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# 2016 Annual and Summary Report

**January 1, 2016 – December 31, 2016**

## **Guelph Drinking Water System**

Corporation of the City of Guelph

## **Gazer Mooney Subdivision Distribution System**

Township of Guelph/Eramosa



### **Water Services**

### **Environmental Services Department**

Revision Date: February 3, 2017

As per the Accessibility for Ontarians with Disabilities Act (AODA), this document is available in an alternate format by e-mailing [waterservices@guelph.ca](mailto:waterservices@guelph.ca) or by calling 519-837-5627

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 and to satisfy the regulatory requirements of the Safe Drinking Water Act (SDWA) including the Drinking Water Quality Management Standard (DWQMS), 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 Drinking Water System (Guelph DWS) is a Class IV Water Distribution and Supply Subsystem and is composed of water supply and treatment facilities and a water distribution system. The Gazer Mooney Subdivision Distribution System (Gazer Mooney SDS) is a Class I distribution system supplied with water from the Guelph Drinking Water System.

Both the Guelph DWS and the Gazer Mooney SDS are required to comply with the Safe Drinking Water Act (SDWA) and 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.

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 (i.e. Carter Well field, Arkell 1 and the Arkell Spring Grounds Collectors).

The City has approximately 44,000 fully metered water service connections, 551 kilometres of underground watermains, and a population of approximately 132,000 within the City of Guelph. The Gazer Mooney Subdivision has approximately 70 fully metered water service connections, 2 kilometres of underground watermains, and an approximate population of 200.

There was one incident of non-compliance associated with the Guelph DWS and the Gazer Mooney SDS in 2016. Collected data associated with annual reporting requirements for two Permits-to-Take-Water were not supplied to the Ministry of the Environment and Climate Change (MOECC) prior to the annual due date of March 31st. The data has now been reported and the delay caused no issue with the work of the MOECC.

As the Operating Authority for both the Guelph DWS and Gazer Mooney SDS, Guelph Water Services is annually inspected by the MOECC for compliance with regulatory requirements. The report for the Guelph DWS related to the 2015-2016 MOECC Annual Inspection has not yet been received at the time of this publication. A score of 100% was achieved in the 2015-2016 MOECC Annual Inspection Report for the Gazer Mooney SDS.

In 2016, Guelph Water Services reported six AWQIs in the Guelph Drinking Water System – please refer to the Annual and Summary Water Services Report section b) Adverse Water Quality Incidents and Table 1 Summary of Guelph Drinking Water System Adverse Water Quality Incidents. There were no AWQI's in the Gazer Mooney Subdivision Distribution System in 2016. In conjunction with Wellington-Dufferin-Guelph Public Health and the MOECC, all appropriate corrective actions and required reporting were completed with no health-based issues.

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 (fire demands) with various combinations of supply sources in operation at any given time. A total of 16,940,220 (16.9 billion litres) of water was treated and pumped to the system in 2016. The average daily water demand was 46,285 cubic metres (46.3 million litres). The maximum day production of water in 2016 was 56,498 cubic metres (56.5 million litres) and occurred on Jun. 23, 2016. The minimum day production of water in the same time period was 33,273 cubic metres (33.3 million litres) and occurred on Dec. 26, 2016.

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. All supplied water was continually tested and met all regulatory standards.

City 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 J of this report and include successful programs related to: water conservation and efficiency, source water protection, and lead reduction.

### **Water Services continues to implement:**

- Recommendations of the 2009 Water Conservation and Efficiency Strategy.

- Source water protection based on an MOECC-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.
- The Adaptive Management Plan associated with the Arkell Bedrock Wells to assess the aquifer under pumping conditions to determine a sustainable capacity with respect to environmental conditions in the area.
- Facility asset management and infrastructure reviews to optimize priority projects.
- A robust backflow prevention program overseeing 2,774 properties with 6,293 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](http://guelph.ca/water) or contact Guelph Water Services at (519) 837-5627 or [waterservices@guelph.ca](mailto:waterservices@guelph.ca).

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## Table of Contents

Executive Summary .....	2
Water Services continues to implement: .....	3
Introduction.....	13
Purpose.....	13
Scope.....	13
Systems Overview .....	15
Guelph Drinking Water System .....	15
Gazer Mooney Subdivision Distribution System .....	19
Annual & Summary Water Services Report .....	20
a) Incidents of Regulatory Non-Compliance .....	20
Guelph Drinking Water System .....	20
Gazer Mooney Subdivision Distribution System .....	20
b) Adverse Water Quality Incidents .....	21
Guelph Drinking Water System .....	21
Gazer Mooney Subdivision Distribution System .....	23
c) Deviations from Critical Control Point (CCP) Limits and Response Actions .....	24
d) The Efficacy of the Risk Assessment Process .....	24
e) Internal and Third-Party Audit Results .....	25
f) Results of Emergency Response Testing.....	26
Emergency Response Tests (exercises noted as “test” in brackets) .....	26
Hazardous Event/ Hazard.....	26
g) Operational Performance and Statistics .....	29
2016 Totalized Pumpages and Instantaneous Flows .....	29
2016 Totalized Pumpages .....	29
Arkell Spring Grounds Collector Source Water .....	31
System Maintenance and Updates .....	32
Major Water Supply Maintenance Activity .....	36

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Major Maintenance Activity/ Expenditure .....	36
SCADA System Improvements.....	36
SCADA/Security Maintenance & Improvement Activities .....	37
Water Distribution Locates .....	37
Summary of Form 1's and Form 2's .....	38
h) Raw and Treated Water Quality – Guelph Drinking Water System .....	39
Water Quality Review – Guelph Drinking Water System.....	39
Microparticulate and Laser Particle Counting Sampling .....	43
Treated Water Quality Statistics – Operational VOC Scan Results Summary.....	48
Treated Water Quality Statistics – O. Reg. 170/03 Schedule 23 Results Summary .....	48
Treated Water Quality Statistics – O. Reg. 170/03 Schedule 24 Results Summary .....	50
Treated Water Quality Statistics – General Chemistry Results Summary .....	58
i) Treated Water Quality – Gazer Mooney Subdivision Distribution System .....	60
Water Quality Review - Gazer Mooney Subdivision Distribution System.....	60
j) Status of Ongoing and Emerging Water Quality, Supply and Distribution Initiatives.....	63
Water Conservation and Efficiency.....	63
Source Water Protection Plan.....	64
Lead Reduction Plan .....	65
k) Expected Future Changes That Could Affect the DWS or the QMS .....	69
Changes Affecting the Drinking Water System (DWS) / Licence Approvals / Amendments ....	69
Municipal Drinking Water Licensing documents.....	70
Changes Affecting the Quality Management System (QMS) .....	74
Ontario's updated Drinking Water Quality Management Standard (DWQMS) .....	75
l) Consumer Feedback.....	76
m) The Resources Needed to Maintain the DWS and QMS.....	77
n) The Results of Infrastructure Review .....	78
Distribution Infrastructure Needs .....	78
Supply & Facilities Infrastructure Needs .....	78

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---

Burke Well Station Upgrades .....	79
Clair Road Pumping Station .....	80
Backflow Prevention Program .....	80
o) Operational Plan Currency, Content and Updates.....	82
p) Staff Suggestions .....	82
q) New or Other Business .....	82
r) Next Meeting Dates .....	82
Appendix "A" – Summary of Critical Control Points and Control Limits .....	83
Critical Control Point (CCP) - Multi-Barrier Primary Disinfection .....	83
Hazard Description.....	83
Critical Control Limit (CCL) .....	83
Monitoring Process & / or Procedures.....	84
Response Procedures.....	84
Critical Control Point (CCP) - Secondary Disinfection.....	84
Hazard Description.....	84
Critical Control Limit (CCL) .....	84
Monitoring Process & / or Procedures.....	85
Response Procedures.....	85
Critical Control Point (CCP) - Backflow Prevention .....	85
Hazard Description.....	85
Critical Control Limit (CCL) .....	86
Monitoring Process & / or Procedures.....	86
Response Procedures.....	86
Appendix "B" – Executive Summary of Risk Assessment Outcomes .....	87
Appendix "C" – Internal and External Audit Plans .....	88
Appendix "D" – Total Water Pumped and Instantaneous Flows .....	92
City of Guelph Water Services .....	93
Appendix "E" – Treated Water Quality Statistics .....	106

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Appendix "F" – Legal and Other Requirements Update .....	120
Appendix "G" Management Review Action Items .....	136
Appendix "H" Summary of Staff Suggestions .....	142
Appendix "I" – Water Conservation & Efficiency Program .....	146
Background: .....	146
Water Reduction Target Progress: .....	147
Water Conservation and Efficiency Public Advisory Committee: .....	148
Leak Detection Program: .....	149
Residential Water Conservation Rebate Programs: .....	150
Blue Built Home Water Efficiency Standards and Rebate Program: .....	151
Institutional, Commercial and Industrial (ICI) Water Capacity Buyback Program: .....	151
Municipal Facility Water Efficiency Upgrades: .....	152
Youth and Public Education: .....	153
H2Awesome: .....	153
Planet Protectors: .....	153
Canada Water Week: .....	154
Waterloo Wellington Children’s Groundwater Festival: .....	155
Annual Water Services Open House: .....	155
Spring and summer events: .....	155
The eMERGE Home Visit and Audit Service Program .....	155
Guelph Water Wagon: .....	156
Peak Season Water Demand Management: .....	156
Watr - water conservation Mobile app: .....	157
Water Softener Alternatives Testing: .....	158
Appendix "J" – Glossary .....	160
Terms and Descriptions .....	160

