b – "Three Year" Results Summary (Jan. 1 – Dec. 31, 2016)

Table 39: O. Reg. 170/03 Schedule 24, 13-4b - "Three Year" Results Summary

Parameter	ODWQS MAC mg/L	½ MAC mg/L	Total Samples	Samples Above MDL	# Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Alachlor	0.005	0.0025	13	0	0	< 0.0005	< 0.0005	n/a
Atrazine + N-dealkylated metabolites	0.005	0.0025	13	0	0	< 0.001	< 0.001	n/a
Azinphos-methyl	0.02	0.01	13	0	0	< 0.002	< 0.002	n/a
Benzene	0.005	0.0025	71	0	0	< 0.0001	< 0.0001	n/a
Benzo(a)pyrene	0.00001	0.000005	13	0	0	< 0.000009	< 0.000009	n/a
Bromoxynil	0.005	0.0025	13	0	0	< 0.0005	< 0.0005	n/a
Carbaryl	0.09	0.045	13	0	0	< 0.005	< 0.005	n/a
Carbofuran	0.09	0.045	13	0	0	< 0.005	< 0.005	n/a
Carbon Tetrachloride	0.005	0.0025	71	0	0	< 0.0001	< 0.0001	n/a
Chlorobenzene	0.08	0.04	71	0	0	< 0.0001	< 0.0001	n/a
Chlorpyrifos	0.09	0.045	13	0	0	< 0.001	< 0.001	n/a

Parameter	ODWQS MAC mg/L	½ MAC mg/L	Total Samples	Samples Above MDL	# Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Diazinon	0.02	0.01	13	0	0	< 0.001	< 0.001	n/a
Dicamba	0.12	0.06	13	0	0	< 0.001	< 0.001	n/a
1,2-Dichlorobenzene	0.2	0.1	71	0	0	< 0.0002	< 0.0002	n/a
1,4-Dichlorobenzene	0.005	0.0025	71	0	0	< 0.0002	< 0.0002	n/a
1,2-Dichloroethane	0.005	0.0025	71	0	0	< 0.0002	< 0.0002	n/a
1,1-Dichloroethylene (vinylidene chloride)	0.014	0.007	71	0	0	< 0.0001	< 0.0001	n/a
Dichloromethane	0.05	0.025	71	0	0	< 0.0005	< 0.0005	n/a
2,4-Dichlorophenol	0.9	0.45	13	0	0	< 0.0005	< 0.0005	n/a
2,4-Dichlorophenoxy acetic acid (2,4-D)	0.1	0.05	13	0	0	< 0.001	< 0.001	n/a
Diclofop-methyl	0.009	0.0045	13	0	0	< 0.0009	< 0.0009	n/a
Dimethoate	0.02	0.01	13	0	0	< 0.003	< 0.003	n/a
Diquat	0.07	0.0035	14	0	0	< 0.007	< 0.007	n/a
Diuron	0.15	0.075	13	0	0	< 0.01	< 0.01	n/a

Parameter	ODWQS MAC mg/L	½ MAC mg/L	Total Samples	Samples Above MDL	# Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Glyphosate	0.28	0.14	13	0	0	< 0.002	< 0.002	n/a
Malathion	0.19	0.095	13	0	0	< 0.005	< 0.005	n/a
MCPA	0.05	0.025	13	0	0	< 0.00012	< 0.00012	n/a
Metolachlor	0.05	0.025	13	0	0	< 0.0005	< 0.0005	n/a
Metribuzin	0.08	0.04	13	0	0	< 0.005	< 0.005	n/a
Paraquat	0.01	0.005	14	0	0	< 0.001	< 0.001	n/a
Pentachlorophenol	0.06	0.03	13	0	0	< 0.0005	< 0.0005	n/a
Phorate	0.002	0.001	13	0	0	< 0.0005	< 0.0005	n/a
Picloram	0.19	0.095	13	0	0	< 0.005	< 0.005	n/a
Polychlorinated Biphenyls (PCB)	0.003	0.0015	13	0	0	< 0.00005	< 0.00005	n/a
Prometryne	0.001	0.0005	13	0	0	< 0.0003	< 0.0003	n/a
Simazine	0.01	0.005	13	0	0	< 0.001	< 0.001	n/a
Terbufos	0.001	0.0005	13	0	0	< 0.0005	< 0.0005	n/a

Parameter	ODWQS MAC mg/L	½ MAC mg/L	Total Samples	Samples Above MDL	# Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Tetrachloroethylene (perchloroethylene)	0.03	0.015	71	2	0	< 0.0001	0.00011	0.00011
2,3,4,6-Tetrachlorophenol	0.1	0.05	13	0	0	< 0.0005	< 0.0005	n/a
Triallate	0.23	0.115	13	0	0	< 0.001	< 0.001	n/a
Trichloroethylene	0.005	0.0025	71	30	0	< 0.0001	0.00137	0.00055
2,4,6-Trichlorophenol	0.005	0.0025	13	0	0	< 0.0005	< 0.0005	n/a
Trifluralin	0.045	0.0225	13	0	0	< 0.001	< 0.001	n/a
Vinyl Chloride	0.002	0.001	71	0	0	< 0.0002	< 0.0002	n/a

Operational VOC Scan Results Summary (Jan. 1 – Dec. 31, 2017)

Table 40: Operational VOC Scan Results Summary

Parameter	ODWQS MAC mg/L	½ MAC mg/L	Total Samples	Samples Above MDL	# Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
1,1-Dichloroethane	n/a	n/a	171	0	n/a	< 0.0001	< 0.0001	n/a
1,1-Dichloroethylene	0.014	0.007	176	0	0	< 0.0001	< 0.0001	n/a
1,1,1-Trichloroethane	n/a	n/a	171	0	n/a	< 0.0001	< 0.0001	n/a
1,1,2-Trichloroethane	n/a	n/a	171	0	n/a	< 0.0002	< 0.0002	n/a
1,1,2,2-Tetrachloroethane	n/a	n/a	171	0	n/a	< 0.0001	< 0.0001	n/a
Ethylene Dibromide	n/a	n/a	171	0	n/a	< 0.0002	< 0.0002	n/a
1,2-Dichlorobenzene	0.2	0.1	176	0	0	< 0.0002	< 0.0002	n/a
Cis-1,2-Dichloroethylene	n/a	n/a	171	72	n/a	< 0.0001	0.00394	0.00178

Parameter	ODWQS MAC mg/L	½ MAC mg/L	Total Samples	Samples Above MDL	# Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Trans-1,2-Dichloroethylene	n/a	n/a	171	2	n/a	< 0.0001	0.00018	0.00016
1,2-Dichloropropane	n/a	n/a	171	0	n/a	< 0.0001	< 0.0001	n/a
1,3-Dichlorobenzene	n/a	n/a	171	0	n/a	< 0.0002	< 0.0002	n/a
1,4-Dichlorobenzene	0.005	0.0025	176	0	0	< 0.0002	< 0.0002	n/a
Acetone	n/a	n/a	171	0	n/a	< 0. 01	< 0. 01	n/a
Benzene	0.005	0.0025	176	0	0	< 0.0001	< 0.0001	n/a
Bromodichloromethane	0.1	0.05	178	52	0	< 0.0001	0.0188	0.0049
Bromoform	0.1	0.05	178	50	0	< 0.0002	0.00412	0.00145
Carbon Tetrachloride	0.005	0.0025	176	0	0	< 0.0001	< 0.0001	n/a
Chloroethane	n/a	n/a	171	0	n/a	< 0.0002	< 0.0002	n/a
Chloroform	0.1	0.05	178	85	0	< 0.0001	0.0341	0.00266

Parameter	ODWQS MAC mg/L	½ MAC mg/L	Total Samples	Samples Above MDL	# Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Dibromochloromethane	0.1	0.05	178	54	0	< 0.0002	0.0119	0.00469
Dichloromethane	0.05	0.025	176	0	0	< 0.0005	< 0.0005	n/a
Ethylbenzene	0.0024	n/a	175	1	0	< 0.0001	< 0.00049	0.00049
Methyl Ethyl Ketone	n/a	n/a	171	0	n/a	< 0.0005	< 0.0005	n/a
Styrene	n/a	n/a	171	0	n/a	< 0.0002	< 0.0002	n/a
Tetrachloroethylene (perchloroethylene)	0.03	0.015	176	6	0	< 0.0001	0.00014	0.00011
Tolulene	0.024	n/a	176	0	0	< 0.0002	< 0.0002	n/a
Trichloroethylene	0.005	0.0025	176	66	0	< 0.0001	0.00194	0.00081
Trichlorofluoromethane	n/a	n/a	171	0	0	< 0.0002	< 0.0002	n/a
Vinyl Chloride	n/a	n/a	176	0	0	< 0.0002	< 0.0002	n/a
o-Xylene	n/a	n/a	175	1	0	< 0.0001	0.00135	0.00135

Parameter	ODWQS MAC mg/L	½ MAC mg/L	Total Samples	Samples Above MDL	# Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
m- + p- Xylene	n/a	n/a	175	1	0	< 0.0001	0.00314	0.00314
Total Xylene	0.3	n/a	175	1	0	<0.0001	0.00448	0.00448
Trihalomethanes	0.100	n/a	178	68	0	< 0.0002	0.0613	0.0115

General Chemistry Results Summary (Jan. 1 – Dec. 31, 2017)

Table 41: General Chemistry Results Summary

Parameter	ODWQS MAC	ODWQS AO	ODWQS OG	Total Samples	Samples Above MDL	# Above Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Aluminum	n/a	n/a	0.1	14	0	0	< 0.005	< 0.005	n/a
Alkalinity (as $CaCO_3$)	n/a	n/a	30-500	13	13	0	250	340	291
Ammonia-N	n/a	n/a	n/a	13	2	n/a	< 0.05	0.18	0.14
Anion Sum	n/a	n/a	n/a	13	13	n/a	7.02[22]	17.5[21]	12.35[21]

[22] Units in Milliequivalents Per Litre (mEq/L)

Parameter	ODWQS MAC	ODWQS AO	ODWQS OG	Total Samples	Samples Above MDL	# Above Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Antimony	0.014	n/a	n/a	14	3	0	<0.0005	0.00091	0.0007
Arsenic	0.025	n/a	n/a	14	2	0	<0.001	0.0025	0.0018
Barium	1.0	n/a	n/a	14	14	0	0.030	0.097	0.068
Beryllium	n/a	n/a	n/a	14	0	n/a	<0.0005	<0.0005	n/a
Boron	5.0	n/a	n/a	14	13	0	<0.01	0.066	0.034
Cadmium	0.005	n/a	n/a	14	3	0	< 0.0001	0.00026	0.00017
Calcium	n/a	n/a	n/a	14	14	n/a	87	160	118.5
Cation Sum	n/a	n/a	n/a	13	13	n/a	7.35[21]	17.6[21]	12.4[21]
Chloride	n/a	250	n/a	13	13	0	37	280	150
Chromium	0.05	n/a	n/a	14	0	0	<0.005	<0.005	n/a
Cobalt	n/a	n/a	n/a	14	5	n/a	<0.0005	0.0035	0.0024

Parameter	ODWQS MAC	ODWQS AO	ODWQS OG	Total Samples	Samples Above MDL	# Above Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Copper	n/a	1	n/a	14	8	0	< 0.001	0.0071	0.0025
Dissolved Organic Carbon (DOC)	n/a	5	n/a	14	14	0	0.56	2.9	1.32
1,4 Dioxane	n/a	n/a	n/a	5	0	n/a	<0.0001	<0.0001	n/a
Hardness (Calculated as CaCO3)	n/a	n/a	80-100	13	13	13	320	550	441
Ion Balance (% difference)	n/a	n/a	n/a	13	13	n/a	0.05[23]	2.28[22]	0.8454[22]
Iron	n/a	0.3	n/a	14	3	1	< 0.1	0.49	0.31
Langalier's Index at 4°C	n/a	n/a	n/a	13	13	n/a	0.471[24]	0.882[23]	0.698[23]

[23] Units in %

[24] Units in Langalier's Index

Parameter	ODWQS MAC	ODWQS AO	ODWQS OG	Total Samples	Samples Above MDL	# Above Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Langalier's Index at 20°C	n/a	n/a	n/a	13	13	n/a	0.718[23]	1.13[23]	0.945[23]
Lead	0.01	n/a	n/a	14	2	0	<0.0005	0.0013	0.00099
Magnesium	n/a	n/a	n/a	14	14	n/a	26	43	36
Manganese	n/a	0.05	n/a	14	11	1	<0.002	0.065	0.0143
Molybdenum	n/a	n/a	n/a	14	12	n/a	<0.0005	0.0051	0.00225
Nickel	n/a	n/a	n/a	14	13	n/a	<0.001	0.014	0.0056
o-Phosphate	n/a	n/a	n/a	13	0	n/a	<0.01	<0.01	n/a
pH	n/a	n/a	6.5-8.5	13	13	0	7.77	8.13	7.92
Phosphorus	n/a	n/a	n/a	14	0	n/a	<0.1	<0.1	n/a
Potassium	n/a	n/a	n/a	14	14	n/a	1.4	3.3	2.143
Saturation pH at 4°C	n/a	n/a	n/a	13	13	n/a	7.13	7.34	7.22
Saturation pH at 20°C	n/a	n/a	n/a	13	13	n/a	6.88	7.09	6.97

Parameter	ODWQS MAC	ODWQS AO	ODWQS OG	Total Samples	Samples Above MDL	# Above Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Selenium	0.01	n/a	n/a	14	0	0	<0.002	< 0.002	n/a
Silicon	n/a	n/a	n/a	14	14	n/a	3.7	8.8	5.2
Silver	n/a	n/a	n/a	14	0	n/a	<0.0001	<0.0001	n/a
Sodium	n/a	20 and 200	n/a	14	14	14	20	160	84
Strontium	n/a	n/a	n/a	14	14	n/a	0.15	5.3	2.573
Sulphate	n/a	550	n/a	13	13	0	38	250	106
Thallium	n/a	n/a	n/a	14	7	n/a	<0.00005	0.0002	0.000084
Titanium	n/a	n/a	n/a	14	0	n/a	<0.005	<0.005	n/a
Total Dissolved Solids	n/a	n/a	n/a	13	13	n/a	380	1000	686
Uranium	0.02	n/a	n/a	14	13	0	<0.0001	0.0044	0.00143
Vanadium	n/a	n/a	n/a	14	0	n/a	<0.0005	<0.0005	n/a
Zinc	n/a	5	n/a	14	13	0	<0.005	0.31	0.0849

Appendix E: Legal and Other Requirements Table

Table 42: Legal and Other Updates that Could Affect the Drinking Water System or the Quality Management System, 2018

Date - 2018	Source	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Jan. 2	MECP Email	**Proposed Amendments to a regulation under the Clean Water Act and establish a new regulation under the Safe Drinking Water Act have been posted on the Environmental Registry** The first regulation proposal (ERO #013-1840) is being made under the Safe Drinking Water Act, 2002. A second proposal (ERO #013-1839) outlines proposed amendments to Ontario Regulation 287/07 – "General" under the Clean Water Act, 2006.	Quality Management Specialist forwarded email to Source Water Protection Staff, Division Manager, Manager of Tech. Services and Water Compliance Specialist.
Jan. 8	OMWA News-wire	**Ontario Regulation 588/17: Asset Management Planning for Municipal Infrastructure** The Infrastructure for Jobs and Prosperity Act, 2015 ("IJPA") in section 6(2) sets out principles for the provincial government to regulate asset management planning for municipalities. On December 27, 2017, O. Reg. 588/17 under the IJPA was released. Every municipality must have an asset management plan ("AMP") for its entire core municipal infrastructure by July 1, 2021 (water assets; wastewater assets; stormwater assets; roads; bridges; culverts) and for all other municipal infrastructure assets by July 1, 2023.	Quality Management Specialist forwarded info to Division Manager and Manger of Operations and Manger of Technical Services.