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## List of Tables

Table 1: Distribution Maintenance Activity .....	32
Table 2: Water Distribution Locates Number of locate requests received by month - 2016.....	38
Table 3: Historical locate requests received .....	38
Table 4: Summary of 2016 Form 1's and Form 2's (Jan. 01 to Dec. 31, 2016) .....	39
Table 5: O. Reg. 170/03 Schedule 7-2, City of Guelph – Distribution Manual Free Chlorine Residual Summary (Jan. 01 to Dec. 31, 2016) .....	40
Table 6: O. Reg. 170/03 Schedule 10-4, City of Guelph – Raw Bacteriological Sampling Summary (Jan. 01 to Dec. 31, 2016).....	41
Table 7: Reg. 170/03 Schedule 10-2, 10-3 and 6-3, City of Guelph – Treated Bacteriological Sampling Summary (Jan. 01 to Dec. 31, 2016).....	42
Table 8: O. Reg. 170/03 Schedule 7-3, City of Guelph – Raw Source Turbidity Sampling Summary (Jan 01. To Dec.31, 2016) .....	43
Table 9: O. Reg. 170/03 Schedule 6-5, "Continuous Monitoring" Results Summary (Jan. 01 to Dec. 31, 2016).....	44
Table 10: O. Reg. 170/03 Schedule 13-6 and 13-7, City of Guelph – "Three Month" Sampling Results Summary (Jan. 01 to Dec. 31, 2016).....	46
Table 11: City of Guelph Operational VOC Scan Selected Results Summary (Jan. 01 to Dec. 31, 2016) .....	48
Table 12: O. Reg. 170/03 Schedule 23, 13-2a, City of Guelph – Annual Schedule 23 Sampling Results Summary (Jan. 01 to Dec. 31, 2016).....	49
Table 13: O. Reg. 170/03 Schedule 24, 13-4a, City of Guelph – Annual Schedule 24 Sampling Results Summary (Jan. 01 to Dec. 31, 2016).....	52
Table 14: O. Reg. 170/03 Schedule 13-8 and 13-9, City of Guelph - "Five Year" Sampling Results Summary .....	57
Table 15: City of Guelph General Chemistry Selected Results Summary (Jan. 01 to Dec. 31, 2016) .....	59

---

Table 16: O. Reg. 170/03 Schedule 7-2, Gazer Mooney - Distribution Manual Free Chlorine Residual Summary (Jan. 01 to Dec. 31, 2016) .....	61
Table 17: O. Reg. 170/03 Schedule 10-2, Gazer Mooney Treated Bacteriological Sampling Summary (Jan. 01 to Dec. 31, 2016).....	61
Table 18: O. Reg. 170/03 Schedule 13-6, Gazer Mooney - "Three Month" Sampling Results Summary (Jan. 01 to Dec. 31, 2016).....	62
Table 19: Gazer Mooney General Chemistry Results Summary (Jan. 01 to Dec. 31, 2016) .....	63
Table 20: Lead Reduction Plan Lead Sampling – Guelph Drinking Water System 2016 .....	66
Table 21: Lead Reduction Plan – Gazer Mooney Subdivision Distribution System 2016.....	66
Table 22: Lead Service Line Replacements 2016 (Jan. 1 to Dec. 31) .....	67
Table 23: Private Lead Service Line Replacement Grant Programs (2010 – Dec. 31, 2016).....	68
Table 24: Water Services Staff with Certificates .....	72
Table 25: Competency & Years' Experience of Management Directly Affecting Drinking Water..	73
Table 26: Years' Experience of Water Services Operators Directly Affecting Drinking Water .....	74
Table 27: 2016 Customer Calls Received.....	76
Table 28: 2016 Backflow Report - Number of Letters Sent out for Annual Testing and Re-survey .....	81
Table 29: Executive Summary of Risk Assessment Outcomes.....	87
Table 30: Internal and External Audit Plans .....	88
Table 31: Pumpage to System – Jan. 1 – Dec. 31, 2016.....	93
Table 32: Permit to Take Water Pumpages – Jan. 1 – Dec. 31, 2016.....	96
Table 33: Permit to Take Water Pumpages – Jan. 1 – Dec. 31, 2016 continued .....	99
Table 34: Instantaneous Flows Summary (PTTW) – Jan. 1 – Dec. 31, 2016.....	102
Table 35: Instantaneous Flows Summary (PTTW) – Jan. 1 – Dec. 31, 2016 continued .....	104
Table 36: O. Reg. 170/03 Schedule 23, 13-2b – "Three Year" Results Summary (Jan. 01 to Dec. 31, 2016) .....	106

---

Table 37: O. Reg. 170/03 Schedule 24, 13-4b – “Three Year” Results Summary (Jan. 01 to Dec. 31, 2016) ..... 107

Table 38: Operational VOC Scan Results Summary (Jan. 01 to Dec. 31, 2016) ..... 111

Table 39: General Chemistry Results Summary (Jan. 01 to Dec. 31, 2016) ..... 115

Table 40: Legal and Other Requirements Update..... 120

Table 41: Management Review Action Items..... 136

Table 42: Summary of Staff Suggestions ..... 142

## List of Figures

Figure 1: Guelph Drinking Water System Facility Locations .....	18
Figure 2: Gazer Mooney Subdivision Distribution System.....	20
Figure 3: 2016 Totalized Pumpages (Jan. 1 to Dec. 31).....	30
Figure 4: 2016 Arkell Spring Grounds' Collector Volumes (Jan. 1 to Dec. 31).....	32
Figure 5: Annual Backflow Prevention Device Re-Survey and Testing Letters from Building Services to Customers in 2016 .....	82
Figure 6: Water Conservation and Efficiency Strategy Update: Estimated Annual Savings vs. Program Reduction Targets .....	148

## Introduction

### 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), 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 Annual & Summary Water Services 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, 2016 (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, and the 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 and Climate Change (MOECC) including corrective actions taken;
  - a description of major expenses incurred to install, repair or replace required equipment;

- the locations where this report is available for inspection.

And;

- 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:

- **F.M. Woods Reception**, 29 Waterworks Place, Guelph;
- **Township of Guelph/Eramosa**, 8348 Wellington Rd. 124, Rockwood; and
- **Online** at [guelph.ca/water](http://guelph.ca/water).

Any inquiries can be made to:

- **City of Guelph Water Services** by e-mailing [waterservices@guelph.ca](mailto:waterservices@guelph.ca) or by calling 519-837-5627.
- **Township of Guelph/Eramosa Public Works – Water / Wastewater** by e-mailing [general@get.on.ca](mailto: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.

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## Systems Overview

### Guelph Drinking Water System

The mission of the City of Guelph's Water Services department ("Water Services") is to provide customers and the community with a safe, consistent supply of high quality drinking water while meeting, exceeding, and continually improving on legal, operational, and quality management system requirements.

Water Services strives to provide reliable, cost-effective systems for the safe production and delivery of consistently high quality water.

Water Services is a municipally-owned and operated water utility established in 1879. The Guelph Drinking Water System is a Class IV Water Distribution and Supply Subsystem and is composed of water supply and treatment facilities and a water distribution system. Thirty-six team members (28 operators, 1 manager, 4 supervisors, 3 technical staff) were certified to operate and maintain the water systems.

Water Services maintains full scope accreditation to the Drinking Water Quality Management Standard after a successful on-site audit in June 2016 conducted by a 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 132,000 within the City of Guelph. All new system components meet NSF 61<sup>1</sup> requirements or approved equivalents and are installed and maintained in accordance with approved industry standards. The system is 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);

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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);
  - 551 kilometres of buried watermain with a diameter < 900 mm;
  - 4,184 watermain valves;
  - 2,763 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; this system consists primarily of true groundwater sources, with some "groundwater under the direct influence of surface water with effective filtration" (GUDI-WEF) sources (i.e. Carter Well field, Arkell 1 and the Glen Collectors). The Guelph Drinking Water System uses 12 per cent Sodium Hypochlorite (that is NSF 60<sup>2</sup> certified) for primary disinfection at 10 locations and for multi-barrier primary disinfection at three locations. At three locations, ultraviolet light is also applied as part of multi-barrier primary disinfection. At two locations (Helmar Well and Queensdale Well), NSF 60-certified sodium silicate is used for aesthetic purposes to sequester dissolved iron and manganese. In total, Water Services operates and maintains 31 facilities for water.

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. The majority of 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 or maintenance of the system.

A total of 16,940,220 cubic metres (16.9 billion litres) of water was treated and pumped to the system in 2016. The average daily water demand was 46,285 cubic metres (46.3 million litres). The maximum day production of water in 2016 was 56,498 cubic metres (56.5 million litres) and occurred on Jun. 23, 2016. The minimum day production of water in the same time period was 33,273 cubic metres (33.3 million litres) and occurred on Dec. 26, 2016.

In 2016, all regulatory microbiological and chemical quality samples were taken by certified operators and tests performed by accredited, licensed laboratories on water samples collected throughout the drinking water system. These tests include both regulatory and operational testing – in most cases only regulatory reporting is included in this report. In all cases, the

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



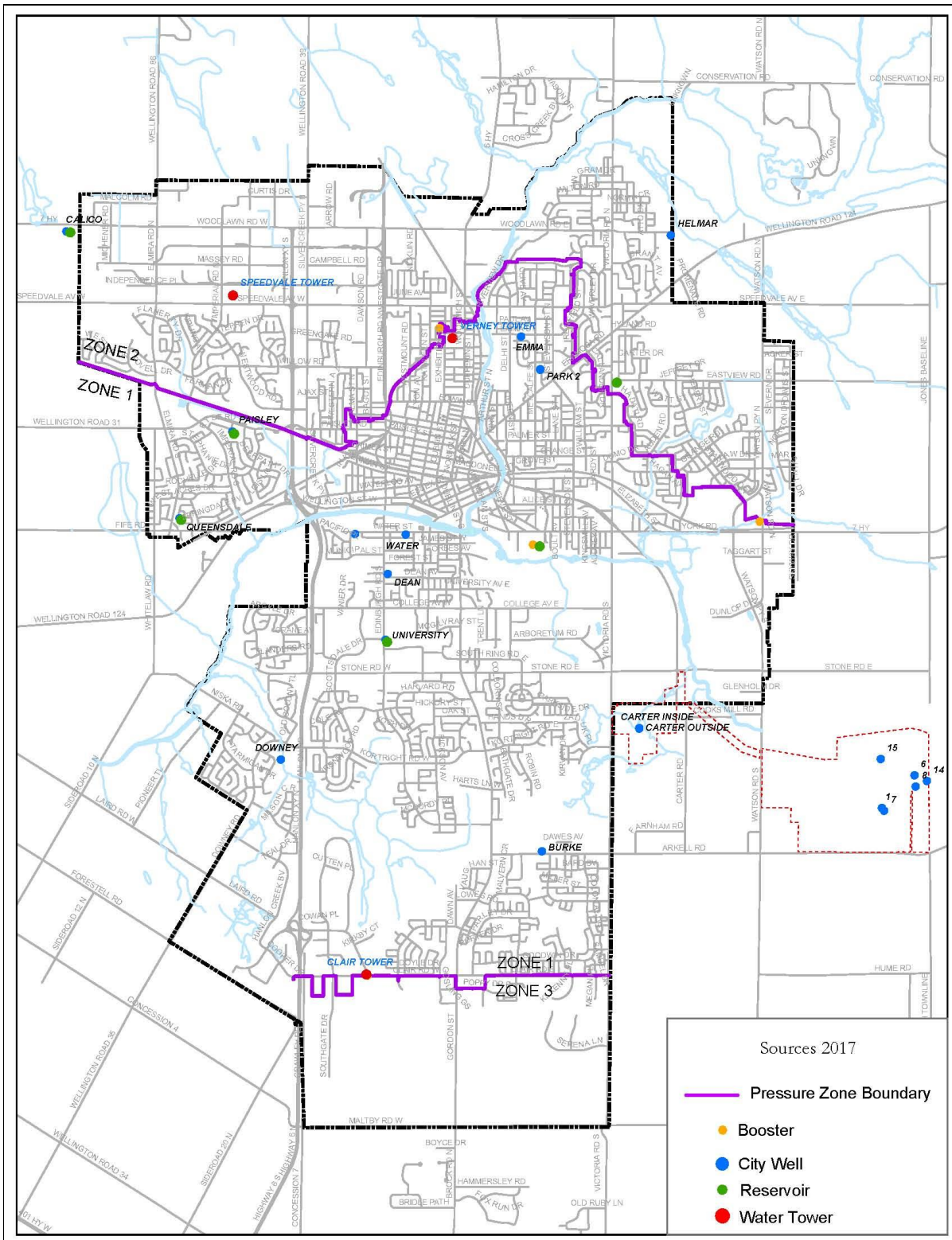
drinking water supplied to all customers was confirmed safe and the water was of higher quality than all Ontario and Canadian health-related guidelines.