Date - 2018	Source	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Jan. 10	OMWA News-wire	**A New Standard For Lead Service Line Replacement** The AWWA has released a new standard for the replacement of Lead Service Lines.	Quality Management Specialist forwarded information to the Lead Program Technician.
Jan. 14	Guelph Today	The Lake Erie Source Protection Region is looking for members of the general public to take part on the Community Liaison Group (CLG) for the Guelph-Guelph/Eramosa Water Quantity Policy Development Study. The study area includes the City of Guelph, as well as parts of the Townships of Guelph/Eramosa and Puslinch, and parts of the Towns of Erin, Halton Hills and Milton.	No action required.
Jan. 17	MECP News-room	**Dennis Coelho fined $6,000 for Safe Drinking Water Act (SDWA) violation** The conviction relates to giving/submitting false or misleading information, either orally, in writing or electronically, to a Provincial Officer.	No action required.
Jan. 20	The Record	**Watermain burst left wide swath in Kitchener without water** At least 150,000 residents in Kitchener suddenly found their taps were running dry after a 12-inch, 1965 cast iron watermain pipe burst just after 8 a.m. Saturday.	No action required.

Date - 2018	Source	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Feb. 2	MECP Email	**Subject: Source Protection Information Atlas (SPIA) Updates Now Live** Launched in January of 2017, this interactive mapping tool has been improved to provide additional support for the implementation of source water protection efforts by our program stakeholders. The information atlas displays more than 1,100 wellhead protection areas and intake protection zones, with features that allow you to easily search, customize and access vital source protection science and policy information.	Manager of Technical Services forwarded the email to Technical Staff.
Feb. 26	MECP Email	**Governments of Ontario and Canada release action plan to reduce harmful algal blooms in Lake Erie**	Quality Management Specialist forwarded email to General Manager, Manager of Operations and Manager of Technical Services for information purposes.
Feb. 27	Guelph Today	**City growth could be complicated by Greenbelt expansion** The province is considering expanding its greenbelt zone that protects various water resources and agriculture land. As it considers the expansion, part of the process is inviting municipalities in the greenbelt to offer their input.	No action required.

Date - 2018	Source	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Mar. 9	City of Guelph News	**City sharing groundwater modeling analysis with Nestlé Waters Canada to meet new provincial guidelines for water-taking permits** The City of Guelph has signed an agreement to provide Nestlé Waters Canada with access to analysis from its science-based groundwater flow model through a consultant. The model was developed by the City with the Grand River Conservation Authority and Guelph-Eramosa Township and uses the best available science to determine the effects of water-taking impacts on groundwater availability.	No action required.
Mar. 21	Govern-ment of Canada website	**Guidance on the Use of Quantitative Microbial Risk Assessment in Drinking Water** Document for Public Consultation Prepared by the Federal-Provincial-Territorial Committee on Drinking Water.	Document sent from Division Manager to Quality Management Specialist, Water Compliance Specialist, and Manager of Tech Services.
Mar. 26	OMWA News-wire	**Report finds patchwork water infrastructure standards** A new report prepared for the Ontario Sewer and Watermain Construction Association (OSWCA) has found a hodgepodge of standards among municipalities in cataloguing, inspecting and renewing underground water infrastructure.	Quality Management Specialist emailed article to Management Team for interest.

Date - 2018	Source	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Mar. 27	City of Guelph News	**City introducing water and wastewater credit programs** City Council approved two new credit programs for Guelph water and wastewater customers. The new programs will provide forgiveness on high water bills from unknown residential leaks, and cost relief on wastewater charges for business customers who use or evaporate water during operation or production.	No action required.
Mar. 28	Walker-ton Clean Water Centre	The Walkerton Clean Water Centre (WCWC) is pleased to announce a new online service, the **Drinking Water Resource Library**. The Drinking Water Resource Library was developed to provide easy access to trusted resources related to drinking water. The library consists of a catalog of documents and features multiple search functions to ease the research of information.	The management team shared this information with their staff and it was mentioned in the full staff meeting.
Mar. 29	City of Guelph News	**Notice of study completion: Schedule 'B' Class Environmental Assessment for Clythe Well Treatment Upgrades** The City of Guelph has completed a Municipal Class Environmental Assessment (EA) for proposed treatment upgrades to bring the Clythe well back into service.	No action required.
Apr. 5	Health Canada	Health Canada is asking for public comment on a **proposed guideline technical document for copper in drinking water**. The existing guideline on copper, last updated in 1992, established an aesthetic objective of ≤1.0 mg/L, to ensure palatability and to minimize staining of laundry and plumbing fixtures. There is no health-based guideline at present.	Email sent by Water Services Technician to appropriate staff.

Date - 2018	Source	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Apr. 11	Ontario News	**Bulk Chemical Distribution Company fined $60,000 for Hydrogen Peroxide Spill** Flochem Ltd. was convicted of one offence under the Environmental Protection Act (EPA) and was fined $60,000 plus a Victim Fine Surcharge (VFS) of $15,000 with 6 months to pay. The conviction relates to permitting the discharge of a contaminant, namely Hydrogen Peroxide, into the natural environment which may cause an adverse effect.	No action required.
Apr. 13	MECP Email	Two decision notices have been posted on the Environmental Registry in relation to the Drinking Water Source Protection Program, part of Ontario's multi-barrier drinking water safety net. These decisions are intended to ensure sources of drinking water continue to be protected by the Clean Water Act and have an effective date of July 1, 2018. **ERO #013-1840** **ERO #013-1839**	Quality Management Specialist sent email to Source Water Protection staff, Division Manager, manager of technical services and the Water Compliance Specialist.
Apr. 18	ERO	**Guideline on Community Emissions Reduction Planning** The purpose of the Guide is to provide direction to municipalities and other climate change practitioners in completing GHG inventories, setting interim and long term emission reduction targets, and developing community emissions reduction plans. The ministry recognizes that municipalities are key partners in reducing greenhouse gas emissions.	Email sent from the City's Manager of Policy and Intergovernmental Relations to staff.

Date - 2018	Source	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
May 1	MECP Email	The MECP has launched a beta version of the new **Environmental Registry of Ontario.**	Quality Management Specialist forwarded link to Water Compliance Specialist.
May 2	City of Guelph News	**Construction notice: Verney water tower upgrades** The City is undertaking maintenance work at the Verney water tower including removing the existing coating of paints, repainting the interior and exterior of the tank, upgrading the tower safety systems, and installing new pipes and valves.	No action required.
May 15	City of Guelph News	**City launches updated Blue Built Home program** The City has updated its Blue Built Home water efficiency certification program to include retrofits in existing homes and multi-residential building units in Guelph.	No action required.
May 29	MECP Email	**O. Reg. 205/18** A new regulation, under the Safe Drinking Water Act, takes effect July 1, 2018. This regulation applies in source protection areas identified under the Clean Water Act and ensures that municipal residential drinking water sources are protected before drinking water can be provided to the public.	Quality Management Specialist forwarded link to the Manager of Technical Services.

Date - 2018	Source	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
June 14	OMWA News-wire	**Why Barrie sent this homeowner a nearly $7,500 water bill**	Quality Management Specialist forwarded story to Supervisors of Conservation and Metering for interest.
June 19	MECP Email	**ANSI/AWWA C810-17 Standard for Replacement and Flushing of Lead Service Lines** On November 1, 2017 the American Water Works Association published a new standard to provide guidance for communities undertaking replacement of lead service lines. The Ministry of the Environment and Climate Change recommends the use of this standard to all municipalities when undertaking lead service line replacement.	Quality Management Specialist forwarded email to the Water Compliance Specialist, Water Supply Technician, Water Services Managers of and Supervisors of Supply and Distribution.
June 28	OMWA News-wire	**How Do Water Towers Work? (VIDEO)** How do water towers work - explained in a short informative video by Concerning Reality.	Quality Management Specialist forwarded video to Program Coordinator for interest.

Date - 2018	Source	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
June 28	Staff Memo	Please be advised that as of July 1, 2018, Ontario's Construction Lien Act will undergo several significant changes. These changes include: • technical amendments relating to the title, holdbacks, liens, bonding, and trusts; • introduction of a new prompt payment regime; • introduction of new mandatory adjudication; and, • amendments dealing with the Act's application to alternative financing and procurement (AFP/P3 projects).	Manager of Technical Services sent memo to all appropriate staff.
July 10	City of Guelph News	**Dry conditions move outside water use level up to yellow** The City is enforcing watering restrictions for level 1 yellow of the outside water use program because of a lack of rainfall, hot temperatures and increased demands on the water system.	No action required.
Aug. 1	Letter from MECP dated May 9, 2018	**Haloacetic Acids (HAAs) Sampling Concerns** A letter to clarify ministry guidance for HAAs sampling.	Sent to the Manager of Operations, Supervisor of Water Supply, Water Supply Technician, Water Compliance Specialist.

Date - 2018	Source	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Aug. 7	Nature Nano-tech-nology	**Low risk posed by engineered and incidental nanoparticles in drinking water** This article on the risk of engineered and incidental nanoparticles in drinking water concludes risks to human health are low. The authors have examined a substantial number of articles and justify this by stating that "engineered nanoparticles (ENPs) are currently orders of magnitude less common than NNPs in waters that flow into drinking water treatment plants.	Email with article sent by the Division Manager to the Management Team, Water Compliance Specialist, Quality Management Specialist, Hydrogeologist and Supply Tech.
Aug. 24	Email from GRCA	The Province has released a short bulletin developed for municipal drinking water system owners explaining the new *Safe Drinking Water Act, 2002* regulation, where it applies and system owner responsibilities.	Email sent from the Water Supply Program Manager to the Water Compliance Specialist, Quality Management Specialist & Manager of Tech. Services.
Aug. 24	The Welling-ton Advertis er	**Greatest risks to Guelph's water supply include drought, city growth covering water recharge areas** On Aug. 15, Grand River Conservation Authority's source protection program manager Martin Keller updated Puslinch council with respect to the Guelph/Guelph-Eramosa water quantity policy development study.	Story forwarded to the Management Team and Hydrogeologist by the Quality Management Specialist.

Date - 2018	Source	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Aug. 24	Govern-ment of Canada	**Guidelines for Canadian Drinking Water Quality: Guideline Technical Document – Bromate** Based on this review, the guideline for bromate in drinking water is a maximum acceptable concentration of 0.01 mg/L (10 µg/L), based on a locational running annual average of a minimum of quarterly samples. This information is made available to provide Canadian jurisdictions (provinces, territories and federal departments) with the scientific basis they need to establish or update their requirements for bromate in drinking water.	Email forwarded to the Division Manager, Manager of Tech. Services, Water Compliance Specialist, Quality Management Specialist & Supply Tech.
Sept. 6	City of Guelph News	**Construction notice: Emma Street well site construction** The City is working with our contractor to install a water chamber at the Emma Street well located at 93 Emma Street.	No action required.
Sept. 7	Govern-ment of Canada	**Public Consultation: Guidelines for Canadian Drinking Water Quality - Guideline Technical Document on 1,4-Dioxane** The Federal-Provincial-Territorial Committee on Drinking Water (CDW) has assessed the available information on 1,4 dioxane and intends to establish a drinking water guideline. It has requested that this document be made available to the public and open for comments.	Email sent to the Division Manager, Manager of Tech. Services, Water Compliance Specialist, & Quality Management Specialist.

Date - 2018	Source	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Sept. 18	Guelph Mercury Tribune	**Sustainable Guelph homes use much less energy than typical new homes** The Braendlis and Colvins are among the first in Guelph to be certified under the city's Blue Built Homes program. Blue Built Homes include a certification and rebate program that encourages households to implement technologies and behaviours that will help people conserve water and save money.	No action required.
Oct. 9	Orange-ville News	**WDGPH survey shows 88 per cent of private well owners aren't testing water enough** A Wellington-Dufferin-Guelph Public Health survey of private well owners has found only 12 per cent are testing their water frequently enough. With Public Health Ontario recommending wells be tested at least three times a year in the spring, summer and fall, more than half of the survey's respondents that aren't following those guidelines say they planned to but forgot.	No action required.
Oct. 16	City of Guelph News	**City moving forward with Clythe well upgrades** The City is moving forward with the detail design of a water treatment facility at 37 Watson Road, across from the existing Clythe well site.	No action required.

Date - 2018	Source	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Oct. 30	ERO	**Extending the moratorium on water bottling permits** The Ministry of the Environment, Conservation and Parks is proposing to amend Ontario Regulation 463/16 to extend the moratorium for one year, until January 1, 2020. This will give us time to further advance the ministry's understanding of the water resources in the province, with a particular focus on groundwater takings by water bottling facilities.	Sent information to the Water Services Managers, Water Compliance Specialist, Hydrogeologists, and Source Water Protection staff.
Nov. 5	City of Guelph News	**Logan Well Maintenance and Repairs** The City of Guelph is performing maintenance and construction activities on the City-owned Logan well site at 5206 Jones Baseline.	No action required.
Nov. 21	MECP email	The Ministry of the Environment, Conservation and Parks has released a new organizational chart.	Email sent to the Management Team and Technical Services staff.
Nov. 24	The Record	**Chloride levels are rising in Waterloo Region drinking water** The chloride found in road salt is seeping into both surface water as well ground water aquifers, from the Region draws our drinking water.	No action required.

Date - 2018	Source	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Nov. 26	Health Canada	Public consultations under the Canadian Drinking Water Guideline were announced - Barium, Chloramines and Enterococci.	Email sent to Manager of Water Services, Manager of Technical Services, Water Compliance Specialist, and Quality Management Specialist.
Nov. 27	MECP email	The Ministry of the Environment, Conservation and Parks has released the 2017-2018 Chief Drinking Water Inspector Annual Report. This report highlights efforts to provide the people of Ontario with high quality drinking water that is among the best protected in the world. Visit Ontario's Open Data Catalogue to see our supporting Drinking Water Quality and Enforcement data.	Email sent to Water Services staff.
Nov. 30	Welling-ton Advertis er	**Guelph tracking aqueduct through Puslinch** The City of Guelph is on a bit of a hunt, not for buried treasure, but for a buried aqueduct in Puslinch Township. City representatives met with Puslinch council on Nov. 21 to explain the exact location of the aqueduct is unclear.	Article sent to the Project Manager and Manager of Technical Services for information.
Dec. 4	Ontario News	**Clean Water Operator fined $20,000 for Safe Drinking Water Act Violation** The conviction relates to failing to ensure that the Saugeen Shores Drinking Water System was operated by persons who had the proper training and expertise to fulfil their operational duties.	Email sent from Water Certification Specialist to all Water Services staff.