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 <http://www.e-laws.gov.on.ca>). In 2016, the Guelph Drinking Water System operated under Municipal Drinking Water Licence (MDWL) 017-101 (issue numbers 8 and 9) and the Drinking Water Works Permit (DWWP) 017-201 (issue number 6).

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.

Figure 1 shows the locations of the Guelph Drinking Water System facilities that were active in 2016.

**Figure 1: Guelph Drinking Water System Facility Locations**



## 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 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. 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:

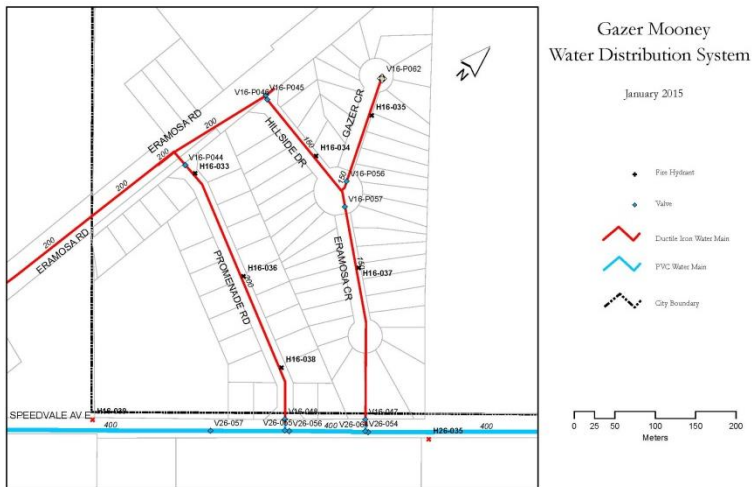
- approximately two kilometres of buried watermain with a diameter < 900 mm;
- approximately six watermain valves;
- approximately six fire hydrants; and
- approximately 72 water services and water meters.

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 <http://www.e-laws.gov.on.ca>.

In 2016, the Gazer Mooney Subdivision Distribution System operated under Municipal Drinking Water Licence No. 104-103 (issues number 1 and 2), and Drinking Water Works Permit No. 104-203 (issues number 1 and 2). These documents are available by request for viewing at 29 Waterworks Place, Guelph and at Township of Guelph/Eramosa, 8348 Wellington Rd. 124, Rockwood.

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

**Figure 2: Gazer Mooney Subdivision Distribution System**

## Annual & Summary Water Services Report

### a) Incidents of Regulatory Non-Compliance

This section describes all incidents of non-compliance.

#### Guelph Drinking Water System

There was one incident of non-compliance associated with the Guelph Drinking Water System in 2016 (January 1 to December 31).

The report for the 2015-2016 Ministry of the Environment and Climate Change (MOECC) Annual Inspection has not yet been received at the time of this publication. Collected data associated with annual reporting requirements for two Permits-to-Take-Water were not supplied to the MOECC prior to the annual due date of March 31st. The data has now been reported and the delay caused no issue with the work of the MOECC.

#### Gazer Mooney Subdivision Distribution System

There were no incidents of non-compliance associated with the Gazer Mooney Subdivision Distribution System in 2016 (January 1 to December 31).

A score of 100% was achieved in the 2015-2016 Ministry of the Environment and Climate Change (MOECC) Annual Inspection Report for the Gazer Mooney SDS.

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## 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 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 in the Water System. The process of water quality sampling and testing can result in false positive results; these results can be caused by contaminated sampling containers and equipment, improper sampling technique, handling and transportation, and sampling analysis errors. In almost all cases, mandatory follow-up sampling and analysis confirms that contaminants are not present in the water provided to customers.

Please note: The City was granted full regulatory relief from Schedule 15.1 of O.Reg 170/03 (in its entirety). Any residential tap lead sample results above 10 µg/L collected as per Lead Reduction Plan (LRP) are tracked and reported separately to Wellington-Dufferin-Guelph Public Health, the Ministry of the Environment and Climate Change (MOECC) and the customer. See Section J for more information.

### Guelph Drinking Water System

In 2016, there were six adverse water quality incidents (AWQI’s #128568, #129144, #130490, #130658, #131245, and #131436) and a summary of these is included below: Summary of Guelph Drinking Water System Adverse Water Quality Incidents.

#### **Summary of Guelph Drinking Water System Adverse Water Quality Incidents** (Jan. 1 to Dec. 31, 2016)

1. Date: Mar. 10
  - a. AWQI #: 128568
  - b. Location: Kensington Sample Tap (D0245) and Robertson Outlet Sample Tap (S108)
  - c. Description: Lead (Pb) result of 11 ppb at D0245 and a result of 95 ppb at S108
  - d. Corrective Action: Wellington-Dufferin-Guelph Public Health (WDGPH), MOECC, and Spills Action Centre (SAC) were notified. Re-samples showed non-detect results for

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Lead (Pb) at D0245 plus upstream and downstream locations (S051 and D003 respectively).

- e. Re-sample Results Good: Yes
- f. Deviation from Critical Control Point<sup>3</sup>: No

2. Date: Apr. 12

- a. AWQI #:129144
- b. Location: Kensington Sample Tap (D0245)
- c. Description: Total Coliform (TC) result of 1 at D0245
- d. Corrective Action: Wellington-Dufferin-Guelph Public Health (WDGPH), MOECC, and Spills Action Centre (SAC) notified. Re-samples showed non-detect results for Total Coliforms (TC) at D0245 plus upstream and downstream locations (S006 and D003 respectively).
- e. Re-sample Results Good: Yes
- f. Deviation from Critical Control Point: No

3. Date: Jul. 27

- a. AWQI #:130490
- b. Location: Waterloo Sample Tap (D0248)
- c. Description: Total Coliform (TC) result of 1 at D0248
- d. Corrective Action: Wellington-Dufferin-Guelph Public Health (WDGPH), MOECC, and Spills Action Centre (SAC) notified. Re-samples showed non-detect results for Total Coliforms (TC) at D0248 plus upstream and downstream locations (S051 and D218 respectively).
- e. Re-sample Results Good: Yes
- f. Deviation from Critical Control Point: No

4. Date: Aug. 09

- a. AWQI #:130658
- b. Location: Park POE (S006)

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<sup>3</sup> Please see section C of this report for a description of “critical control points”.

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- c. Description: Diquat/Paraquat – unable to read results at licenced lab.
  - d. Corrective Action: Wellington-Dufferin-Guelph Public Health (WDGPH), MOECC, and Spills Action Centre (SAC) notified. Re-samples showed non-detect results for Diquat/Paraquat
  - e. Re-sample Results Good: Yes
  - f. Deviation from Critical Control Point: No
5. Date: Sep. 20
- a. AWQI #:131245
  - b. Location: Temporary Watermain
  - c. Description: Total Coliform (TC) result of 6
  - d. Corrective Action: Wellington-Dufferin-Guelph Public Health (WDGPH), MOECC, and Spills Action Centre (SAC) notified. Re-samples showed non-detect results for Total Coliforms (TC) at upstream and downstream locations (D0525 and D253 respectively).
  - e. Re-sample Results Good: Yes
  - f. Deviation from Critical Control Point: No
6. Date: Oct. 05
- a. AWQI #:131436
  - b. Location: Calico POE (S026)
  - c. Description: Total Coliform (TC) result of 1 at S026
  - d. Corrective Action: Wellington-Dufferin-Guelph Public Health (WDGPH), MOECC, and Spills Action Centre (SAC) notified. Re-samples showed non-detect results for Total Coliforms (TC) at S026 plus two downstream locations (D007 and D138).
  - e. Re-sample Results Good: Yes
  - f. Deviation from Critical Control Point: No

## **Gazer Mooney Subdivision Distribution System**

From January 1 – December 31, 2016 there were no adverse water quality incidents.

### **Summary of Gazer Mooney Subdivision Distribution System Adverse Water Quality Incidents (Jan. 01 to Dec. 31, 2016)**

1. Date: n/a
  - a. AWQI #: n/a
  - b. Location: n/a
  - c. Description: n/a
  - d. Corrective Action: n/a
  - e. Re-sample Results Good: n/a
  - f. Deviation from Critical Control Point: n/a

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

This section describes any deviation from essential steps or points in the drinking water system at which control can be applied to prevent or eliminate a drinking water hazard or to reduce it to an acceptable level. These essential steps or points in the system are known as critical control points (CCP). The CCPs are used to identify control measures that are in place to address hazards and hazardous events. These CCPs are in part stipulated by regulation and in part derived through risk assessment of the Drinking Water System.

Water Services' Critical Control Points include:

- primary disinfection,
- secondary disinfection, and
- backflow prevention.

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

Deviations from the CCPs are reported to both the Owners and Top Management, and are summarized in the tables included in Section B of this report. There were no deviations from CCP Limits in 2016 (January 1 to December 31).

### **d) The Efficacy of the Risk Assessment Process**

This section confirms the occurrence of reviews of the risk assessment process to determine the effectiveness of the process in identifying and appropriately assessing the risk of hazardous

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events and hazards, and in identifying the appropriate control measures, critical control points (CCPs) and related critical control limits (CCLs).

The annual risk assessment review described in "QMS 07 Risk Assessment" was conducted by Water Services over several meetings between October 24 and November 9, 2016. The updated risk assessment was subsequently approved at a Management Review Meeting on Feb. 1, 2017 and presented in Appendix "B" (in summary format).