Date - 2018	Source	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Dec. 7	MECP email	The MECP has proposed amendments to the Watermain Disinfection Procedure and is requesting comments by January 24th, 2019.	Email sent from Quality Management Specialist to Supervisor of Distribution and Distribution Operators.
Dec. 18	MECP email	The Ministry of the Environment, Conservation and Parks released the **Minister's Annual Report on Drinking Water 2018**. It showcases how Ontario is taking action to protect drinking water and water resources.	No action required.
Dec. 21	ERO email	The MECP is extending the current moratorium on new or increasing permits to take groundwater to produce bottled water for one year, to January 1, 2020. Accordingly, Ontario Regulation 463/16 has been amended to change the date the regulation will be revoked from January 1, 2019 to January 1, 2020.	Email sent from the Quality Management Specialist to the Water Services Managers, Water Compliance Specialist and Hydrogeologist.

Appendix F: Action Items from Management Review

Below are the Action Items from the 2018 and 2019 Management Review Meetings

Status and Descriptions

CIR #734 Closed: 2018-02-01:

- For the A&S Report: The notice about EDMS being internal in the introductory section is all that is required. Remove this statement from other places in the document.

CIR #735 Closed: 2018-01-30

- For the A&S Report: Figure 1 – update to better show Zone Boundaries.

CIR #736 Closed: 2018-02-01

- For the A&S Report: Emergency Response Testing: Need to add a section re: emergency preparations that were done before the Paisley-Clythe Feedermain work at Woods Station.

CIR #737 Closed: 2018-01-30

- For the A&S Report: Table 3: include number of sample stations installed through DMA Program.

CIR #738 Closed: 2018-03-19

- For the A&S Report: Table 3: Should Locate information be included in this table, instead of its own section? Review the necessity of including the Locate section next year because Locates is a Corporate Initiative, not just Water Services.

CIR #739 Closed: 2018-01-31

- For the A&S Report: Need more information on SCADA uptime improvements.

CIR #732 Closed: 2018-01-31

- For the A&S Report: Add Zone 3 chlorine residuals to Table 5.

CIR #741 Closed: 2018-12-20

- Arrange for the installation of a sample station in Zone 3.

CIR #742 Closed: 2018-01-31

- For the A&S Report: Add UVT values to Table 9, or create a new table.

CIR #743 Closed: 2018-01-31

- For the A&S Report: Clarification on the Water St. Wellfield PTTW application is needed.

CIR #744 Closed: 2019-01-11

- For the A&S Report: Need to capture the total number of Lead Replacements (done by City staff and Contractors) in the 2018 report.

CIR #745 Closed: 2018-02-01

- For the A&S Report: Update Management Review Section, as per today's meeting.

CIR #746 Closed: 2018-02-01

- For the A&S Report: Infrastructure Review: Add information on the York Trunk Project to the A&S Report.

CIR #878

- For the A&S Report: Include 2018 consumption data in Figure 4 when it is available.

CIR # 879 Closed: 2019-01-25

- For the A&S Report: Consider well field permits for Arkell in Table 2 (as we often pump more than 66l/s).

CIR #880 Closed: 2019-01-25

- For the A&S Report: For the water supply maintenance activity, remove Logan and Speedvale should be Verney.

CIR #881 Closed: 2019-01-25

- For the A&S Report: Add Calico work to the infrastructure section.

CIR #882

- For the A&S Report: Review if we should add information describing that the water quality values may be an average and can depend on the location of the sample.

CIR #883

- The procedure for documenting calls needs to be reviewed as a lot of calls aren't being logged properly.

CIR #884 Closed: 2019-01-25

- For the A&S Report: Add Arkell 14 generator section to section n.

CIR #885 Closed: 2019-01-25

- For the A&S Report: Add Emma and Water contact chamber projects to the infrastructure section.

CIR #886

- For the A&S Report: Add Energy work being done in 2019 report (reported in 2020).

CIR #887 Closed: 2019-01-25

- For the A&S Report: Confirm the backflow numbers are accurate.

CIR #888 Closed: 2019-01-25

- Put the Water Efficiency Communications Strategy on EDMS.

CIR #889 Closed: 2019-01-25

- For the A&S Report: Change the picture of the water wagon picture frame to one with people in it.

Appendix G: Status of Management Action Items Identified between Reviews

Please note that this list does not include any Opportunities for Improvement identified in the Internal or External Audit. Staff Suggestions are found in Appendix H: Summary of Staff Suggestions

Below are the Management Action Items Identified between Management Review Meetings, 2018

Status and Descriptions

CIR #734 Closed: 2018-02-01

- For the A&S Report: The notice about EDMS being internal in the introductory section is all that is required. Remove this statement from other places in the document.

CIR #735 Closed: 2018-01-30

- For the A&S Report: Figure 1 – update to better show Zone Boundaries.

CIR #736 Closed: 2018-02-01

- For the A&S Report: Emergency Response Testing: Need to add a section re: emergency preparations that were done before the Paisley-Clythe Feedermain work at Woods Station.

CIR #737 Closed: 2018-01-30

- For the A&S Report: Table 4: include number of sample stations installed through DMA Program.

CIR #738 Closed: 2018-03-19

- For the A&S Report: Table 4: Should Locate information be included in this table, instead of its own section? Review the necessity of including the Locate section next year because Locates is a Corporate Initiative, not just Water Services.

CIR #739 Closed: 2018-01-31

- For the A&S Report: Need more information on SCADA uptime improvements.

CIR #732 Closed: 2018-01-31

- For the A&S Report: Add Zone 3 chlorine residuals to Table 9.

CIR #741 Closed: 2018-12-20

- Arrange for the installation of a sample station in Zone 3.

CIR #742 Closed: 2018-01-31

- For the A&S Report: Add UVT values to Table 13, or create a new table.

CIR #743 Closed: 2018-01-31

- For the A&S Report: Clarification on the Water St. Wellfield PTTW application is needed.

CIR #744 Closed: 2019-01-11

- For the A&S Report: Need to capture the total number of Lead Replacements (done by City staff and Contractors) in the 2018 report.

CIR #745 Closed: 2018-02-01

- For the A&S Report: Update Management Review Section, as per today's meeting.

CIR #746 Closed: 2018-02-01

- For the A&S Report: Infrastructure Review: Add information on the York Trunk Project to the A&S Report.

CIR #878

- For the A&S Report: Include 2018 consumption data in Figure 4 when it is available.

CIR # 879 Closed: 2019-01-25

- For the A&S Report: Consider well field permits for Arkell in Table 3 (as we often pump more than 66l/s).

CIR #880 Closed: 2019-01-25

- For the A&S Report: For the Table 5, remove Logan and Speedvale should be Verney.

CIR #881 Closed: 2019-01-25

- For the A&S Report: Add Calico work to the infrastructure section.

CIR #882

- For the A&S Report: Review if we should add information describing that the water quality values may be an average and can depend on the location of the sample.

CIR #883

- The procedure for documenting calls needs to be reviewed as a lot of calls aren't being logged properly.

CIR #884 Closed: 2019-01-25

- For the A&S Report: Add Arkell 14 generator section to section n.

CIR #885 Closed: 2019-01-25

- For the A&S Report: Add Emma and Water contact chamber projects to the infrastructure section.

CIR #886

- For the A&S Report: Add Energy work being done in 2019 report (reported in 2020).

CIR #887 Closed: 2019-01-25

- For the A&S Report: Confirm the backflow numbers are accurate.

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- For the A&S Report: Change the picture of the water wagon picture frame to one with people in it.

Appendix G: Status of Management Action Items Identified between Reviews

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Management Action Items Identified Between Management Review Meetings, 2018

Status and Descriptions

CIR #747

- During recirculation of a station, double valve isolation was completed correctly and verified by the operator; however, the incorrect drain valves were utilized to verify valve isolation. A station specific SOP with pictures should be developed and potentially labelled valves would be helpful.

CIR #755 Closed: 2018-03-22

- Add a box to the Master Log to indicate that the Operator has checked the Quick Panel screens/ran the query. Update the Master Log file for next year.

CIR #752 Closed: 2018-03-22

- Conduct training on the QP Failure event with the Operators to show them what to look for on the Historian screens to recognize when this happens in the future.

CIR #749

- Work with the vendor to investigate how to alarm if the Quick Panel stops working.

CIR #761

- Contact Aquafor Beech to complete a study to determine what could be done at the Glen Collector to prevent turbidity events from happening in the future.

CIR #763 Closed: 2018-11-22

- Need an operator/or other qualified person to oversee the well disinfection done by contractors. Have a sign off on the disinfection checklist to verify that the form is filled out completely by an operator or other qualified staff. (There may be an opportunity for on-the-job training hours.)

CIR #762 Closed: 2018-08-23

- Include "Do not direct chlorinated water to the storm drain" in the well disinfection checklist. Ensure Operators are trained on the disinfection procedure, including not to direct highly chlorinated water to the storm drains. Information during the training should include that if highly chlorinated water enters a river; it is considered a spill, must be reported and could result in fines.

CIR #855

- Schedule frequent (minimally monthly) Distribution meetings and have a standing agenda item to review SOPs and WIs to ensure that all new SOPs, WIs, etc. are being communicated to staff.

CIR #853

- Complete an assessment for all Distribution jobs to ensure all documentation that is necessary is captured in SOPs, WIs Forms, etc. This will help with succession planning as well.

CIR #851

- It is recommended that a review of all required Forms and/or checklists used by Distribution Staff is conducted to determine if they meet the requirements of Element 5.

CIR #848 Closed: 2018-11-27

- Update the Flushing SOP with input from Operational Staff to ensure that it reflects what is happening in the field.

CIR #846

- Create a Clair Fill Station Backflow Event SOP to ensure that response to events is consistent.

CIR #845

- Install cameras at the Clair Fill Station.

CIR #843 Closed: 2019-01-24

- Update the current user agreement for the Clair Fill Station to better define backflow requirements and the potability of the water.

CIR #841 Closed: 2018-09-25

- Update the Incident Notification Procedure to include all events involving a CCP and events where a Water Services' backflow prevention device is activated. This will ensure that the appropriate people are being notified during the event.

CIR #856

- Install a chlorine analyzer on the contact chamber at University to prevent a full reservoir of potentially low chlorinated water if there was a failure of the chlorination system. This would be similar to the process analyzers at Paisley. This has been approved by the ORO.

CIR #872

- Create a Verney and Clair Tower fill/drain procedure. This could include a checklist of all the required aspects of the procedure from various groups (maintenance, compliance, operations, etc.). This should also include a requirement that meetings are conducted with all stakeholders and a plan is in place prior to filling/draining any tower in the future.

CIR #871

- Verify that the Operating a Closed Pressure System in Zone 2 SOP includes information on the filling and draining of Speedvale Tower. If not, it needs to be added.

CIR #870 Closed: 2019-01-24

- In future tenders, make Method 2 a requirement as it is the preferred disinfection method for Water Services. This would apply for reservoir cleaning as well.

Appendix H: Summary of Staff Suggestions

Table 43: Suggestions Provided by Staff, 2018

Item #	Status	Description of Staff Suggestion
1	CIR #757	For succession planning: ensure that knowledge and work instructions are developed prior to known staff retirements. Work towards creating detailed job descriptions with all required tasks for all positions. For example, the Distribution Technician and the Supervisor of Distribution - Construction are set to retire in the near future.
2	CIR #758 Closed: 2019-01-21	Add a section to the 2018 A&S Report that outlines the work done around Frozen Service Monitoring.
3	CIR #759	Recommend LPS (Total Loss Prevention System) training - for all staff at Water Services. This will help improve our health and safety program here at Water Services. LPS is a total loss management system that works to prevent all types of losses including but not limited to personal injuries, equipment or property damage, environmental issues, regulatory assessments, product quality, reliability issues, and business inefficiencies.
4	CIR #767 Closed: 2018-08-01	For HMI Screens, it is suggested that the pressure reported in kPa do not have any decimal places.
5	CIR #768 Closed: 2018-08-01	For the HMI Screens, it is suggested that flow be expressed with only 1 decimal place. Currently there are two decimal places listed.
6	CIR #784 Closed: 2018-09-20	Once a Root-Cause Analysis form is filled out and completed, consider saving the form as a .pdf so that nothing can be adjusted after the fact and a record is maintained. Allows it to become a more permanent record and stored in EDMS.

Item #	Status	Description of Staff Suggestion
7	CIR #801 Closed: 2018-09-25	In order to improve on Maintenance's Work Order process, it would be beneficial if support staff had further training to ensure that there is sufficient detail when completing a Work Order. For example, if a pump is replaced, you need to retire that asset and assign a new asset to the new pump. It is suggested that admin/support staff have more training on the work that maintenance performs.
8	CIR# 802	The last Outside Water Use Bylaw was updated in 2014 and is almost 5 years old. Under the new requirements for the Element 7 Risk Assessments, more emphasis is placed on Climate Change and prolonged drought conditions. It would be worthwhile to review the by-law to address these changes if necessary.
9	CIR #803	Recommend that Operators take the DWQMS course put on by WCWC to get a better understanding of the requirements of the DWQMS and their role in ensuring these requirements are being met.
10	CIR #804 Closed: 2018-10-10	If possible, add additional fields to the hydrant check sheets, need more room on them for comments, such as: who serviced the hydrant; when they were there; and what did they do.
11	CIR #805 Closed: 2018-10-10	Whenever practical, water use from hydrants should be metered using a meter, or should be estimated by Water Services staff to help with the annual Water Budget that is completed.
12	CIR # 806 Closed: 2018-12-03	Consideration should be given to the order in which the grids for hydrant checks are completed to ensure all hydrants are checked in a timely manner and within the calendar year.
13	CIR #807 Closed: 2018-10-12	Ensure Top Management provides an update on the status on electronic log books and the status of these changes as this was identified in last year's audit.
14	CIR #808 Closed: 2018-11-22	Look at working with WaterTrax on the alerts that Operators/staff receive on sample results to avoid confusion about what to do when the results come in. For example Distribution staff receive alerts for supply raw water samples.

Item #	Status	Description of Staff Suggestion
15	CIR #809	Look at the traffic plan requirements to try and streamline the process to reduce the amount of forms being completed by operational staff during their shift. See if some of these forms can be combined. Any update forms should include version control and be documented on EDMS.
15	CIR #811 Closed: 2018-10-10	Streamline the customer response process to following the new Customer Notification SOP which identifies which customers are critical. If customers who are not identified as critical are being provided specific exceptions, this should be documented and communicated to staff on the "why".
16	CIR #812 Closed: 2018-10-12	Consider a better way (tablets?) to access SOPs in the field, including emergency contacts. SOPs are difficult to read on a phone as the screen is small.
17	CIR #813 Closed: 2018-11-22	A better understanding is needed for the Distribution Operational staff about how changes to infrastructure are communicated up through the Water Distribution Technician to City Hall so that Engineering and GIS are able to document these changes. It may be a formalized process, it is just not known at the Operator level.
18	CIR #814	Consider using the turn on/turn off app to record when a residual is outstanding before a service is turned back on after a renewal or other maintenance. Consider separating the job sheet form from the stock form (hours, equipment used, parts used, etc.) so that the residual can be added to the job sheet before it is sent to admin for filing. Currently, the form needs to be sent to admin right away to process payroll and equipment used, but the service may still be off and a residual is still needed. Using a similar electronic job sheet to what the Locate team uses would be ideal for the information, sketch and chlorine residual for a job – it could be set up to prompt when information is missing (such as a chlorine residual) and can be uploaded.

Item #	Status	Description of Staff Suggestion
19	CIR #815 Closed: 2018-09-20	Determine a better way for Water Services staff to have access to an organization chart as many don't know how to access it.
20	CIR #816 Closed: 2018-09-28	In order to improve/ enhance the knowledge of chlorine residuals throughout the system, a systematic and regularly scheduled dead-end flushing program would be beneficial.
21	CIR #818	The Manager of Technical Services has recommended that completed OFIs are presented in the full staff meetings so that staff are aware of the status of their suggestions and opportunities for improvement. This could also be presented on a progress board in the lunchroom for staff to look at to improve communication and knowledge of the DWQMS system.
22	CIR #819 Closed: 2018-09-20	Consider adding an "as of" date to QMS 06 so that the reader and the QMS rep know when the process flow diagrams were last updated.
23	CIR #820 Closed: 2018-09-20	Include more Operational staff to the "big" emergency test with the MECP, WDGPHU, etc. Consider rotating out 5 or 6 Operators/Admin staff/Conservation staff each year.
24	CIR #821 Closed: 2018-08-23	Consider implementing a numbering system for SOPs, as titles can change.
25	CIR #822	Confirm the mitigating factors cited for sodium contamination in the Annual Risk Assessment Review. For example, does the Risk Management Official audit the Operations Department road salt use? Is there a sampling program of storm water ponds to monitor sodium levels?
26	CIR #823 Closed: 2019-01-24	Consider moving the test exercise to the spring so it doesn't conflict with the QMS External Audit.

Item #	Status	Description of Staff Suggestion
27	CIR #824	Consider mandatory timelines for addressing staff suggestions to ensure they are reviewed and communication is provided back to staff on their progress.
28	CIR #825 Closed: 2018-09-28	In order to properly account for water used during hydrant use, (i.e. street sweepers using an unmetered hydrant) we need a better way to track water use at hydrants to complete the Water Balance and ensure it is accurate.
29	CIR #826 Closed: 2018-09-27	As Leak Detection can be used at anytime to help locate watermain breaks and other leaks, consider adding another leak detection company to the WS-RD "Ensuring Adequate Equipment..." document. Currently, there is only one company listed and they may not always be available after hours.
30	CIR #827 Closed: 2018-09-28	In order to complete the annual Water Balance, the following information is needed: 1. Water consumption through the bulk water meter at Woods needs to be broken down into revenue vs non-revenue water. 2. New temporary watermains that have continual flow running through them need to be metered and tracked. 3. Water used for Fire Flow testing needs to be tracked. Could a pito gauge be used? 4. Water used for watermain commissioning – is this revenue or non-revenue water?
31	CIR #828 Closed: 2018-11-22	It was suggested that SOPs and WIs cover all relevant work areas, where applicable, rather than having a separate SOP for Management, Supply, Distribution, etc. for the same process. For example, Category 2 watermain break response.
32	CIR #829 Closed: 2018-09-26	Ensure that the training form being used for new maintenance staff is included under Element 10 – Competencies in the Operational Plan.

Item #	Status	Description of Staff Suggestion
33	CIR #830 Closed: 2018-09-20	Include more operational staff in the Risk Assessment process, if they are interested about the process.
34	CIR #831	In order to ensure that Supply Operators are being proactive in alarm response and potentially preventing alarms from occurring, it is suggested that the number of operational staff with SCADA experience is increased. It would also be beneficial to have more SCADA programming staff to catch-up on the back-log of SCADA work.
35	CIR #832	Look at creating a 1-2 hour presentation on SCADA (how it is used by Operators, what does it tell you, what stations do what, what controls what) for Distribution Operators and any other interested staff.
36	CIR #833 Closed: 2018-11-22	Remind Supply Operational staff on the protocol for calling Rogers when there is a communication issue.
37	CIR #834 Closed: 2018-10-26	For the QMS Rep, present the results of the Risk Assessment at a full staff meeting.
38	CIR #835 Closed: 2018-10-12	Continue working towards facility improvements, similar to what has been done at Queensdale.
39	CIR #836	Develop a Project Management Manual (purchasing, tender process, etc.) for succession planning. Ensure that it provides standards for contactor requirements, i.e. invoicing.
40	CIR #837 Closed: 2018-09-25	Recommend that the Water Compliance Specialist upload the AWWA Disinfection Standards to EDMS, with a periodic review to ensure the most recent edition is represented.
41	CIR #838 Closed: 2018-10-04	Ensure that water treatment process knowledge is included in the SCADA programming standards that are in the works.

Item #	Status	Description of Staff Suggestion
42	CIR #839 Closed: 2018-09-20	Consider including the Manager of Emergency Preparedness in future Water Services Emergency tests.
43	CIR #840	Consider performing the Water Services Internal Audit with other members of the Executive Team.
44	CIR #857	Audit Engineering's Form 1 process during next year’s Internal Audit.
45	CIR #859	Consider installing a SCADA node in distribution.
46	CIR #860 Closed: 2018-11-20	Add the appropriate service agreements and open PO numbers to the WS-SOP Ensuring Adequate Equipment to Deal with Emergencies so they are easily accessible in one location.

Appendix I: Water Efficiency Program – 2018 Annual Progress Report

Background

The City of Guelph strives to be a leader in water conservation and efficiency. As one of Canada's largest communities reliant on a finite groundwater supply for our drinking water needs, our ability to reclaim water and wastewater serving capacity through conservation initiatives offers numerous benefits to our community and local ecosystem.

Between 2006 and 2016, 9,520 cubic meters (m3) per average day of water and wastewater capacity was reclaimed due to the successful uptake of the City's 2009 Water Conservation and Efficiency Strategy. This reclaimed supply allowed the City to delay the need for over $41 million in additional water and wastewater infrastructure with an investment of approximately $11.3 million in water conservation programming. Further, the reduction in water use across the city has resulted in a cumulative daily operational savings of over $625,000 per year in electricity and treatment chemical costs, creating a significant financial benefit to water rate payers. As a result, the City's water and wastewater rates remain close to the median of Council-approved Ontario comparator municipalities responsible for the provision of water and wastewater services.

In July 2014, Guelph City Council endorsed the update to the Water Supply Master Plan (WSMP). Water servicing capacity reclaimed through conservation and efficiency continued to be a top priority in achieving a sustainable and cost effective community water supply. The WSMP established a new reduction target of 9,147 cubic meters in average daily production by 2038 to guide the City's water efficiency programming.

In support of the new reduction target, Guelph City Council endorsed the 2016 Water Efficiency Strategy. The proposed measures of this Strategy defines the programs, policies and resources that will help Guelph meet its reduction targets while ensuring the City continues to offer effective programs providing value for the community.

The following sections provide an update of the water efficiency program activities and successes as they relate to the 2016 Water Efficiency Strategy from January 1 to December 31, 2018. For more information on the City's Water Efficiency Program and individual program resources please visit guelph.ca/ourstoconserve.

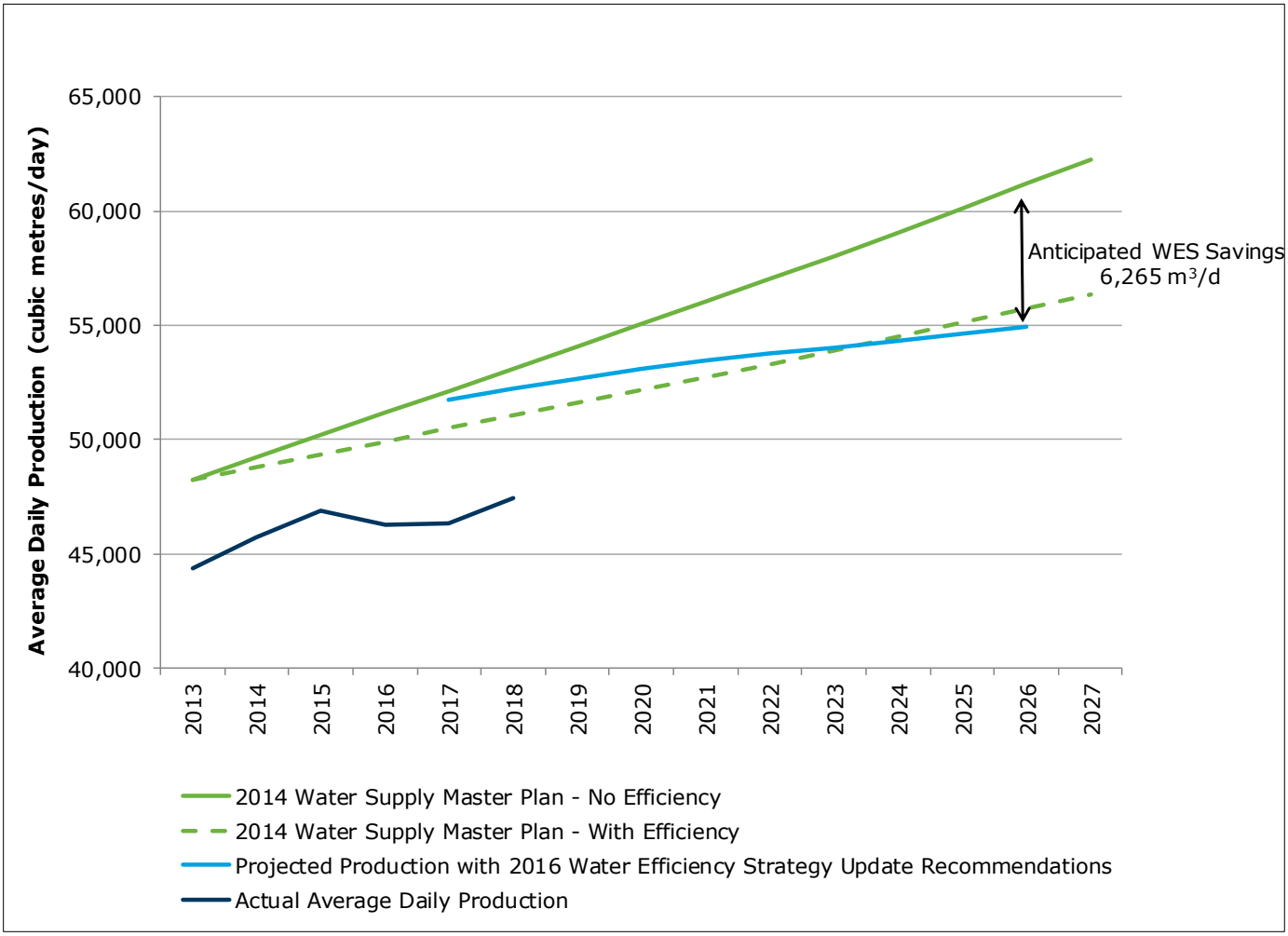
Water Reduction Target Progress

Building off the data analysis completed for the 2014 Water Supply Master Plan, the 2016 Water Efficiency Strategy identified a 10-year water savings goal of 6,265 m3 per day between 2017 to 2026. The updated Strategy anticipates a considerable amount of supply capacity can be reclaimed through enhanced water loss management (i.e. Leak Detection and District Metered Areas) and the industrial, commercial and institutional sector.

Based on community uptake and participation in new and enhanced water efficiency programs, the total water savings achieved for 2018 is 123,518 m3, or 339 m3 per day. Since the implementation of the 2016 WESU, the cumulative water savings achieved to date is 158,410 m3, or 434 m3 per day. The district-metered areas will be implemented in 2019, which shall bring about the anticipated savings from this program.

Figure 6: Water Supply Master Plan and Water Efficiency Strategy Production Rates presents the anticipated production rates as presented in the 2014 Water Supply Master Plan and the 2016 Water Efficiency Strategy. The forecasted rates are above the actual water production rates. This is due, in part, to the successful implantation of the Water Efficiency Strategy.

Figure 6: Water Supply Master Plan and Water Efficiency Strategy Production Rates



The Water Supply Master Plan also set water use, or consumption, targets for 2038. Between 2013 and 2017, the City of Guelph's residential water use declined by an average rate of 2.85 litres per capita per day. Total water use (also referred to as consumption) has been on a downward trend with the exception of 2014 and 2015 which can be attributable to a high number of frozen water pipes, where some homes were running their water to prevent their water lines from freezing.

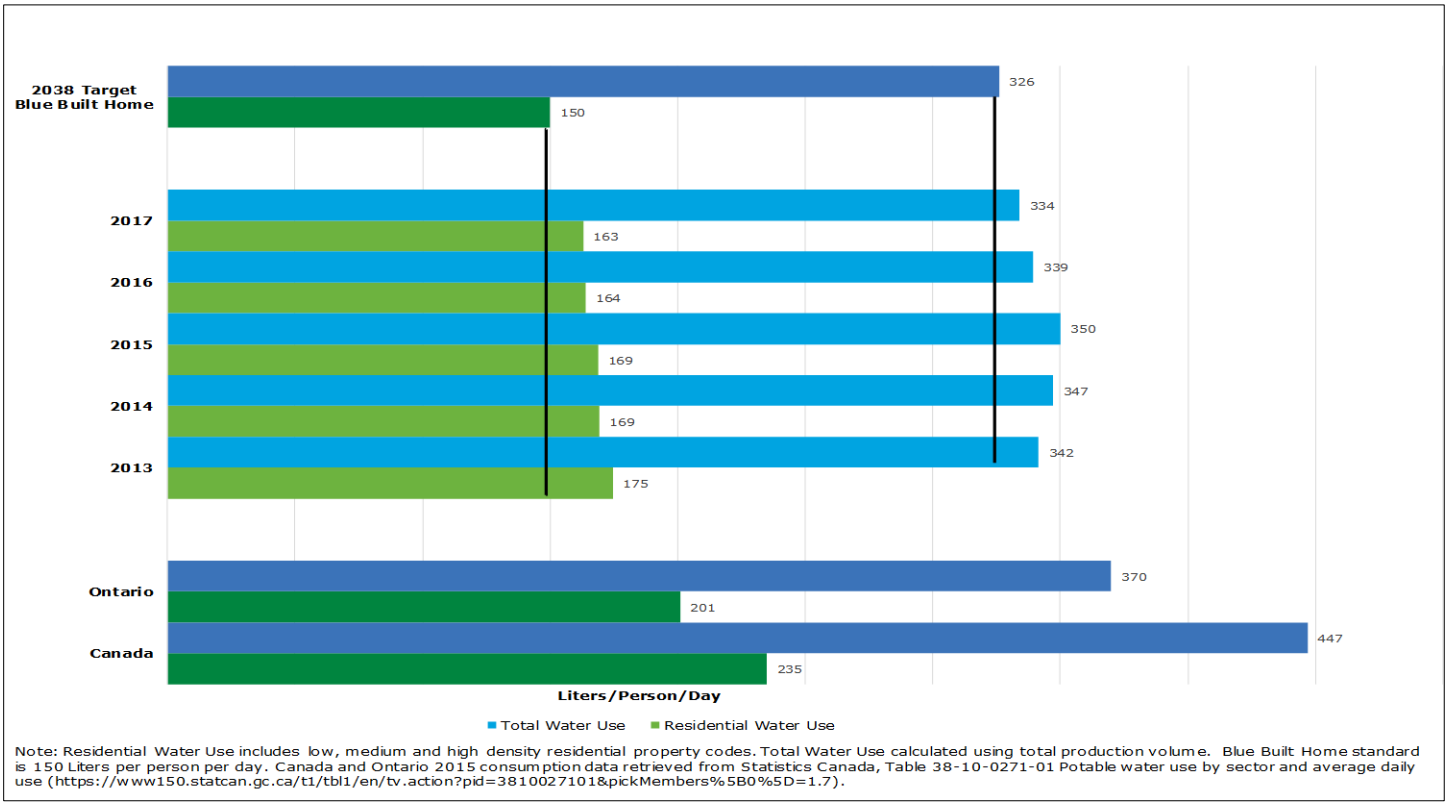
Average daily water use per Guelph resident continues to decline each year and remains below the published provincial and national averages.