The following Water Services program or process aspects were added:

- Qualifiers for "small", "large", and "very large" as related to the size of infrastructure in watermain breaks or hits.
- Condition descriptions of drinking water system appurtenances (i.e. meters, valves, hydrants) and water services, such as "frozen", "leaking", "inoperable".

## **e) Internal and Third-Party Audit Results**

This section describes any of the audit outcomes identified to date that require follow-up actions.

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 staff. The purpose of audits is 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 "C" includes the past 3 years' internal and external audit plans.

The last internal process audits were completed on Dec. 7-15, 2016. No nonconformities were identified during these internal audits. Various opportunities for improvement suggested by staff (such as improved document and records control, training, communications, essential services, instrumentation calibration / verification, emergency preparedness, and internal audit) were also noted in the internal audit report. Water Services continuously strives to address issues identified in internal audits. The next scheduled internal audit will take place in April 2017.

The 2016 third-party external on-site audit was completed on Jun. 8 to Jun. 10, 2016 by NSF International Strategic Registrations. There was one nonconformity identified during this audit related to reporting to the Owner the results of Management Review meetings (deficiencies, decisions and action items), as required under element 20 of the DWQMS. This report to the Owner has fully addressed the nonconformity.

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Noted opportunities for improvement by the auditor were related to improving the following processes: document and records control (QMS 05); tracking staff training related to QMS (QMS 10); infrastructure maintenance programs (QMS 15); and instrument calibration (QMS 17). The corrective action issued and opportunities for improvement will be reviewed by the external auditor at the next on-site audit scheduled in November 15-17, 2017.

## **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.

Feedback from emergency testing and from actual events is gathered during debriefing sessions and improvement items are incorporated into the Emergency Plan and /or daily operations.

Water Services' last emergency test exercise was a "Water Shortage" scenario where the aqueduct is hit by accident during an excavation and took place on Nov. 25, 2016. November's test exercise involved Water Services staff and representatives from the MOECC (Inspector and district office Manager) and Wellington-Dufferin-Guelph Public Health (WDGPH) staff. All other Water Services' staff sessions took place on December 13, 2016 and January 20, 2017.

Below includes the dates of Completed Emergency Response Tests for the past three years.

## **Emergency Response Tests (exercises noted as "test" in brackets)**

### **Hazardous Event/ Hazard<sup>4</sup>**

2014

- Long-term impacts of climate change: n/a
- Source water supply shortfall: n/a

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<sup>4</sup> The Hazardous Event / Hazard list has been updated to reflect MOECC's mandated "Potential Hazardous Events for Municipal Residential Drinking Water Systems to Consider in the Risk Assessment" document.

- Extreme weather events (e.g. tornado, ice storm): n/a
- Sustained extreme temperatures (e.g. heat wave, deep freeze): Feb-Mar, 2014 (frozen services)
- Chemical spill impacting source water: n/a
- Sustained pressure loss: n/a
- Backflow / Cross-connection: Feb. 11, 2014 (test)
- Terrorist threat: n/a
- Vandalism: n/a
- Sudden changes to raw water characteristics (e.g. turbidity, pH): Membro Well (carter in 2013) investigation
- Failure of equipment or process associated with primary disinfection (e.g. UV, chlorination): n/a
- Failure of equipment or process associated with secondary disinfection (e.g. chlorination): n/a
- Loss or contamination of treated water supply: n/a
- Loss of monitoring system: n/a
- City of Guelph Corporate-Level Test by the EOCG: Jul-Aug, 2014 (labour)

## 2015

- Long-term impacts of climate change: n/a
  - Source water supply shortfall: n/a
  - Extreme weather events (e.g. tornado, ice storm): n/a
  - Sustained extreme temperatures (e.g. heat wave, deep freeze): Feb-Apr, 2015 (frozen services)
  - Chemical spill impacting source water: n/a
  - Sustained pressure loss: n/a
  - Backflow / Cross-connection: n/a
  - Terrorist threat: n/a
  - Vandalism: n/a
-

- Sudden changes to raw water characteristics (e.g. turbidity, pH): Rehabilitation: Membro Well/Carter Wells
- Failure of equipment or process associated with primary disinfection (e.g. UV, chlorination): n/a
- Failure of equipment or process associated with secondary disinfection (e.g. chlorination): n/a
- Loss or contamination of treated water supply: n/a
- Loss of monitoring system: n/a
- City of Guelph Corporate-Level Test by the EOCG: Jul-Aug, 2014 (labour)

## 2016

- Long-term impacts of climate change: Summer (drought)
- Source water supply shortfall: Dec. 2016 (test)
- Extreme weather events (e.g. tornado, ice storm): Mar. 23-25, 2016 (ice storm)
- Sustained extreme temperatures (e.g. heat wave, deep freeze): n/a
- Chemical spill impacting source water: n/a
- Sustained pressure loss: Jan. 7, 2016 (test)
- Backflow / Cross-connection: n/a
- Terrorist threat: n/a
- Vandalism: n/a
- Sudden changes to raw water characteristics (e.g. turbidity, pH): Improvements: Membro Well/Carter Wells
- Failure of equipment or process associated with primary disinfection (e.g. UV, chlorination): n/a
- Failure of equipment or process associated with secondary disinfection (e.g. chlorination): n/a
- Loss or contamination of treated water supply: Jan. 7, 2016 (test)
- Loss of monitoring system: Jan. 14, 2016 (fibre network failure)
- City of Guelph Corporate-Level Test by the EOCG: 3 dates focusing on " recovery" Sep-Oct 2016

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## g) Operational Performance and Statistics

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

- 2016 Totalized Pumpages as per the Municipal Drinking Water Licence and Permits to Take Water;
- 2016 Instantaneous Flows as per Permit to Take Water requirements;
- Water Production and Population;
- 2016 Collector Flows; and
- System Maintenance and Updates.

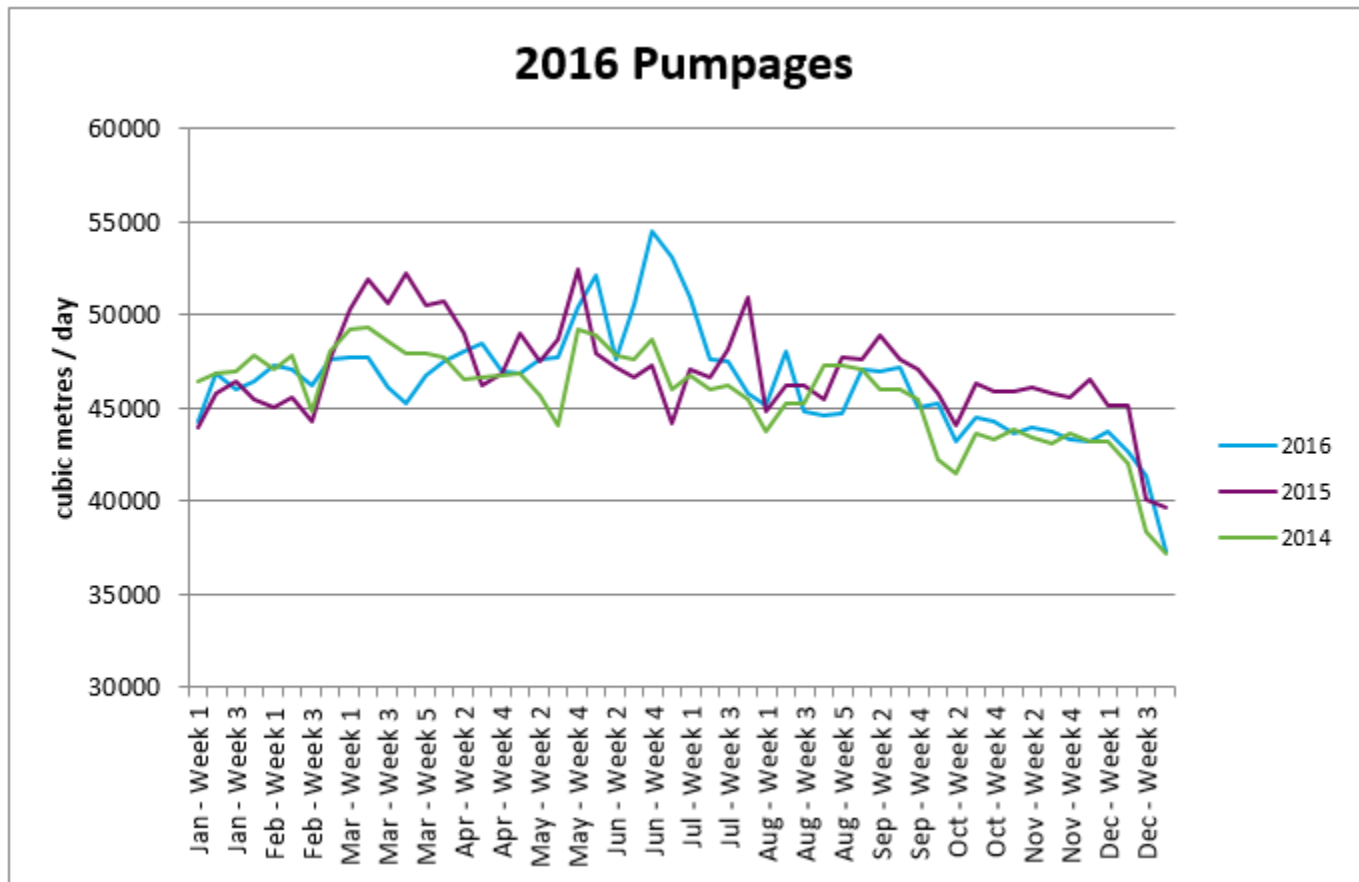
### 2016 Totalized Pumpages and Instantaneous Flows

The Safe Drinking Water Act (SDWA) and the Ontario Water Resources Act (OWRA) each require that operating authorities record and report both water takings as governed by Permits to Take Water (PTTWs), 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 "D" – Total Water Pumped and Instantaneous Flows.

### 2016 Totalized Pumpages

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

**Figure 3: 2016 Totalized Pumpages (Jan. 1 to Dec. 31)**

Water Services processed 16,940,220 cubic metres (16.9 billion litres) of water to the distribution system in 2016 (January 1 to December 31). This represents 0.98 per cent less water being supplied to the distribution system in 2016 as compared to the same time period in 2015 and 1.44 per cent more water than in 2014.

The increase in water use in June 2016 over the previous two years is due to the lack of precipitation and drought conditions seen across the Grand River Watershed in 2016. In advance of the Ontario Low Water Response program declaration of Level 1 conditions, the City moved their Outside Water Use Program from Level 0- Blue to Level 1-Yellow watering restrictions on June 6th to curb further peak water demands from summer water use. It is noted that drought conditions remained in place until November 2016 across the Grand River Watershed.