Figure 7 presents the City of Guelph's water use between 2013 and 2017. The City's target is 150 litres per person per day for residential water use and 326 litres per person per day for total water use, as identified in the Water Supply Master Plan. Residential water use includes low,

medium and high density residential property water use. Total water use is calculated using total water production volume.

In 2017, the average water use was 163 litres per person per day, whereas the average for Ontario is 201 litres per person per day.

Figure 7: Water Use Progress and Targets



The following sections outline the 2018 program successes as identified in the 2016 Water Efficiency Strategy. As noted in the Water Efficiency Strategy, some projects may achieve water savings sooner than others. However, the overall target is a combined value for all programs.

Leak Detection Program

The City's leak detection program started in the spring of 2011 and aims to reduce the amount of water lost between treating and delivering it to customers. The 2018 Leak Detection Program included sounding and correlation of all 345 kilometers of metallic watermains within the City's distribution system. In total, 10 watermain and service leaks were identified through this survey. The average daily volume of servicing capacity reclaimed through the location and remediation

of these leaks equate to approximately 230 m3 per day, with a total reclaimed volume of 85,100 m3 in 2018.

The 2018 leak detection program also included the development of a detailed operational plan for district metered areas (DMAs). The objective of the DMA program is enhance operational understanding of water demand patterns and to recognize changes early to address unaccounted for water loss in our system. In recognition of benefits offered through continuous water demand monitoring as proactive water loss management, staff will be working to activate the DMAs starting 2019 through 2020. Although water savings were noted in the Water Efficiency Strategy, for 2018 the execution of the DMA program was delayed.

Therefore, the overall Water Loss Management savings goal of 239 m3 per day for 2018 was not achieved (off by 9 m3 per day) due to the delay in execution of the DMA program.

Water Efficiency Incentive and Rebate Programs

During 2018, 878 rebate applications were processed through the City's residential rebate programs. For more information on individual water efficiency program details, visit guelph.ca/rebates.

Royal Flush Toilet Rebate Program

In line with changes to rebate structure noted in the Water Efficiency Strategy, the Royal Flush Toilet Rebate was adjusted in early 2017 moving from a $75 rebate to a $50 rebate, effective the first of the year. It was further broadened to the replacement of 6L toilets instead of only 13L toilets. A total of 857 toilet rebates claimed in 2018, achieved an in-year water savings of 34 m^3 per day. This surpasses the Strategy's 2018 goal of 28 m^3 per day.

Residential Sub-Water Meter Rebate Program

Sub-water metering identify water leaks and high water-using behaviours, creating awareness of water use and potential cost savings for property owners (i.e. homeowners, landlords, property managers). Sub-water meters can provide specific and measurable conservation challenges and goals for property owners and tenants. This offers significant opportunities for motivating behaviour change since a knowledge gap often exists in regards to how much water residents actually use.

It is because of this that Water Services staff, supported through the 2016 Civic Accelerator program, explored a pilot rebate in 2017 with the Alert Labs technology "Flowie", a strap-on sub-meter for a household's water billing meter. Through a smart phone application, a

homeowner can receive time-of-use information on their water using behaviour. Thirty-one Guelph property owners purchased a Flowie and received a rebate through the pilot.

Water Services staff analyzed water use data for eleven (35%) properties that purchased and installed a Flowie through the pilot. A comparison of the water use data six months before and after the sub-water meter was installed, in both single family and multi-residential buildings, demonstrated an average 3% water saving for each property during this time period. While it is recognized that this analysis does not account for seasonal variability or other influential factors, the results suggest the installation of a sub-water meter can encourage actions and behaviours that result in actual and sustained water savings.

Staff launched the Residential Sub-Water Meter Rebate program January 1, 2018. This Program rebates up to half of the sub-water meter's cost to a maximum of $125 per permanent sub-meter installed and $100 for an add-on sub-meter with smart technology (e.g. a strap-on sub-meter).

In 2018 the Sub-Water Meter Rebate Program witnessed encouraging participation rates. Fifteen add-on sub-meter rebates were issues for the City of Guelph's Residential Sub-Water Meter Rebate Program.

- Six multi-residential properties participated, surpassing the target of two per year.
- Nine households across Guelph participated, falling short of one of the target of ten per year.

Despite positive participation rates, the sample size of participants remains relatively small, making it difficult to calculate a measure on related water savings. Outliers in water usage data also tended to be significant, having a disproportionate impact on calculating associated savings.

As it relates to 2018 program participation, water savings ranged from 7 per cent to 15 per cent, within the program target. Alternatively, multi-residential property participants demonstrated an increase in water consumption. Many assumptions can be made as to why:

- Changing occupancy rates;
- Development of leaks that are unreported or unrecognized by unit owners/tenants; and
- Planning retrofits to save water take time.

While the difficulties inherent in measuring associated water savings will remain, growing participation and additional time to collect related data will shed a stronger light on the Sub-Water Meter Rebate Program's connection to water savings.

Water Use Home Visit and Audit Program

The 2016 Water Efficiency Strategy recommended the continuation of the water use home visit and audit program. These visits continues to provide a unique opportunity to engage with Guelph residents to understand their water using behaviours, habits, fixtures and appliances. A one-on-one audit enables verification of water using appliances, fixtures and behaviour, and allows for individualized feedback which can help reduce a resident's water use.

Since November 2013, the eMERGE home-tune up has been offered to Guelph residents. The eMERGE Home Tune-up program is an innovative collaboration between the City of Guelph, Guelph Hydro Electric Systems Inc., Union Gas, Transition Guelph and other local partners. This service offers a free one-hour home audit by trained advisors, a complimentary retrofit of common home water use fixtures (such as water efficient showerheads and faucet aerators), and toilet leak detection. Each participating household receives an Action Plan; a personalized report that provides information and suggestions to help reduce home resource use. The action plan directs Home Tune-up participants to further resources and tools to assist with the implementation of recommended improvements.

In verifying the household water consumption data, the City has concluded that on average, the homeowner who receives the visit will reduce their water consumption by up to 10 per cent depending on the retrofit measures taken. To date, eMERGE home visits have engaged 1367 households with a home audit.

The eMERGE Home Visit service continued engaging 125 households in 2018, achieving an estimated in-year savings of 4 m3 per day. This value is down from the 13 m3 per day goal outlined in the Strategy. The significant decline in the number of Home Tune-Ups was primarily due to the impact of human resource changes in the organization.

To improve water savings in 2019, a marketing strategy will be developed and implemented to boost participation rates. The Home-Tune-Up program has also been incorporated into the Blue Built Home Program which offers significant cross-promotion opportunities that can help boost participation rates for both programs. It is anticipated that between 200-300 Home Tune-Ups will be performed in 2019.

Blue Built Home Water Efficiency Standards and Rebate Program

The Blue Built Home (BBH) Water Efficiency Standards and Rebate Program is a voluntary construction or retrofit standard designed to outperform the plumbing and water–using fixture

requirements of the Ontario Building Code. The installation of more water efficient technologies contributes to reduced water use in single-family detached homes. Residents with certified Blue Built Homes could save water and reduce water and wastewater utility bills by 15 to 62 per cent. From launch in 2010 until year-end 2017, a total of 50 new homes have been BBH certified (44 Bronze, 4 Silver and 2 Gold).

The Water Efficiency Strategy included a plan to transition BBH from a three-tier (bronze, silver and gold certification) to a single-tier program. BBH certification and associated rebates are to be made available to both existing and new homes and the multi-residential community. Through Q4 2017 and Q1 2018, preparations were made to update the program accordingly and on May 15, 2018, an updated BBH program was launched. Through this update, BBH became a single tier program and was expanded to include both existing single-family and multi-family residential properties. In 2019, research will begin on how new-build multi-family homes will be incorporated into the program.

Since the program re-launched, 11 homes were Blue Built Home certified. Of these, all were classified as single-family homes, and only one was a new build. Six of the eleven certified homes received rebates, meaning that 55% of households purchased and installed more water efficient fixtures to achieve their Blue Built Home certification.

With the Blue Built Home update, the six homes that purchased and installed new water saving fixtures are conserving an additional 0.38 m^3 per day or 138.7 m^3 each year. While improved from last years 0.25m^3 per day, water savings are still lower than the anticipated 2018 goal of 2 m^3 per day. However, the program update did not occur until May and program revisions are still underway to incorporate newly constructed multi-family homes. It is anticipated that through further program expansion and promotion of Blue Built Home program update water savings from this program will continue to improve.

Water use monitoring at the four Net Zero Homes, constructed by Reid's Heritage Homes', continued throughout 2018, with final data collection taking place in October. A Net Zero Home aims to produce as much energy as it consumes on an annual basis using technologies available to the average builder. To date, 5 reports on household water consumption have been submitted to Reid's Heritage Homes. Data is not considered statistically significant, but two of the four Homes exhibited consistent and significant water savings when compared to modelling of a home built to Ontario Building Code standards. The annual water savings in these four BBH ranges from 0.5 and 107 m3 when compared to a home of equal size built to the Ontario Building Code standard.

Multi-Residential Water Audit Program

Following endorsement from the Water Efficiency Strategy, a water audit program for Guelph's multi-residential apartment and condominium buildings launched in March 2018. These residential buildings, both new and existing, pose significant potential for water savings.

The Multi-Residential Water Audit program offers participants a no-cost water audit completed by a third party consultant. The audit includes the completion of flow monitoring and data logging of the whole building and on specific water using processes, such and pools and irrigation systems. A proportionate number of units per multi-residential building are also assessed to identify water saving opportunities. Building owners or property managers are provided a report on all water using fixtures, appliances and processes with tailored recommendations to help reduce their water bill. Following the water audit, property owners/condo boards are encouraged and supported by staff to access a suite of retrofit options, and provided a tailored list of rebates available for their specific upgrades, including Blue Built Home, Residential Sub-Water Meters or, if capital infrastructure needs to be replaced or upgraded, incentives through the Water Smart Business program.

In the first year of implementation, the Multi-Residential Water Audit Program had three participants and was associated with direct water savings of 4.05 m3 per day based on estimates outlined in the 2016 Water Efficiency Strategy. This falls 6 m3 short of the modified estimate outlined in the Strategy. Launch timing, program eligibility, budget and change in staffing support constrained participation in 2018.

In 2019, program eligibility will be modified to:

- Accept applications from properties with 6 or more units; and
- Accept applications from properties that use 130 m3 per unit per day average.

These modifications aim to encourage additional interest to participate. Further, an engaging marketing strategy is planned for 2019. Three additional multi-residential buildings have already applied for participation, and qualify. These will be completed in 2019.

Water Smart Business Program

Between 2007 and 2016, the City has successfully reclaimed an annual average daily savings of 1,590 m3 in water and wastewater servicing capacity through participation in the Industrial, Commercial and Institutional Capacity Buyback Program – a program to assist local businesses reduce their ongoing operational utility costs and decrease their demand on municipal supply.

Through the 2016 Water Efficiency Strategy Update, several changes were identified to enhance the program and increase uptake. The Strategy recommended an increased incentive for capital projects permanently offsetting reliance on municipal supply, effectively buying-back water-servicing capacity. Further, through consultation, it was identified that streamlining the process to offer financial assistance and incentives to local industrial, commercial and institutional clients to complete water efficiency process audits and capital retrofits that reduce water demand, required more dedicated staff resources to support this water-using sector of the community.

Throughout the course of 2018, staff consulted with internal and external stakeholders in an ongoing effort to best meet the needs of Guelph's water-using business community. Staff continued networking and relationship building to facilitate several program applications for the Water Smart Business Program in 2018. As such, three water reviews were completed in 2018, and an updated water audit revised with a past participant.

Subsequently, a combined 62.4 m^3 of water is being saved daily by process upgrades and the installation of a rainwater harvesting system to offset domestic demand in two different businesses this year. An additional two water reviews were completed that resulted in an estimated 15m^3 per day of unexpected, indirect savings. This is assumed to have been achieved through leak and process change identification and adjustments made by participants of the program but has not yet be verified.

While these results do fall short of the ambitious goal of 150m^3 per day of savings estimated through the Water Efficiency Strategy, many projects do not happen without several years of planning before execution. As such, Water Smart Business staff commitments to fostering supportive and participant-focused conversations, offering technical support and advice, aligning project planning cycles with businesses fiscal year, is prudent and remains a valuable investment long-term to see water saving projects come to fruition.

Further to that, staff hosted an event for local businesses in December to learn more about the Water Smart Business program. "Efficiency for Smart Businesses" lunch-and-learn was hosted at the Cutten Club. The event was well attended, with 32 representatives spanning various businesses - manufacturing, food and beverage, government, and hospitality. Since the event, meetings have been held and are scheduled which indicate a high probability of increased program participation in 2019.

Ontario's Municipal Eco-Cluster

To evaluate industrial, commercial and institutional water efficiency programming across the province, Guelph's Water Smart Business staff have been participating in Ontario's Municipal

Eco-Cluster – a joint effort between municipalities (York Region, City of Toronto, Region of Waterloo, Peel Region, and the City of Guelph), the Ontario Water Works Association and hosted by Partners in Project Green, Toronto Region Conservation Authority. The intent of the Eco-Cluster, which was funded through an Independent Electric System Operators grant, was to establish best program practices, highlight individual program successes, and establish an audit process which evaluates embedded energy, greenhouse gas savings associated with process water savings. To meet grant funding deadlines, this project completed in December 2018. A final report will follow in early 2019.