The average daily water demand was 46,285 cubic metres (46.3 million litres). The maximum day production of water in 2016 was 56,498 cubic metres (56.5 million litres) and occurred on

Jun. 23, 2016. The minimum day production of water in the same time period was 33,273 cubic metres (33.3 million litres) and occurred on Dec. 26, 2016.

## **Arkell Spring Grounds Collector Source Water**

The Arkell Spring Grounds Collector (“Collectors”) Source Water, one of Guelph’s many water sources, consist of a gravity-fed under-drain system that collects shallow overburden groundwater. This system has been in use since the early 1900s and can represent as much as 40 per cent of the total city-wide daily water production. 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 15th and November 15th, the City has a Permit to Take Water (PTTW) 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 is filtered in-situ through the ground and approximately 50 per cent of the flow is captured in the Glen Collector System. It should be noted that the Recharge System was not utilized from 2011 through 2014 in order to accommodate the Arkell Operational Testing Plan / Adaptive Management Plan (OTP/AMP) which was a condition of the Arkell Well Field PTTW. The Recharge System was returned to service for the 2015 season. 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 as well as upgrades to the weir system. The Recharge System is scheduled to be returned to service in April 2017.

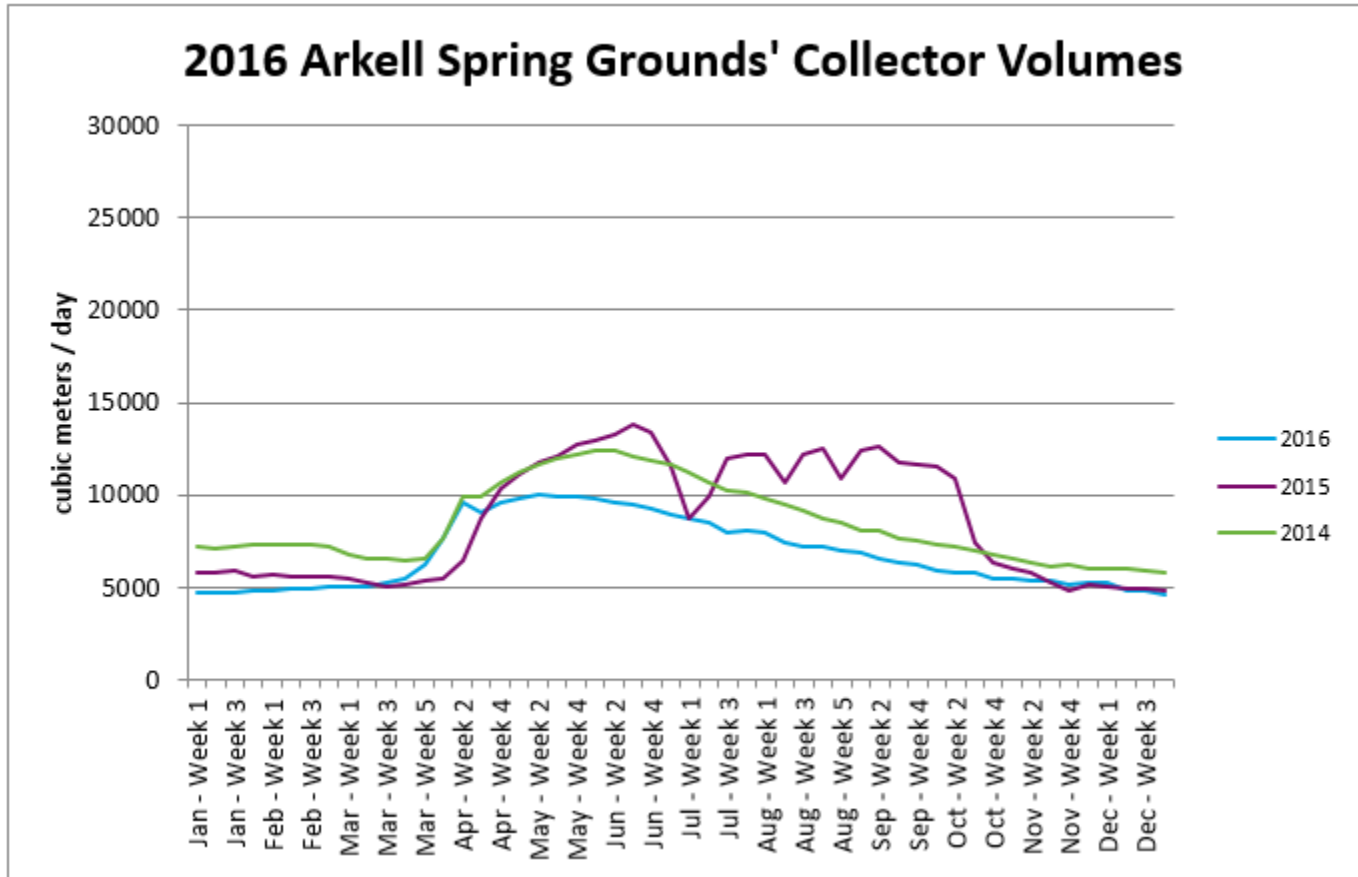
The productivity of the Collectors can be used as one of many predictive tools. If the production volume from the Collectors is low, then it can be assumed that other water supplies would be needed to make up the difference. This may alter how regular maintenance is performed as well as the urgency with 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 2,474,957 cubic metres (2.5 billion litres) of water in 2016. This represents 21.1 per cent less water as compared to the same time period in 2015 and 19.5 per cent less water than in 2014.

For a visual representation, please refer to Figure 4: 2016 Arkell Spring Grounds’ Collector Volumes (Jan. 1 to Dec. 31). Figure 4 depicts the Arkell Spring Grounds Collector flow rate in cubic metres per day (m<sup>3</sup>/day) that is averaged each week.

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**Figure 4: 2016 Arkell Spring Grounds' Collector Volumes (Jan. 1 to Dec. 31)**



Please note that collector flow was not augmented by the addition of recharge water from the Eramosa river in 2011 through 2014 and in 2016.

### System Maintenance and Updates

The table that follow summarize Water Services' maintenance work – for Distribution (Table 1)

**Table 1: Distribution Maintenance Activity**

Job Type	2014 Q1&2	2014 Q3&4	2014 Total	2015 Q1&2	2015 Q3&4	2015 Total	2016 Q1&2	2016 Q3&4	2016 Total
Acoustic Leak – Dry	0	3	3	0	1	1	0	4	4



Job Type	2014 Q1&2	2014 Q3&4	2014 Total	2015 Q1&2	2015 Q3&4	2015 Total	2016 Q1&2	2016 Q3&4	2016 Total
Blow Off Install	0	2	<b>2</b>	0	0	<b>0</b>	0	0	<b>0</b>
Dig to find leak	1	2	<b>3</b>	1	0	<b>1</b>	1	1	<b>2</b>
Hi/Low Jumper Install	0	0	<b>0</b>	0	0	<b>0</b>	0	0	<b>0</b>
Hydrant Install (WW)	0	0	<b>0</b>	0	0	<b>0</b>	0	0	<b>0</b>
Hydrant Remove	1	0	<b>1</b>	0	0	<b>0</b>	1	0	<b>1</b>
Hydrant Repair	2	31	<b>33</b>	2	7	<b>9</b>	1	29	<b>30</b>
Hydrant Repair Hit	0	2	<b>2</b>	0	0	<b>0</b>	0	1	<b>1</b>
Hydrant Replace (WW)	0	6	<b>6</b>	0	1	<b>1</b>	2	6	<b>8</b>
Hydrant Replace Hit	1	1	<b>2</b>	0	0	<b>0</b>	0	0	<b>0</b>
Main Break	58	19	<b>77</b>	57	14	<b>71</b>	26	27	<b>53</b>
Other (e.g. exploratory excavations, miscellaneous repairs, etc.)	3	7	<b>10</b>	2	2	<b>4</b>	1	2	<b>3</b>
Re-route Watermain	0	0	<b>0</b>	0	0	<b>0</b>	0	0	<b>0</b>
Sample Station Install	0	0	<b>0</b>	0	0	<b>0</b>	0	1	<b>1</b>

Job Type	2014 Q1&2	2014 Q3&4	2014 Total	2015 Q1&2	2015 Q3&4	2015 Total	2016 Q1&2	2016 Q3&4	2016 Total
Sample Station Replace	0	0	<b>0</b>	0	0	<b>0</b>	0	4	<b>4</b>
Service Cut Off	5	7	<b>12</b>	0	5	<b>5</b>	1	4	<b>5</b>
Service Lowered	3	0	<b>3</b>	0	0	<b>0</b>	0	0	<b>0</b>
Service New Install	0	0	<b>0</b>	0	0	<b>0</b>	0	0	<b>0</b>
Service Repair	47	69	<b>116</b>	54	45	<b>99</b>	58	86	<b>144</b>
Service Replace Lead (City-side)	1	2	<b>3</b>	1	1	<b>2</b>	0	0	<b>0</b>
Service Replace Non-Lead	2	16	<b>18</b>	9	16	<b>25</b>	8	8	<b>16</b>
Trench Repair	-	-	<b>-</b>	-	-	<b>-</b>	1	0	<b>1</b>
Valve Install (WW)	0	2	<b>2</b>	0	6	<b>6</b>	0	0	<b>0</b>
Valve Remove	0	0	<b>0</b>	0	0	<b>0</b>	0	0	<b>0</b>
Valve Repair	4	10	<b>14</b>	1	4	<b>5</b>	3	5	<b>8</b>
Valve Replace (WW)	8	14	<b>22</b>	9	5	<b>14</b>	1	7	<b>8</b>
Meters New	217	200	<b>417</b>	141	412	<b>553</b>	336	277	<b>613</b>
Meters Exchanged	373	244	<b>617</b>	202	423	<b>625</b>	286	246	<b>532</b>
<b>Items reported annually:</b>	n/a	n/a	<b>n/a</b>	n/a	n/a	<b>n/a</b>	n/a	n/a	<b>n/a</b>

<b>Job Type</b>	<b>2014 Q1&amp;2</b>	<b>2014 Q3&amp;4</b>	<b>2014 Total</b>	<b>2015 Q1&amp;2</b>	<b>2015 Q3&amp;4</b>	<b>2015 Total</b>	<b>2016 Q1&amp;2</b>	<b>2016 Q3&amp;4</b>	<b>2016 Total</b>
Hydrants new/replaced by Engineering	-	-	<b>24</b>	-	-	<b>52</b>	-	-	<b>39</b>
Total City Hydrants	-	-	<b>2,698</b>	-	-	<b>2,745</b>	-	-	<b>2,763</b>
Valves new/replaced by Engineering	-	-	<b>28</b>	-	-	<b>122</b>	-	-	<b>57</b>
Total City Main Valves	-	-	<b>4,062</b>	-	-	<b>4,135</b>	-	-	<b>4,184</b>
Watermains new/replaced by Eng. (km)	-	-	<b>3.25</b>	-	-	<b>9.13</b>	-	-	<b>3.93</b>
Total Watermains Excluding Aqueduct (km)	-	-	<b>542.1</b>	-	-	<b>548.5</b>	-	-	<b>550.8</b>
Watermains Cleaned (km)	-	-	<b>195.3</b>	-	-	<b>107.1</b>	-	-	<b>231.4</b>
Watermains Re-lined (m)	-	-	<b>0</b>	-	-	<b>0</b>	-	-	<b>0</b>

Below includes Water supply-related major maintenance activities and expenditure (may include programs that have a series of projects).

## Major Water Supply Maintenance Activity

### Major Maintenance Activity/ Expenditure

1. Booster and Zone 3 Commissioning. Well Site(s): Claire Booster Station.
2. Booster Pump Motor Replacement. Well Site(s): F.M Woods.
3. Chlorination System Upgrades. Well Site(s): F.M Woods.
4. Electrical and Instrumentation Upgrades. Well Site(s): Various Sites.
5. Facility Repairs and Maintenance. Well Site(s): Various Sites.
6. Fencing and Security Upgrades. Well Site(s): Various Sites.
7. Generator Fuel System Compliance Upgrades. Well Site(s): Various Sites.
8. Monitoring and Process Equipment Replacements. Well Site(s): Various Sites.
9. Process Piping Upgrades. Well Site(s): Various Sites.
- 10.Recharge Phase 1 Upgrades. Well Site(s): Arkell Spring Grounds.
- 11.UV and Process Upgrades. Well Site(s): Membro Well.
- 12.Well Inventory Database: Various Sites.
- 13.Well Rehabilitation, Liner Installation and Pump Replacement. Well Site(s): Dean Well.
- 14.Well Replacement. Well Site(s): Membro Well.

## SCADA System Improvements

The Supervisory Control and Data Acquisitions (SCADA) system is the computerized control system that looks after the monitoring and automatic control of the pumps, valves, water towers and online instrumentation at the 21 water facilities located throughout the city. 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.

In 2016, the SCADA system had an uptime of approximately 99.5%.

The following section provides a summary of improvements to SCADA and Security:

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## SCADA/Security Maintenance & Improvement Activities

1. Process flow diagrams and piping & instrumentation diagrams (P&ID's) update. Well Site(s): Various Sites.
2. SCADA hardware and software inventory update. Well Site(s): Various Sites.
3. SCADA network architecture and configuration documentation update. Well Site(s): Various Sites.
4. SCADA network connectivity monitoring server. Well Site(s): Various Sites.
5. SCADA network redundancy (with secondary back-up connections). Well Site(s): Various Sites.
6. SCADA software code update (multi-year program). Well Site(s): Various Sites.
7. SCADA software code revision control software. Well Site(s): Various Sites.
8. Security systems upgrades. Well Site(s): Various Sites.

## 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 the Water Services division is notified of and attends a locate request for every excavation in proximity to water infrastructure; enabling the division to further prevent damage and protect Guelph'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. In 2016, two full time utility locators were hired, and the peak season supplemented with temporary utility locators. Utility locators now locate all infrastructure in one site visit rather than each department individually. Table 2 includes all water locate requests received and responded to for the period of January 1 to December 31, 2016 with a year to year comparison below.

**Table 2: Water Distribution Locates Number of locate requests received by month - 2016**

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
285	263	697	1,031	1,048	1,100	775	727	751	585	529	188	7,979

**Table 3: Historical locate requests received**

Year	Total
2016	7,979 <sup>5</sup>
2015	9,255
2014	8,943
2013	7,884

### Summary of Form 1's and Form 2's

Table 4: Summary of 2016 Form 1's and Form 2's includes the total number of Form 1's and Form 2's completed over the course of 2016 (January 1 to December 31). These forms are required to document significant changes to the drinking water system. Engineering Services staff complete "Form 1 – Record of Watermains Authorized as a Future Alteration" and retain copies in applicable project files and Water Services staff complete "Form 2- Record of Minor Modification or Replacements to the Drinking Water System" that are retained by the Water Services Compliance Coordinator.

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<sup>5</sup> Volume reduction in 2016 is attributed to an increase in larger more complex excavation projects submitted as 1 single ticket rather than broken into multiple tickets via streets or street segments as in the past.

**Table 4: Summary of 2016 Form 1's and Form 2's (Jan. 01 to Dec. 31, 2016)**

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	62

## h) Raw and Treated Water Quality – Guelph Drinking Water System

This section describes the water quality monitoring, both regulatory and operational, that has been completed in 2016 (January 1 to December 31).

### Water Quality Review – Guelph Drinking Water System

Under the Safe Drinking Water Act (SDWA), 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 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 electronic document management system (EDMS). Note: EDMS is available for internal use only. 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, 2016. This database is used to closely track the instances of the identified chemical parameters and therefore provide time for planning / budgeting if treatment or an alternative supply is eventually required due to the presence of a given parameter. The database is updated semi-annually.

2. Tabulated values are from best available information at the time of table creation. While the values above satisfy the minimum regulatory requirements, Water Services performs many additional operational tests not listed in this report.
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 required to be included in the report for reference.
4. All acronyms and initialisms included in tables are described in Appendix "J" – Glossary.

The following section summarizes daily Distribution free chlorine residual test results required by O. Reg. 170/03 Schedule 7-2 where "secondary disinfection" is provided for the period of January 1 to December 31, 2016. The Verney Tower sample point is used to represent the water quality provided by the Zone One distribution system pressure zone and the Speedvale Tower sample point represents the water quality provided by Zone Two 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 2016 associated with these sampling sites.

**Table 5: O. Reg. 170/03 Schedule 7-2, City of Guelph – Distribution Manual Free Chlorine Residual Summary (Jan. 01 to Dec. 31, 2016)**

Parameter	ODWQS Criteria	Total Analyses	Total Samples above Detection Limit	Total Outside ODWQS Criteria	Range	Units
Free Chlorine Residual – Zone One	0.05 – 4.0	366	366	0	0.51 – 1.02	mg/L
Free Chlorine Residual – Zone Two	0.05 – 4.0	366	366	0	0.54 – 1.07	mg/L

Table 6 summarizes raw bacteriological sampling and test results required by O. Reg. 170/03 Schedule 10-4 for the period of January 1 to December 31, 2016.

- Number of raw samples taken: 974



- Number of raw analyses: 2,925

**Table 6: O. Reg. 170/03 Schedule 10-4, City of Guelph – Raw Bacteriological Sampling Summary (Jan. 01 to Dec. 31, 2016)**

Parameter	ODWQS Criteria	Total Analyses	Total Outside ODWQS Criteria	Range	Units
Raw - E. coli	n/a	973	n/a	0 - 1	cfu/100 mL
Raw - Total Coliform	n/a	973	n/a	0 - 2	cfu/100 mL
Raw - HPC	n/a	3	n/a	0	cfu/mL
Raw - Background	n/a	973	n/a	0 – 86	cfu/100 mL
Raw River Source (prior to in situ filtration) – E. coli	n/a	1	n/a	OG1	cfu/100 mL
Raw River Source (prior to in situ filtration) – Total Coliform	n/a	1	n/a	OG1	cfu/100 mL
Raw River Source (prior to in situ filtration) - Background	n/a	1	n/a	OG1	cfu/100 mL

The next table summarizes treated bacteriological sampling and test results required by O. Reg. 170/03 Schedule 10-3 and 6-3 for the period of January 1 to December 31, 2016.

- Number of POE samples taken: 276
- Number of POE analyses: 1,380

- Number of Distribution samples taken: 835
- 7Number of Distribution analyses: 4,071

**Table 7: Reg. 170/03 Schedule 10-2, 10-3 and 6-3, City of Guelph – Treated Bacteriological Sampling Summary (Jan. 01 to Dec. 31, 2016)**

Parameter	ODWQS Criteria	Total Analyses	Total Outside ODWQS Criteria	Range	Units
POE - E. coli	0	568	0	0	cfu /100 mL
POE - Total Coliform	0	568	1 <sup>6</sup>	0 - 1	cfu /100 mL
POE – HPC	n/a	565	n/a	0 - 8	cfu /mL
POE – Background	n/a	568	n/a	0 - 8	cfu /100 mL
POE – Free Chlorine Residual	0.05 to 4.0	559 <sup>7</sup>	0	0.65 – 1.72	mg/L
Distribution - E. coli	0	1,657	0	0	cfu /100 mL
Distribution - Total Coliform	0	1,657	2 <sup>8</sup>	0 - 1	cfu /100 mL

6 Reported as AWQI #131436 and described in Table 1 of this document.

7 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).

8 Reported as AWQI #129144; #130490 and described in Table 1 of this document.

Parameter	ODWQS Criteria	Total Analyses	Total Outside ODWQS Criteria	Range	Units
Distribution – HPC	n/a	769	n/a	0 – 440	cfu /mL
Distribution – Background	n/a	1,657	n/a	0 – 15	cfu /100 mL
Distribution – Free Chlorine Residual	0.05 to 4.0	2,581	0	0.25 – 1.23	mg/L

The following section 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, 2016. Schedule 7-3 requires a “Monthly” sampling schedule, 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.

**Table 8: O. Reg. 170/03 Schedule 7-3, City of Guelph – Raw Source Turbidity Sampling Summary (Jan 01. To Dec.31, 2016)**

Parameter	ODWQS Criteria	Total Analyses	Total Samples above Detection Limit	Total Outside ODWQS Criteria	Range	Units
Raw Source Turbidity	n/a	976	976	n/a	0.05– 0.73	ntu

### Microparticulate and Laser Particle Counting Sampling

As a part of the Guelph Drinking Water System’s Municipal Drinking Water Licence (MDWL), Guelph Water services is required, twice annually, to assess the Arkell Collector System which is 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 MOECC. Sampling was performed on this water

source in the spring of 2016. The source continues to meet the GUDI-WEF source water characteristics.

### **Treated Water Quality Statistics – O. Reg. 170/03 Schedule 6-5 - “Continuous Monitoring” Results Summary**

Water Services utilises 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 below. 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 2016** (January 1 to December 31).