Cooling Tower Research

The Water Efficiency Strategy recommended City staff assess participation, cost and water savings associated with a cooling tower audit and conductivity censor and meter rebate pilot. A sample size of at least five buildings were recommended to be studied in order to verify savings and costs effectiveness of the program.

The Water Efficiency Strategy includes a proposed multi-year budget of $120,000 CAD (2021 to 2026) to establish the parameters of a program as well as fund the completion of cooling tower audits and offer an incentive for upgrading.

Alliance for Water Efficiency Cooling Tower Research Project

In 2017, the Alliance for Water Efficiency (AWE) commenced a Cooling Tower Research project. The overall purpose of this study is to gain foundational knowledge needed to create an effective, targeted, and appealing incentive and outreach program to achieve greater efficiency in industrial cooling systems. As part of AWE's broader effort to explore the potential for water conservation in urban areas, the research effort is intended to have multiple phases.

Phase I has five broad goals:

- Develop best practices for identifying water-cooled facilities in urban areas.
- Develop best practices for estimating consumptive and non-consumptive water demands for cooling.
- Determine the conservation potential for improvements to traditional cooling technologies, such as cooling towers.
- Determine the conservation potential of alternative cooling technologies.
- Develop practical guides to increase understanding of cooling technologies.

Thirteen municipalities and utilities from across North America have signed on including Denver Water, Southern Nevada Water Authority and San Antonio Water System in this multi-tasked project.

In 2017, the City of Guelph signed on to participate with an investment of $13,000CAD ($10,000 USD). This provides staff a seat on the Public Advisory Committee to scope and direct the work for the Project, with project outputs including the reports and recommendations of the first four tasks.

In 2018, staff are increasing their contribution to the Project by another $15,000CAD ($11,500 USD). This additional contribution in the Cooling Tower Research project funds a critical task of the report - Task #7 –to provide the development of a practical guide, outreach material and outline incentive programs for water utilities.

As stated, the results of this research will provide the framework for the City of Guelph's Water Smart Business Cooling Tower audit and rebate program. And while the timeline has been accelerated from that outlined in the WES, the City's total investment of $28,000CAD in this leading North American research project will provide a well-researched, value-for-dollar scope for local programming (a total project budget of $530,000CAD; $400,000USD) is a multi-year investment estimated to be completed in June of 2020. This accelerates the groundwork necessary to lead the fulsome pilot planned for 2021.

Municipal Facility Water Efficiency

The City aims to lead by example by increasing water efficiency and cost savings in our own operations and significant progress was made in 2018.

In support of the recommendation through the 2016 Water Efficiency Strategy, the need for a new corporate policy was identified in relation to water use within City-owned facilities. This draft policy has staff continuing to connect with internal stakeholders across the organization (e.g. Facilities Management, Engineering and Capital Infrastructure Services) to support water efficient practices, education and infrastructure upgrades to ensure compliance.

Projects staff engaged in to support water efficiency within Municipal Operations in 2018 include:

- Input and expertise for South End Community Centre design meetings.
- Support to Engineering department on pool heat recovery systems and pump modifications for the West End Recreation Centre and Victoria Road Recreation Centre. Estimated potential water savings to be 4 m3 per day with respect to West End Recreation Centre upgrades. Project completion is estimated for winter 2019.

- Support to Solid Waste on completing a water audit at the Organic Waste Processing Facility. The completed water audit estimated 1,750 to 2,527 m3 of annual water savings by capturing, treating and utilizing rain and snowmelt to offset municipal demand for non-potable purposes. Next steps in project planning will occur in 2019.
- Pre-consultation with Park Planning department for Norm Jary Splash Pad pump upgrades. Estimated savings of 41 m3 per day during the operating season, or 10m3 per day annualized. Project completion is estimated for spring 2019.
- Input and expertise support to Engineering Department for River Run Centre process water upgrades; projects for 2019 to be determined.

The Water Efficiency Strategy's goal related to annual achievements for this program can be variable due to capital investments and asset replacement schedules. In 2017, Staff exceeded of the annual target of 22 m3 per day in municipal facility upgrades. In 2018, the groundwork is completed to achieve another formidable year in 2019.

Youth and Public Outreach and Education Programming

Education is a fundamentally important tool to engage and motivate action. The commitment to increasing local water literacy is a complimentary piece to changing toilets, or completing water audits, or installing water meters, to ensure the wise use of this resource. Staff continue to offer a variety of very successful programs to increase awareness, influence people's attitudes and habits regarding water use, and inform public on how the City invests their rate dollars. Investment in Guelph's water future includes education and outreach programming.

2018 Public Education and Communications Strategy

The Water Efficiency Strategy recognized public education as a municipal best practice for water efficiency programming. The development of this complimentary Strategy to determine the best platform(s) in which to engage the various sectors of the community commenced in August 2017. As an industry leader in municipal water efficiency, it is important Guelph evaluate the best tactics and messaging to resonate with a community aware of the conservation message.

In 2017, two pieces were completed: a literature review of best practices of municipal tap water and conservation programming in both grey and academic literature; and quantitative/qualitative research through market research using telephone survey and focus groups. With this information, a final Public Education and Communication Strategy (PECS) was completed in March 2018 that, identifies current and proposed program constraints, opportunities, recommend communication goals and messages, defines audiences and suggests target groups, identifies outreach and communication strategies, tactics and tools to meet the

recommended communication goals and water efficiency targets. Five key recommendations were included:

1. Further limit Brand proliferation; adopt just three sub-brands (Ours to Conserve, Blue Built Home, and Healthy Landscapes). Continue using the "I Love Guelph Tap Water" sub-brand and consider expanding it to encompass all water services communication, outside water efficiency.
2. Adopt the three updated key messages and use them to underpin content and delivery of all communications:
    a. Using water wisely is normal, easy and will benefit you.
    b. Water conservation is good for our whole Guelph community.
    c. Caring about our water is part of our identify as Guelphites.
3. Use a targeted approach to communications. Market research or a data driven approach based on consumption analytics can refine and prioritize target audiences for each water efficiency program.
4. Communication channels (e.g. traditional media, online tools, marketing collateral) should be seriously considered and purposefully selected to be the most effective for reaching the target audience. This is anticipated to have a significant bearing on program success.
5. Identify opportunities to integrate programs to not only leverage the success of some programs to boost the effectiveness of others but also help improve organizational credibility, efficiency, and help advance water savings targets.

The recommendations and key messages outlined in the PECS are considered when developing or updating any programs and communications materials. Four major tap water promotion pieces were developed in 2018 with consideration for PECS research findings and recommendations, subsequently outlined.

A water fountain with a bottle filling station was installed at the side of Riverside Park concession building in June 2018. Instead of leaving the fountain a plain blue colour, the fountain was wrapped with "I Love Guelph Tap Water (ILGTW)" and "Bring Fill Drink (BFD)" branding and associated visual identify and insignia as shown in Figure 8 and Figure 9 below.

Figure 8: Riverside Park Water Fountain

Figure 9: Riverside Park Water Fountain

The "ILGTW" branding supports key message three (Caring about water is part of our identity as Guelphites) as it encourages those who drink our water at the fountain to adopt the identity of someone who cares about Guelph's water supply. The water droplets convey that the fountains water is a refreshing beverage that is clear and clean, and such aesthetic qualities are associated with safety. The wrap reminds fountain users that the water they are drinking is municipally

supplied, and when combined with the "Bring, Fill, Drink" slogan, substantiates the message that the City of Guelph makes it easy and convenient to find and drink tap water.

These are important associations to make with our tap water as the PECS literature review highlighted that a trust in tap water suppliers and past service performance is an important determinant of willingness to drink tap water. Wrapping the fountain was a unique tap water promotion opportunity that allowed us to communicate key messages and make associations with our tap water directly as people are drinking it. Communicating at the source of the desired behaviour is important for encouraging desired behaviour change.

Water Services' Distribution Trailers

The two trailers utilized by Water Services' distribution team were wrapped in November 2018, as shown in Figure 10 and Figure 11 below. Wrapping the trailers was important to create public awareness that Water Services staff are at work, maintaining Guelph's water system.

Using the "ILGTW" for communications related to distribution work follows key recommendation one, to broaden the use of the "ILGTW" into all Water Services communications. The use of "ILGTW" brand in this context supports key message three, that both the City and the city cares about its water and the City is a good manager of the water supply. The "ILGTW" brand and key message that Guelph cares about its water supply is further supported by the image of the happy worker on the side of the trailer.

The market research conducted for the PECS highlighted that our customers understand that they should conserve water, but not why. There is an appetite from our community to know more about the water utility itself and how rate dollars are used. The literature review revealed transparency and awareness of Water Services operations is important for gaining the trust of our customers, which will influence their decisions to dink tap water.

Making it obvious to our residents that Water Services staff is at work on our water supply will help increase transparency. The image of Guelph's water system is a simple and elegant visual representation of the infrastructure we are responsible for, where our water comes from, and how it gets to our taps promoting greater community awareness about our water supply.

Figure 10: Front of Water Services' Distribution Trailer

Figure 11: Side view of Water Services' Distribution Trailer

Water Services' Promotional Video

A Water Services promotional video was produced in September 2018 and posted on Guelph Today's website on October 8th with accompanying introductory text at as well as the City of Guelph's website. Statistics from Guelph Today indicate that the video was well received with 892 unique page views between October 8th and December 4th and 143 shares to date.

This video was designed to increase transparency about the role of Water Services and how rate dollars are invested to maintain, enhance and protect our water supply. It promotes the City of Guelph as a good manager of the water supply that cares about the community, and outlines the value in the work conducted by Water Services. This video works to increase transparency around the work conducted by Water Services, educate our customers about Water Services, and also supports key message three, that the City of Guelph is a good manager of a safe and reliable water supply that the Guelph community does not take for granted. In Guelph we care about, and take care of, our water.

Curriculum-Linked Education Programming

The City's curriculum-based Grade 2 and Grade 8 in class, water conservation programming continues to be a popular resource for local educators in both the Upper Grand District School Board and the Wellington Catholic District School Board. In 2018, Water Conservation staff provided 26 interactive school presentations, in both a classroom and assembly setting, to 1,228 students. Since the inception of this in-class, curriculum-linked program seven years ago, the City has provided a total of 341 school presentations to over 13,170 students.

In partnership with the Grand River Conservation Authority's Guelph Lake Nature Centre, a total of 638 local Grade 8 and high school students and their chaperones participated in guided educational tours of the City's Water Services facility in 2018.

H2Awesome

With several key changes to H2Awesome event coordination staff, the event was suspended for 2018.

Currently, planning is underway for H2Awesome to return in the spring of 2019. A departure to previous years, 2019 will see H2Awesome take place in 2 phases. Phase 1 will take place on April 30, 2019. With an anticipated crowd of 400-500 students, teachers and chaperones, H2Awesome will host Emily De Sousa, marine conservation educator; The Water Brothers, Tyler and Alex Mifflin; with local Anishinaabe Metis, Jan Sherman, opening and closing the proceedings.

Phase 2 will include a half-day workshop hosted May 1 through May 15, for each of the 20 classes registered for the event. Workshops are aimed to engage grade 8 students across Guelph in a variety of participatory activities linked to water through art, science and technology.

Splitting this event into separate pieces, presentation and workshop, is a departure from past events held over the course of a single school day at one venue; the planning committee will convene post-event to determine which style of event works best for future years.

Planet Protectors

Since 2016, Water Services has partnered with Transportation Services and the Office of Climate Change to offer a curriculum-focused, interactive and activity-based online program called Planet Protectors. This program helps students understand the basics of climate change, the impact of our actions, as well as the importance of energy and water conservation, and transportation choices. Through 'missions', Planet Protectors solicits personal commitments from students and encourages sharing them with their family members - commitments such as shortening shower time.

During the 2017/18 school-year, this program witnessed modest improvements in classroom registrations, active program use and total program completion. In 2018 Planet Protectors was used across 33 classrooms, reaching over 700 students in both the Upper Grand District School Board and the Wellington Catholic District School Board.

Success of the 2018/19 program will be monitored closely. Once a unique offering, new educational programs have surfaced since 2016 that are equally adaptable, relevant and cost effective – if not more so. It will be prudent to determine the program that offers the best value per dollar spent.

Other Outreach and Engagement Programming

H2O Go Festival

In 2018 the City of Guelph hosted the 6th annual H2O Go Festival. The H2O Go Festival is a community celebration of water, hosting a variety of educational and interactive displays aimed at connecting audiences of all ages with water. The Festival runs in tandem with the eMERGE Guelph EcoMarket – a sustainability expo.

This year's H2O Go hosted 9 organizations, collaborating with local not-for-profits, businesses and institutions. Hosted at the Old Quebec Street Shoppes, attendance has continued to grow each year. This year's event attracted over 2,200 participants of all ages.

Coordinated planning for the 2019 event has begun in earnest. It will take place at the Old Quebec Street Shoppes in downtown Guelph on Saturday, March 23, 2019.

Waterloo Wellington Children's Groundwater Festival

Celebrating its 23rd year, the long standing Waterloo Wellington Children's Groundwater Festival was held from May 25 to May 31 in 2018. Water Services is proud to be an ongoing partner, sponsor, contributor and organizer of the Festival. In 2018 the Festival engaged 4,835 students Grades 2 through 5 from the City of Guelph, Wellington County, and the Region of Waterloo. Upwards of 900 students participate from Guelph on an annual basis. Since 1996, over 90,000 students have participated in the Festival, which features fun and interactive activities designed to inform students of the importance of water protection and conservation in their daily lives. In partnership with Guelph's school boards, staff have worked to increase local awareness and participation in this Festival annually.

Guelph Water Wagon

In support of the City's 2009 Public Promotion Action Plan for City Drinking Water Consumption, the Guelph Water Wagon has been providing tap water to attendees of large, outdoor community events during the summer months for six years. The Water Wagon provides access to tap water where water fountains or taps are not readily available. Continually growing in demand year-after-year, the Water Wagon attended 35 events in 2018 and provided 27,197 litres of water to event attendees. The Water Wagon continues to provide staff an excellent opportunity to engage with the public. Staff engage with Guelph residents about:

- the importance of water for the City of Guelph;
- the need for water conservation and source protection;
- questions and concerns regarding municipal tap water;
- Water Services-based public processes, programs and studies; and
- promote tap water consumption over other beverages.

To accompany the Water Wagon at events, a photo frame with handles on the back was produced to enhance public engagement at Water Wagon events as shown in Figure 12. Water Wagon customers can use their own phones to take and share pictures of themselves at the Water Wagon with the photo frame around their faces. This photo frame is covered in Water Wagon imagery including the water droplet background, "Bring Fill Drink" logo, "I love Guelph

Tap Water" slogan in addition to "#guelphwater" to promote social media posts. This interactive prop and associated photo sharing promotes the Guelph Water Wagon's attendance at community events, supports the fun and positive reputation of the Water Wagon, fosters positive associations with our water supply, and encourages the identity of our community and its residents as people who love Guelph's water and support their municipal water supply.

Figure 12: Photo Frame used at Water Wagon Events to Enhance Public Engagement

Wooden A-frame signs were available for the first time in 2018 to direct people at community events to locations where they can access tap water. These signs were used at large community events to direct customers to the Guelph Water Wagon, but are also available for smaller events that do not qualify for Water Wagon attendance. These signs can direct attendees to water fountains or taps from which Guelph tap water can be accessed. Increased promotion of the availability of these signs to smaller events should increase use of them during the 2019 season.

Peak Season Water Demand Management

Reduction of peak season (summer) water demand continues to be a primary objective of the City's water efficiency programming. The ability to reduce or minimize variations in seasonal

water use limits the impact on our finite groundwater supply during times of environmental stress and creates operational efficiencies by reducing capital and operational investment to service our community for only a few days a year.

Outside Water Use Program

Since 2002, the City's Outside Water Use Program (OWUP) has helped to manage peak season (summer) water use through regulatory controls with complementary programs, such as Healthy Landscapes, working to proactively manage potential peak demands by assisting residents and local businesses in establishing low outdoor water use environments. The following activities were completed as part of this program in 2018.

The OWUP finished the season in Level 1 (yellow) on September 30, 2018. Due to warmer than normal temperatures in June and temperatures higher than normal with limited precipitation, the program moved to yellow on July 11, 2018. The Grand River Low Water Response Team moved the entire Grand River Watershed to Level 1 low water conditions on Thursday, July 12th. This decision was reached when river levels dropped and reservoirs were used to add water in addition to low precipitation levels across the watershed.

The successful annual rain barrel truckload sale in May was held at Water Services' open house and yielded the sale of over 500 rain barrels. Rain barrels offer homeowners the benefit of capturing free volumes of water for outside use but also assist in managing stormwater impacts on private property. The sale of rain barrels are a net-zero cost to the City as the barrels are sold at the bulk rate attained through a rain barrel tender process.

Please visit the City of Guelph Webpage for more information on the Outside Water Use Program.

Healthy Landscapes

Proactively managing peak season demand the Healthy Landscapes Program continues to offer various public resources.

The annual Healthy Landscapes Workshops and Seminar Series featured numerous free talks on time–of–year outdoor water conservation topics including water efficient landscape design, plant selection, and proactive maintenance best practices to manage the impact of drought and common turf pests. It is estimated over 350 Guelph residents took part in this Workshop and Seminar series. Further, 100 individuals participated in the annual four-part Design Course.

Healthy Landscapes visits continue to be a popular resource, with 300 complimentary 1- hour visits completed by trained staff in 2018. This service offers a complementary site based consultation aiming to educate residents on garden design and maintenance practices to significantly curb outdoor water demand at their home.

A new addition to the Healthy Landscapes visits in 2018 was the addition of the Blue Built Home Landscape Visit. Homeowners sign up for this specialized visit to complete one of three qualifying water saving options to become Blue Built Home certified. This was offered starting in June and 29 of this type of Healthy Landscape visit was completed.

Visit the City of Guelph webpage for more information on the Healthy Landscapes Program.

Peak Season Water Demand Research

Staff continue to pursue collaborative research opportunities where resources can be leveraged to garner greater products. Included in 2018 research is the City's participation in:

- Alliance for Water Efficiency's Outdoor Water Savings Research Initiative, which seeks to explore the reasons and rationale and water demand impact of landscape changes and the components necessary to achieve reliable and persistent water savings long-term. Research pertaining directly to Guelph attributed a 40 litre per day savings to those who participate in the Healthy Landscapes program. The results of this research is to be released in 2019.
- University of Waterloo Outdoor Water Use Bylaw Study, which is assessing how well outdoor water applications reflect water application out of habit; or based on soil moisture needs and the effectiveness on water use bylaws across Canada. The study is being undertaken by a PhD student at the University of Waterloo as part of her research. This ongoing study is expected to be completed in the spring of 2019.

Water Conservation and Rebound Effects Study

A Conservation Effects and Rebound study – a series of five tasks – commenced as a recommendation of the Strategy in 2017. The research was completed in March of 2018. The study investigated (a) the effects of water conservation and plumbing and municipal water/wastewater infrastructure, and (b) the possibility for a rebound in water use should conservation technologies degrade in performance or land uses (such as intensification) changes over time.

The five tasks completed to support this study were:

1. Guelph Customer Water Billing Data Analysis
    a. There is little question about average water demand values for single-family homes in Guelph. The challenge is with the data used for calculating medium and high density residential sectors, which seems to be due to Municipal Property Assessment Corporation property code data.
    b. In working directly with staff, the report recommended methodology to determine a population demand for the three residential sectors and how best to balance an average residential daily water demand per person in Guelph.
2. Hydraulic Modelling for sensitive areas for intensification
    a. There are several areas in the City that can support, and possibly benefit, from additional development and intensification. The analysis also identified areas in the City that are currently constrained by limited watermain capacity, i.e., areas where additional development or intensification would diminish the hydraulic performance of the system.
    b. In general, the City of Guelph's water distribution infrastructure was found to be in good shape and able to meet the current demands being placed on it.
3. Outdoor Water Demand: Rebound Study
    a. The City's current average summer day and Peak Day water demands are relatively low compared to other Canadian municipalities. The results of this study show that the City's average summer day and peak day demands would increase significantly, and would not be sustainable by current available water supplies, if single-family homeowners began applying 25.4 mm per week – the depth of water commonly referenced as being required to maintain a lush and healthy landscape.
    b. The study reassured that given Guelph's proactive and ongoing efforts to manage seasonal water demand, it seems unlikely that 'worst case' Peak Day and average summer day water demands, as described, would ever be reached. It further recommended Guelph continue the successful outside water use programming, including the Healthy Landscape visits.
4. Impact of Automatic Irrigation Systems on Water Demands
    a. The results of this study indicate that the City's peak day demand would increase significantly if the number of automatic irrigation systems installed in Guelph were to increase significantly. The biggest impact would be from the single-family customer sector simply because of the large number of customers, but the industrial and commercial customer sector may also contribute significantly because of their larger properties.
5. Impact on Water Demands with Changes in Land Use Patterns: Rebound Study

a. Based on the information presented in this study, historical trends and implementation of water efficiency strategies indicate that future demands may be lower than anticipated, even with the same projected population growth.
b. The results of hydraulic modelling indicate that currently planned infrastructure could support demands in 2032. When demands were doubled in areas of high population growth, the east and south parts of the City operated well but the downtown core experienced high headlosses when demands were doubled. Areas of high headloss concern in 2032 remained consistent with 2016 exiting conditions, but flow through the proposed feedermains helped to maintain elevated tank levels around the City.

Automatic Meter Reading Technology Study

As the Strategy encourages Water Services' to consider the advancements in metering technology, providing customers more insight into their daily water using behaviour, a shift in business services and technology needs to occur. As such, Guelph has collaborated with the Alliance for Water Efficiency and nine other utilities and municipalities from across North America to complete an Automatic Meter Reading (AMR) Technology and Automatic Meter Infrastructure (AMI) Study.

Started in June, this research aims to support a series of deliverables to encourage and advance AMR and AMI meter reading processes through the creation and dissemination of standards for AMI and AMR and to push for interoperability between meters and other devices and AMI systems. This is an effort to continue the work initiated through a 2014 Water Research Foundation project on AMI/AMR Standardization for Water Utilities.

The four tasks to support this study are:

1. Hardware interoperability and software integration guidelines
2. Template for AMI Request for Proposal
3. Manual of Practice for AMI
4. Strategic consulting time with a consultant in the AMI field.

Final wrap up on this will be complete by the end of March.

Water Softener Alternatives Testing and Market Research

With high levels of naturally occurring hardness in the City's groundwater source, the use of residential ion-exchange (salt-based) water softener technologies is quite common amongst

Guelph households. It is estimated that approximately 77 per cent of local households, as part of a 2009 residential call survey, use a water softener.

The Region of Waterloo and the City of Guelph financed ground-breaking research in 2015 to assess the performance of an alternative to ion-exchange softening technology that treats hard water without the need for salt and recharge water. This technology referred to as salt and water free technology through the use of: media induced crystallization (nucleation assisted crystallization (NAC) and template assisted crystallization (TAC)); electromagnetic water treatment (MWT); chemical conditioning with complexing; or chelating agents. Salt and water free technology employs a combination of processes to prevent scale buildup in household water heaters and appliances. However, these technologies do not allow for the same lathering effect as salt-based water softeners provide.

In June 2017, the City of Guelph again collaborated with the Region of Waterloo to continue the research, trialling the NAC/TAC technology in real life scenarios. The aim of this study is to assess the field performance and user benefits associated with salt and water free residential water softener treatment technology.

Through this study, social research in both communities was completed (phone surveys, focus groups) to generate a technology test group, a participant list of 18 homes, to install a single technology in their home for testing for user experience.

As of December 2017, all participating homes have the technology installed. Use of the systems has continued throughout the year in 2018. Engaging participants through subsequent focus groups and ongoing dialogue through an online discussion board, saw many experiences and feedback on the systems.

The final report is scheduled to be delivered February 2019. Due to a good deal of interest from the public over the last year, a public communications plan will be developed and information shared on the technology, experiences of those who participated, and presentations to other water professionals is anticipated throughout 2019.

The results of this Water Conditioner Study, when available, will be posted to the joint website, watersoftenerfacts.ca.

Appendix J: Water Services Committees

Water Conservation and Efficiency Public Advisory Committee – Annual Report

The Water Conservation and Efficiency Public Advisory Committee (WCEPAC) – a Guelph Committee of Council – was formed in 2009 through Council approval. Council recommitted to this Committee in 2016 with the approval of the Water Efficiency Strategy update. This committee provides a forum for community input and guidance throughout the City's implementation of the Water Efficiency Strategy.

The WCEPAC met three times in 2018. The WCEPAC continues to provide valued insights on opportunities for continued enhancement of current and developing water conservation programming, policy and education, engagement and outreach resources. In alignment with Council reporting requirements outlined in the committee's Terms of Reference, the following Annual Report details activities of this Water Conservation and Efficiency Public Advisory Committee within 2018.

In 2018 WCEPAC continued to provide invaluable citizen feedback and recommendations to enhance the City of Guelph's successful water efficiency program, including:

- Consultation during the development of the Public Education and Communication Strategy Update and feedback on education and outreach efforts including the H2O Go Festival, Canada Water Week, and the tap water promotional video.
- Feedback on the following water efficiency programs that were updated or developed as directed through the 2016 Water Efficiency Strategy:
    - Blue Built Home Water Efficiency Standard and Rebate Program,
    - Water Smart Business water review, audit and incentive program for industrial, commercial and institutional water users,
    - Multi-Residential Water Audit Program, and
    - Residential Sub-meter Rebate Program.
- Feedback on the use and type of key performance indicators for water conservation to report on the success of water efficiency programs.
- Comment on various innovative research, study and pilots including fit-for-purpose water reuse and the water-energy nexus.
- Engagement in succession planning to ensure continuity of the committee with four longstanding members reaching the end of their allowable years of service.
- Participation in discussions on how best to utilize and enhance the committee's capacity to provide advantageous and quality input.

- Learning opportunities to support member's role on the committee including informational presentations on Guelph's sewer abatement credit and 2019 Conservation staff work plans.

In 2019, the WCEPAC will continue to be engaged to solicit input throughout continued implementation of the 2016 Water Efficiency Strategy recommendations including, but not limited to:

- Outreach and engagement strategies for City of Guelph's conservation programming and tap water promotion,
- An update to youth based education programs,
- Continued enhancement of the Blue Built Home program,
- Development of a residential raingarden rebate program in partnership with Stormwater Engineering,
- Development of an industrial, commercial and institutional Healthy Landscapes program in line with the Natural Heritage Action Plan,
- Development of a wastewater reuse pilot project in partnership with Wastewater Services and University of Guelph,
- Alternative water softening technology study results and communication in partnership with the Region of Waterloo,
- Water and Wastewater rate review,
- Water Energy Nexus calculator for Guelph's water system and communication, and
- Automated meters research and business case development.

Visit the Water Conservation and Efficiency Public Advisory Committee webpage for a full list of the WCEPAC members, meeting minutes and agendas.

The WCEPAC possesses no annual budget. Funding for the City's Water Efficiency Program is provided within the Council-approved Non Tax Supported Water and Wastewater Services Capital and Operating Budgets as well as through Development Charges.

Well Interference Committee

The Well Interference Committee is a specially arranged—or ad hoc—committee that is brought together to address well interference complaints resulting from the City's water takings.

The committee was established in 2004 to address concerns voiced during the City's Class Environmental Assessment for the Arkell Springs Ground Water Supply Strategy. During the Environmental Assessment, private well owners expressed concern that City water taking may interfere with or reduce the amount of water available for their wells.

No complaints have gone to the Well Interference Committee since it was established. With the election new council members for both the City and County, membership is being confirmed for 2019. Visit the Well Interference Committee webpage for more information.

Appendix K: Source Water Protection

The second annual report summarizes information requested from the Risk Management Official by the Source Protection Authorities, as required under section 81 of the Clean Water Act, 2006 (CWA). The report outlines activities undertaken by the City of Guelph in 2018 to protect municipal drinking water sources. Source Protection is one component of the multi-barrier approach to ensure clean safe drinking water.

The Grand River Source Protection Authority will receive this information in the format they have requested by February 1, 2019. This information may also be requested by the Director of the Ministry of Environment, Conservation and Parks (MECP).

Risk Management Official Update

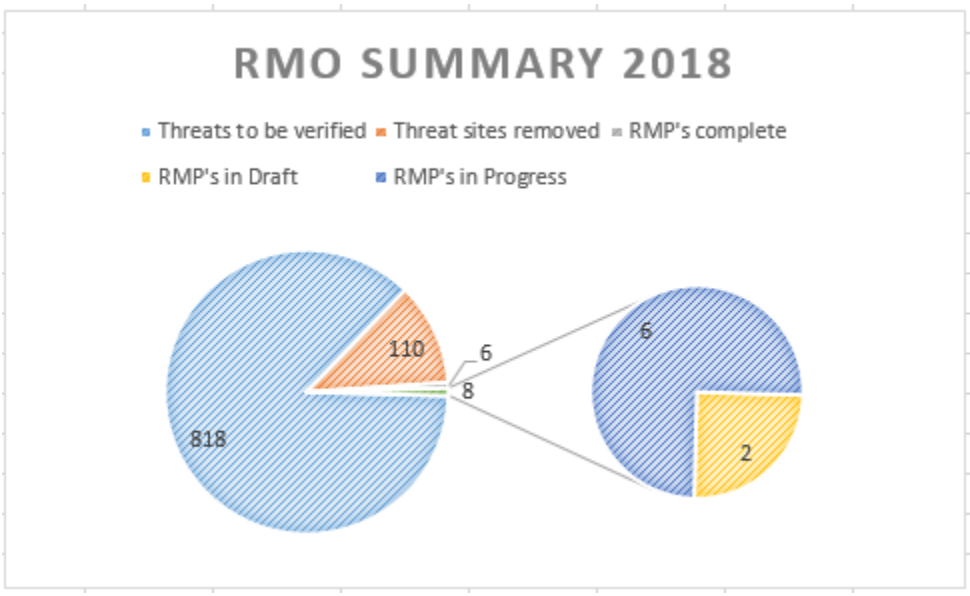
The RMO represents the City of Guelph as a municipal member of the Grand River Source Protection Committee. The Risk Management Official (RMO), Peter Rider, was appointed under subsection 47(6) of the Clean Water Act on May 27, 2016. The Risk Management Inspector (RMI) Kristin Pressey, was appointed on December 19, 2017.