**Table 9: O. Reg. 170/03 Schedule 6-5, “Continuous Monitoring” Results Summary (Jan. 01 to Dec. 31, 2016)**

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

### **Treated Water Quality Statistics – O. Reg. 170/03 Schedule 13-6 and 13-7, “Three Month” Sampling Results Summary**

In 2016, all operational Treated Sources were sampled and analyzed for Schedule 13-6 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 Speedvale Tower, Clair Tower and Paisley Reservoir 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 THM's for all related Distribution System samples in each quarter of 2016 (Jan. 01 to Dec. 31) is below the half of the maximum allowable concentration ( $\frac{1}{2}$  MAC):** Q1 = 0.0342 mg/L; Q2 = 0.0325 mg/L; Q3 = 0.0336 mg/L and Q4 = 0.0340 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 2016** (Jan 01 to Dec. 31). Raw sampling results are also shown in the next table.

**Table 10: O. Reg. 170/03 Schedule 13-6 and 13-7, City of Guelph – “Three Month” Sampling Results Summary (Jan. 01 to Dec. 31, 2016)**

<b>Parameter</b>	<b>ODWQS MAC</b>	<b>½ MAC</b>	<b>Total Samples</b>	<b>Samples Above MDL</b>	<b>Total Above ODWQS Criteria</b>	<b>Min (mg/L)</b>	<b>Max (mg/L)</b>	<b>Average (mg/L)</b>
Trihalomethanes	0.100 <sup>9</sup>	n/a	8	8	0	0.0263	0.0534	0.03256
Nitrate + Nitrite (as nitrogen)	10	5	55	38	0	< 0.10	2.28	0.974
Nitrate + Nitrite (as nitrogen) – Woods’ Raw Sources (Operational Sampling)	n/a	n/a	35	35	n/a	0.30	3.63	1.28
Nitrate + Nitrite (as nitrogen) – University Raw Source (Operational Sampling)	n/a	n/a	5	5	n/a	0.28	0.76	0.38

<sup>9</sup> This standard is expressed as a running annual average.

Parameter	ODWQS MAC	1/2 MAC	Total Samples	Samples Above MDL	Total Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Nitrate + Nitrite (as nitrogen) – Paisley Raw Source (Operational Sampling)	n/a	n/a	5	5	n/a	1.88	2.06	1.97

## Treated Water Quality Statistics – Operational VOC Scan Results Summary

Please note that Schedule 13-6 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 “E” include a repetition of the relevant data from the Schedule 13-6 and Schedule 24 tables. The “Operational VOC Scan Results Summary” lists the total number of samples analyzed for these parameters in 2016 (January 1 to December 31, 2016). Table 11 (below), highlights specific VOC parameters due to their presence / significance within the water supply. There was no instance of an adverse result in 2016.

**Table 11: City of Guelph Operational VOC Scan Selected Results Summary (Jan. 01 to Dec. 31, 2016)**

Parameter	ODWQS MAC	1/2 MAC	Total Samples	Sampl es Above MDL	Total Above ODWQS Criteria	Min (mg/ L)	Max (mg/ L)	Avera ge (mg/ L)
Trichloroethylene	0.005	0.00 25	169	63	0	< 0.000 1	0.001 67	0.0005 5
Trihalomethanes7( TTHMs)	0.100 <sup>10</sup>	n/a	159	63	0	< 0.000 2	0.073 9	0.0135 2

## Treated Water Quality Statistics – 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 three of the eight sources that supply F.M. Woods are GUDI-WEF sources (the Carter Well field, Arkell 1 and the Arkell Glen Collectors).

<sup>10</sup> This standard is expressed as a running annual average.



**The results of the Schedule 23 inorganic parameter analysis in 2016 were all under the half of the maximum allowable concentration ( $\frac{1}{2}$  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 "E" 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 2016 for F.M. Woods' Station were all under the  $\frac{1}{2}$  MAC and the majority were under the laboratory's MDL (minimum detection level).**

**Table 12: O. Reg. 170/03 Schedule 23, 13-2a, City of Guelph – Annual Schedule 23 Sampling Results Summary (Jan. 01 to Dec. 31, 2016)**

Parameter	ODWQS MAC	$\frac{1}{2}$ MAC	Total Samples	Samples Above MDL	Total 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

Parameter	ODWQS MAC	½ MAC	Total Samples	Samples Above MDL	Total Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Uranium	0.02	0.01	26	24	0	< 0.0001	0.0024	0.00124

### Treated Water Quality Statistics – 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 three of the eight sources that supply F.M. Woods’ are GUDI-WEF sources (the Carter Well field, Arkell 1 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 “E” for more information.

It should be noted that values for TCE (trichloroethylene) at Membro and Emma have on occasion, crested the ½ MAC value of 0.0025 mg/L and as a result Water Services has 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 sources on a monthly schedule at Membro and Emma. 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, Park and Paisley<sup>11</sup> POE.

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

<sup>11</sup> The TCE at Paisley POE can be attributed to Emma, Membro, Water Street and Park source water via the Paisley Reservoir low zone fill line as VOC analysis from 2007 to the present on Paisley raw water shows values below the lab’s MDL (minimum detection level) for all parameters.

**The results of the Annual Schedule 24 organic parameter analysis in 2016 for F.M. Woods' Station were all under the half of the maximum allowable concentration ( $\frac{1}{2}$  MAC) and the laboratory's MDL (minimum detection level).**

**Table 13: O. Reg. 170/03 Schedule 24, 13-4a, City of Guelph – Annual Schedule 24 Sampling Results Summary (Jan. 01 to Dec. 31, 2016)**

<b>Parameter</b>	<b>ODWQS MAC</b>	<b>½ MAC</b>	<b>Total Samples</b>	<b>Samples Above MDL</b>	<b>Total Above ODWQS Criteria</b>	<b>Min (mg/L)</b>	<b>Max (mg/L)</b>	<b>Average (mg/L)</b>
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
Chlorpyrifos	0.09	0.045	71	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	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	13	0	0	< 0.001	< 0.001	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	< 0.0002	< 0.0002	n/a
Dichloromethane	0.05	0.025	71	0	0	< 0.0001	< 0.0001	n/a
2,4-Dichlorophenol	0.9	0.45	71	0	0	< 0.0005	< 0.0005	n/a
2,4-Dichlorophenoxy acetic acid (2,4-D)	0.1	0.05	13	0	0	< 0.0005	< 0.0005	n/a
Diclofop-methyl	0.009	0.0045	13	0	0	< 0.001	< 0.001	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)
Dimethoate	0.02	0.01	13	0	0	< 0.0009	< 0.0009	n/a
Diquat	0.07	0.0035	13	0	0	< 0.003	< 0.003	n/a
Diuron	0.15	0.075	14	0	0	< 0.007	< 0.007	n/a
Glyphosate	0.28	0.14	13	0	0	< 0.01	< 0.01	n/a
Malathion	0.19	0.095	13	0	0	< 0.005	< 0.005	n/a
2-Methyl-4- chlorophenoxyacetic acid	0.1	0.05	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
Chlorobenzene	0.08	0.04	14	0	0	< 0.001	< 0.001	n/a
Paraquat	0.01	0.005	13	0	0	< 0.0005	< 0.0005	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)
Pentachlorophenol (PCP)	0.06	0.03	13	0	0	< 0.0005	< 0.0005	n/a
Phorate	0.002	0.001	13	0	0	< 0.005	< 0.005	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
Prometryn	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
Tetrachloroethylene (PCE)	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

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<b>Parameter</b>	<b>ODWQS MAC</b>	<b>½ MAC</b>	<b>Total Samples</b>	<b>Samples Above MDL</b>	<b>Total Above ODWQS Criteria</b>	<b>Min (mg/L)</b>	<b>Max (mg/L)</b>	<b>Average (mg/L)</b>
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

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## Treated Water Quality Statistics – 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 14 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 14. This data is provided to Wellington-Dufferin-Guelph Public Health.

**Table 14: 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 Criteri	Min (mg/L)	Max (mg/L)	Average (mg/L)
Sodium	20 and 200 <sup>12</sup>	n/a	27	27	27	24	150	73.6
Fluoride	1.5 and 2.4 <sup>13</sup>	n/a	20	20	0	0.13	0.77	0.292

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12 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.

13 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.

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## **Treated Water Quality Statistics – 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 et cetera.

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 “E” 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 2016.

In 2016, all operational “Treated Sources” were sampled and analyzed for general chemistry parameters. Please refer to the “General Chemistry Results Summary” in Appendix “E” for the full list of parameters.

Table 15 highlights specific parameters due to their presence / significance within the water supply.

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**Table 15: City of Guelph General Chemistry Selected Results Summary (Jan. 01 to Dec. 31, 2016)**

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	13	0	n/a	< 0.05	< 0.05	n/a
Chloride	n/a	250	n/a	13	13	0	41	240	130.154
Hardness (Calculated as CaCO <sub>3</sub> )	n/a	n/a	80-100	13	13	13	360	550	442.3
Iron	n/a	0.3	n/a	26	9	5	< 0.1	0.65	0.321
Lead	0.01	n/a	n/a	26	6	0	<0.0005	0.0020	0.00114
Manganese	n/a	0.05	n/a	26	22	1	<0.002	0.066	0.0176
Sodium	n/a	20 and 200	n/a	27	27	27	24	150	73.6

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## i) Treated Water Quality – 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 2016 (January 1 to December 31, 2016). For regulatory sampling schedules that do not occur in 2016 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 (SDWA), 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 (electronic document management system). Note: EDMS is available for internal use only. 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, 2016. This database is used to closely track the instances of the identified chemical parameters and therefore provide time for planning / 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 above 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 "J" – Glossary.