Threat Verification and Negotiating Risk Management Plans

The City of Guelph continued to work with a number of property owners and businesses to verify and manage threat activities at their sites. Threats identified in the 2010 Assessment Report total 942 within the City of Guelph. Threat verification has been completed for 118 sites, resulting in the completion of 6 Risk Management Plans (RMPs) and an additional 8 in progress. City staff continue to develop RMPs for sites with threats, including evaluating existing practices and identifying potential missing gaps in drinking water protection. A template developed by the City was used to make the Risk Management Plan negotiation process less onerous for business and property owners.

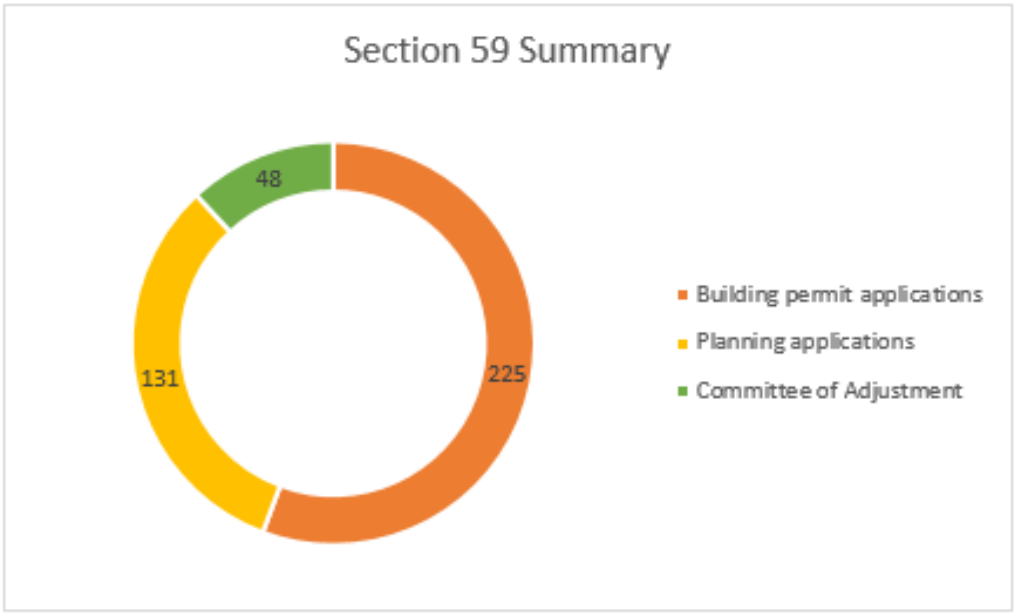
Information related to the Source Protection Program is managed in the Local Source Water Information Management System (LSWIMs), a data management system. This program is used by several other municipalities in southern Ontario to manage data associated with the Source Protection Program. The application is being updated regularly with additional functionality as requested by the collaborating partners.

Figure 13: Risk Management Official Summary, 2018



The CWA requires a section 59 Notice for development within the Wellhead Protection Areas (WHPAs) to determine if an application has a potential to introduce a new threat to drinking water. A notice is required before planning and building applications can be deemed complete. In 2018, Source Water Protection staff reviewed 404 applications and issued 112 Section 59 Notices.

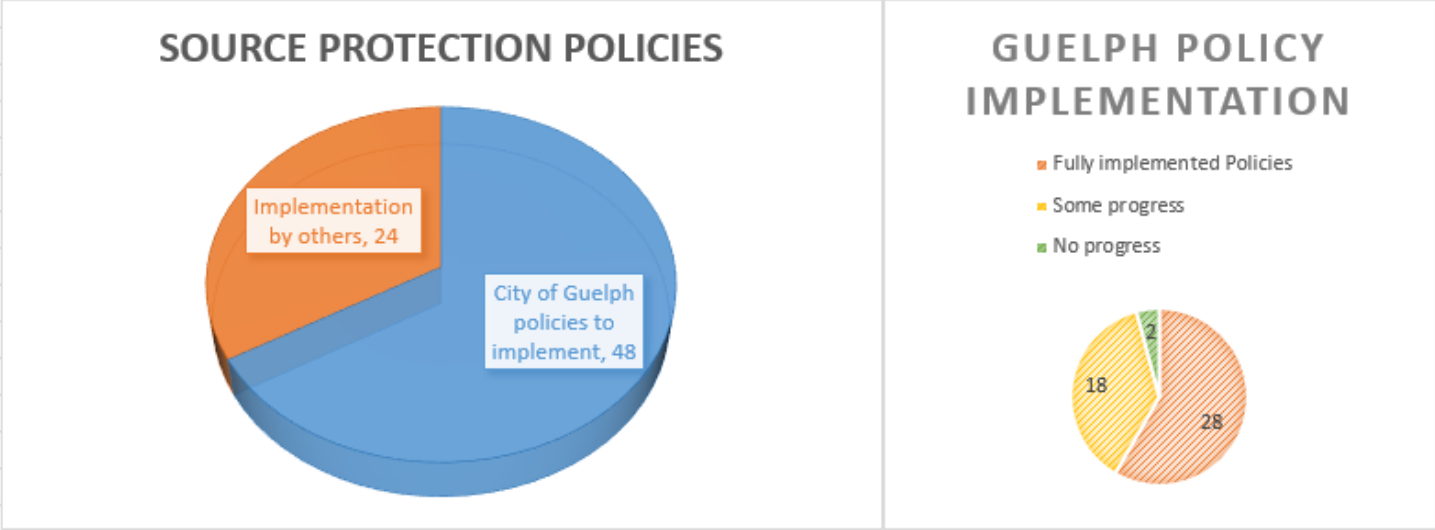
Figure 14: Clean Water Act, Section 59 Summary



Policy Implementation

The City of Guelph is the implementing body responsible for a range of Source Protection Policies, from prohibition to negotiating Risk Management Plans (RMPs) and providing education and outreach. There are 72 policies in the City of Guelph's section of the Grand River Source Protection Plan. Of these, 48 are identified as the City's responsibility to implement. As of January 2018, we currently have 28 policies fully implemented and 18 that we have made some progress on. Efforts are underway to implement the remaining policies, however, there may be certain triggers required (e.g. upon the next Official Plan update) which will determine the pace at which some of the policies will be implemented.

Figure 15: Source Protection Policies and the City of Guelph's Progress for Implementing those Policies



Collaborating with City Staff

Source Protection Staff worked in conjunction with Water Services to complete a City wide assessment for the handling and storage of fuel at municipal well sites, as requested by the Ministry. There was one site found to have a significant drinking water threat activity – FM Woods Station. This facility has had the municipal drinking water licence updated to include several risk management measures that will ensure that the threat associated with the handling and storage of fuel is managed satisfactorily.

Staff continue to work with the City's Sewer Use Bylaw enforcement team to share information on industrial sewer users in wellhead protection areas. Enforcement of the bylaw helps to protect

the City's drinking water sources by protecting assets, such as sewer infrastructure and by providing information on chemical use and storage at industrial facilities.

Protecting Water Quantity

The City of Guelph is working closely with the Townships and staff from the Lake Erie Region Source Protection Authority to develop a set of water quantity threat policies for the identified WHPAs. Meetings are ongoing and it is anticipated that public consultation will be completed by the end of 2019. The draft policies will then be submitted to the Minister of Environment, Conservation and Parks for approval before implementation.

Education and Outreach

In the second half of 2018 moving into 2019, Source Water started a campaigning to bring awareness to our program by having a Guelph Transit advertisement both on the back and side of the bus, along with posters up at various bus shelters throughout the City. We also had advertisement posted through various social media sites and Guelph Chamber of Commerce. Figure 16 below is an example of some source water public communication.

Figure 16: Source Water Protection Advertisement to Reduce Your Winter Salt Use

Moving Forward in 2019

Efforts will continue to develop RMPs, carry out threat verifications as required. We anticipate ramping up efforts to educate the public about road salting and how everyone can play a part in reducing the amount of road salt that is applied to hard surfaces.

The Source Water Protection team will continue to pursue opportunities to educate the public and various stakeholders on the benefits of protecting our water resources. This will be accomplished through meetings, seminars and conferences when opportunities present themselves.

Appendix L: Glossary

Included below is an index of terms used throughout this report.

Table 44: Glossary

Term	Description
<	Less than (used in reference: less than lower detection limit shown)
µg/L	Micrograms per litre = 1 part per billion
½ MAC	half of the maximum allowable concentration
Above Detection Limit	Means the result can be detected using the current level of technology.
AMP	Adaptive Management Plan
AO	Aesthetic Objective
AODA	Accessibility for Ontarians with Disabilities Act
A&S	Annual and Summary
AWQI	Adverse Water Quality Incident
Background	Indicator bacteria group used to monitor general water quality (non - regulatory)
BBH	Blue Built Home program
CAO	Chief Administrative Officer
CAPS	Capital Asset Prioritization System
CCL	Critical Control Limit. The point at which a Critical Control Point response procedure is initiated.
CCP	Critical Control Point. An essential step or point in the Subject System at which control can be applied by the Operating Authority to prevent or eliminate a Drinking Water Health Hazard or to reduce it to an acceptable level.
CELP	Community Environmental Leadership Program
CIR #	Continual Improvement Report Number. Refers to the number assigned to an item in the Continual Improvement Database.
cfu	colony forming unit

Term	Description
Cubic metre (m^3)	1 Cubic metre = 1,000 litres water
Distribution Samples	Samples taken within the distribution system, post primary disinfection.
Distribution System	The part of a drinking water system that is used in the distribution, storage or supply of water and that is not part of a treatment system.
DMA	District Metered Area
Drinking Water System	A system of works, excluding plumbing, that is established for the purpose of providing users of the system with drinking water and includes, (a) any thing used for the collection, production, treatment, storage, supply or distribution of water, (b) any thing related to the management of residue from the treatment process or the management of the discharge of a substance into the natural environment from the treatment system, and (c) a well or intake that serves as the source or entry point of raw water supply for the system.
DWQMS	Drinking Water Quality Management Standard
DWS	Drinking Water System
DWWP	Drinking Water Works Permit
EC	E. coli (Escherichia coli)
E. coli	Escherichia coli, indicator bacteria used to determine the presence of fecal contamination
EDMS	Electronic Document Management System
EHV	Efficient Home Visit
Eng.	Engineering Services
EOCG	Emergency Operations Control Group
EPA	Environmental Protection Act
ERO	Environmental Registry of Ontario
Form 1	Form 1 – Record of Watermains Authorized as a Future Alteration
Form 2	Form 2 – Record of Minor Modification or Replacements to the Drinking Water System

Term	Description
GUDI-WEF	Groundwater Under the Direct Influence of surface water – With Effective Filtration
HAAs	Haloacetic acids (HAAs) are a type of chlorination disinfection by-product that are formed when the chlorine used to disinfect drinking water reacts with naturally occurring organic matter in water.
HPC	Heterotrophic Plate Count, indicator bacteria group used to monitor general water quality (non-regulatory).
ICI	Industrial, Commercial, Institutional
In-situ filtration	Refers to the filtration achieved as river water migrates through the ground and into the Glen Collector System.
km	Kilometre
Langelier Index	An approximate indicator of the degree of saturation of calcium carbonate in water. It is calculated using the pH, alkalinity, calcium concentration, total dissolved solids, and water temperature of a water sample collected at the tap.
LESP	Lake Erie Source Protection
LRP	Lead Reduction Plan
LSL	Lead Service Lines
LSWIMs	Local Source Water Information Management System
L/s	Litres per second
m	Metres
m^3	Cubic metres = 1 m^3 = 1,000 litres water
m^3/day	Cubic metres per day = 1 m^3/day = 1,000 litres per day
MAC	Maximum Allowable Concentration
MCC	Motor Control Centre
MDL	Minimum Detection Limit
MDWL	Municipal Drinking Water Licence
MECP	Ontario Ministry of the Environment, Conservation and Parks
mEq/L	Milliequivalents Per Litre
mg/L	Milligrams per litre = 1 part per million

Term	Description
n/a	Not Applicable
NDOG	Non-Detect Overgrown
NSF 60	NSF/ANSI Standard 60: Drinking Water Treatment Chemicals -- Health Effects
NSF 61	NSF/ANSI Standard 61: Drinking Water System Components -- Health Effects
ntu	nepholometric turbidity unit
O. Reg. 170/03	Ontario Regulation 170/03 Drinking Water Systems
OA	Operating Authority
ODWQS	O. Reg. 169/03 Ontario Drinking Water Quality Standards
ODWSP	Ontario Drinking Water Stewardship Program
OG	Operational Guideline
OIC	Operator-in-Charge
OP	Operational Plan
ORO	Overall Responsible Operator
OTP	Operational Testing Plan
OWRA	Ontario Water Resources Act
OWUP	Outside Water Use Program
OWWCO	Ontario Water Wastewater Certification Office
Pb	Lead
PDDW	Procedure for Disinfection of Drinking Water in Ontario
PLC	Programmable Logic Controller
POE	Point of Entry, the point at or near which treated water enters the distribution system.
ppm	Parts per million (mg/L)
ppb	Parts per billion (µg/L)
PTTW	Permit to Take Water
Q1	Quarter One (aka first quarter), Q2 (second quarter), etc.
QMS	Quality Management System
Raw water	Water in its natural state, prior to any treatment for drinking.

Term	Description
RMPs	Risk Management Plans
RCAp	Rapid Chemical Analysis Package
SAC	Spills Action Centre
SAN	Storage Area Network
SCADA	Supervisory Control and Data Acquisition
SDS	Subdivision Distribution System (as in Gazer Mooney SDS)
SDWA	Safe Drinking Water Act, 2002
TC	Total Coliform, indicator bacteria group used to determine presence of contamination.
TCE	Trichloroethylene
THM	Trihalomethane
TOMRMS	The Ontario Municipal Records Management System
Total Coliform	Indicator bacteria group used to determine presence of contamination.
Treated	Refers to samples that have received disinfection, for example treated sources.
UGDSB	Upper Grand District School Board
UV	Ultraviolet
VOC	volatile organic compound
WCDSB	Wellington Catholic District School Board
WCES	Water Conservation and Efficiency Strategy
WCWC	Walkerton Clean Water Centre
WDGPH	Wellington-Dufferin-Guelph Public Health
WHPA	Wellhead Protection Area
WSMP	Water Supply Master Plan