The following section 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, 2016. **There was no instance of an adverse result in 2016:**

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**Table 16: O. Reg. 170/03 Schedule 7-2, Gazer Mooney - Distribution Manual Free Chlorine Residual Summary (Jan. 01 to Dec. 31, 2016)**

Parameter	ODWQS Range	Total Samples	Total Samples Outside of ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)	Units
Free Chlorine Residual	0.05 – 4.0	365	0	0.63	1.11	0.93	mg/L

Table 17 summarizes bacteriological sampling and test results required by O. Reg. 170/03 Schedule 10 for the period of January 1 to December 31, 2016. **There was no instance of an exceedance for a Regulatory microbiological parameter in 2016:**

- Number of Distribution samples taken: 26
- Number of Distribution analyses: 286

**Table 17: O. Reg. 170/03 Schedule 10-2, Gazer Mooney Treated Bacteriological Sampling Summary (Jan. 01 to Dec. 31, 2016)**

Parameter	ODWQS Criteria	Total Analyses	Total Outside ODWQS Criteria	Range	Units
<b>Distribution - E. coli</b>	0	52	0	0	cfu/100 mL
<b>Distribution - Total Coliform</b>	0	52	0	0	cfu/100 mL
<b>Distribution – HPC</b>	n/a	52	n/a	0 - 5	cfu/mL
<b>Distribution – Background</b>	n/a	52	n/a	0	cfu/100 mL
<b>Distribution– Free Chlorine Residual</b>	0.05 – 4.0	365	0	0.63 – 1.11	mg/L

### Treated Water Quality Statistics – O. Reg. 170/03 Schedule 13-6, “Three Month” Sampling Results Summary

In 2016, Gazer Mooney Subdivision Distribution System was sampled and analyzed for Schedule 13-6 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 (points with high retention times). The 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 average for the Gazer Mooney Subdivision Distribution System samples in 2016 (Jan. 01 to Dec. 30) is below the half maximum allowable concentration (½ MAC):** Q1 = 0.0248 mg/L; Q2 = 0.0240 mg/L; Q3 = 0.0226 mg/L and Q4 = 0.0254 mg/L.

**Table 18: O. Reg. 170/03 Schedule 13-6, Gazer Mooney - “Three Month” Sampling Results Summary (Jan. 01 to Dec. 31, 2016)**

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 <sup>14</sup>	n/a	4	4	0	0.0143	0.0533	0.0254

### Treated Water Quality Statistics – 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 19** in order to gather additional data and answer common inquiries from the public.

<sup>14</sup> This standard is expressed as a running annual average.

**Table 19: Gazer Mooney General Chemistry Results Summary (Jan. 01 to Dec. 31, 2016)**

Parameter	ODW QS MAC mg/L	ODW QS AO	½ MAC mg/L	Total Samples	Sample Above MDL	Total Above ODW QS Criteria	Min (mg/L)	Max (mg/ L)	Average (mg/L)
Sodium	20 and 200 <sup>15</sup>	n/a	n/a	1	1	1	25	25	25
Chloride	n/a	250	n/a	1	1	0	42	42	42

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

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

- 2009 Water Conservation and Efficiency Strategy;
- Source Water Protection Plan; and
- Lead Reduction Plan.

### Water Conservation and Efficiency

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 needs, our ability to reclaim precious water and wastewater serving capacity through conservation 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 and exceed the water reduction targets

<sup>15</sup> 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.

as outlined in the Water Supply Master Plan. Appendix "I" includes a highlight of the progress made for the period of January 1 to December 31, 2016 in the implementation of the 2009 Water Conservation and Efficiency Strategy.

## Source Water Protection Plan

This section includes summaries on Guelph's Source Water Protection Program initiatives and ongoing work related to preparation for implementation. The Grand River Source Protection Plan was approved by the Minister on November 26, 2015 with an effective date of July 1, 2016. In May, Council appointed risk management staff, Risk Management Official (RMO) and Risk Management Inspector (RMI) to protect Guelph's Drinking Water. City staff have been preparing for implementation of the Source Protection Plan including a number of new processes that will be integrated into the building permit and development application process.

Currently, City staff are working on: the development of education and outreach materials for stakeholders, development of guidelines for the preparation of risk management plans, and working with internal City of Guelph departments to ensure conformance with the proposed policies in the Source Protection Plan. The City is also in the process of establishing the data management and information needs that will be required to once the Source Protection Plan is in effect.

For more information on Guelph's Source Water Protection Program visit: [guelph.ca/sourcewater](http://guelph.ca/sourcewater)

Another source water protection initiative is carried out through the **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, which makes it necessary for monitoring, maintenance and new planting plans. The objective of the Arkell Springs Forest Stewardship Project is to manage past plantings, prevent losses while monitoring general forest health and protect the drinking water aquifer.

Delicate forest stands require continued maintenance and observation to ensure the prevention of any unnecessary and undesired losses. The many benefits of the project include the creation of a diverse and functioning 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, and regulation of the flow of water. This multiple barrier approach results in the highest possible quality of water to supply Guelph's drinking water system. Forest systems also extend the longevity of the existing snow pack by stabilizing the temperature of the ground and limiting the evaporative



impact of the sun. This ensures that this water source recharges the underlying aquifer rather than contributing to damaging runoff and flooding.

Since 2007, the Community Environmental Leadership Program (CELP), on a volunteer basis has planted 22,500 trees on 18 acres, and Bartram Woodlands (on-site contractor) has planted 25,720 trees on another 16 acres.

At the beginning of December of 2016 a commercial thinning harvest was started on the Arkell site. Commercial thinning is a silviculture treatment that 'thins' out an overstocked stand by removing trees that are large enough to be sold as products such as poles or fence posts. It is carried out to improve the health and growth rate of the remaining crop trees. Commercial thinning is an intermediate harvest where the merchantable wood removed should cover part or all of the cost of harvesting. The thinning is anticipated to be complete by the third week of January 2017.

## **Lead Reduction Plan**

The MOECC formally approved the City of Guelph's Lead Reduction Plan (LRP) on March 21, 2012. The LRP focuses on physical lead service line replacement and was submitted in lieu of a Corrosion Control Plan (as outlined in O.Reg 170/03 Sched. 15.1) as a result of two rounds of legislated lead sampling indicated that more than ten percent of residential samples taken exceeded the ODWQS of 10 µg/L.

In August 2014, based on the success of the program, the City was granted full regulatory relief from Sched. 15.1 of O.Reg 170/03 (in its entirety) in Schedule D of the City's Municipal Drinking Water Licence issue number 6. In exchange, Water Services will continue with its operational lead identification and removal program as per the LRP and results shared with the local MOECC inspector as needed. This section provides a summary of the aspects of the LRP.

The following table presents summary results for lead sampling in the Guelph Drinking Water System as per our Lead Reduction Plan for the period of January 1 to December 31, 2016:

**Table 20: Lead Reduction Plan Lead Sampling – Guelph Drinking Water System 2016<sup>16</sup>**

Number of Locations	Location Type	Number of Samples	Lead Range (mg/L)	pH Range	Alkalinity Range (mg/L)	Temperature Range (oC)
10	Distribution	10	0.0000 – 0.0017	7.6-7.6	n/a	n/a
187	Lead Verification	187	0.0000 - 0.025	n/a	n/a	n/a

In the Gazer Mooney Subdivision Distribution System, all samples were below the lead detection level.

**Table 21: Lead Reduction Plan – Gazer Mooney Subdivision Distribution System 2016<sup>17</sup>**

Number of Locations	Location Type	Number of Samples	Lead Range (mg/L)	pH Range	Alkalinity Range (mg/L)	Temperature Range (oC)
1	Distribution	6 <sup>18</sup>	0.0000	7.6	260 - 270	n/a

### Lead Sampling

Lead sampling is conducted to identify the presence of lead service lines (LSL) and to monitor lead levels following a LSL replacement. For the period of January 1 to December 31, 2016, 187 locations were sampled under the Lead Verification program. Of these sample results, 4 were above 5 micrograms per litre ( $\mu\text{g/L}$ ) indicating presence of a lead service line. Of all verification samples, 3 also exceeded the ODWQS of 10  $\mu\text{g/L}$ . Lead samples are collected before and after a LSL replacement has been undertaken. There were 12 locations resampled in order to monitor

<sup>16</sup> Includes all samples as required by the MDWL or Lead Reduction Plan.

<sup>17</sup> Includes all samples as required by the MDWL or Lead Reduction Plan.

<sup>18</sup> At each location three (3) samples are taken - one (1) for lead, one (1) for alkalinity and one (1) for pH.

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

There were 9 LSL replacements undertaken in the City between January 1 to December 31, 2016. These replacements include the following situations: i) Full LSL Replacement where both the City- and private-side of the LSL is replaced, ii) Partial LSL Replacement where only the City-side of the service is replaced and connected back to lead or a non-lead material on the private-side, and iii) Private LSL Replacement where the private-side of the service is replaced and the City-side is known to be copper. The next table presents a summary of all LSL replacements in the Guelph Drinking Water system for 2016 up to December 31.

**Table 22: Lead Service Line Replacements 2016 (Jan. 1 to Dec. 31)**

Type of Replacement	#
<b>Full LSL Replacement:</b> Funded under Grant Program <sup>19</sup>	0
<b>Full LSL Replacement:</b> Partner with property owner (not eligible for Grant Program)	0
<b>Partial LSL Replacement:</b> Lead Free - connected back to non-lead material or subsequently replace	2
<b>Partial LSL Replacement:</b> Lead - Connected back to lead on Private side	0
<b>Private LSL Replacement:</b> Replacement by private contractor	1
<b>Private LSL Replacement:</b> Funded under Grant Program	6
<b>Total</b>	9

### Privately Owned Lead Service Line Replacements

<sup>19</sup> The LSL Replacement Grant Program provides eligible property owners funding to off-set the cost of replacing an LSL on private property.

Since 2010, the City initiated two financial incentive programs to encourage replacement of privately-owned LSL by reducing the financial burden to property owners. The grants cover 70 to 100 percent of the LSL replacement cost for homeowners. The Private Lead Water Service Replacement Grant Program provides funding to homeowners to replace a confirmed privately owned LSL where the City-owned water service line is confirmed to be copper (i.e., City-side LSL was previously replaced). The Full Lead Water Service Replacement Grant Program provides funding to homeowners to replace a confirmed privately owned LSL in tandem with City-owned LSL replacement. From 2010 to Dec. 31, 2016, 198 privately owned lead service lines were replaced through the grant programs.

**Table 23: Private Lead Service Line Replacement Grant Programs (2010 – Dec. 31, 2016)**

<b>Grant Program</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>
Full Water Service Replacement Grant Program	15	19	7	2	1	2	0
Private Water Service Replacement Grant Program	45	43	24	18	8	10	6
Yearly Total	<b>60</b>	<b>62</b>	<b>31</b>	<b>20</b>	<b>9</b>	<b>12</b>	<b>6</b>
Cumulative Total	<b>60</b>	<b>122</b>	<b>153</b>	<b>173</b>	<b>182</b>	<b>194</b>	<b>200</b>

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 tailored to address these barriers.

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## k) Expected Future Changes That Could Affect the DWS or the QMS

### Changes Affecting the Drinking Water System (DWS) / Licence Approvals / Amendments

**Appendix "F" Legal & Other Requirements** includes a summary of legislative and regulatory updates from January 1 to December 31, 2016.

#### **Arkell Wellfield – Operational Testing Plan and Adaptive Management Plan (OTP / AMP)**

The OTP/AMP was completed successfully allowing for a maximum taking of 28,800 cubic metres (m<sup>3</sup>/day) from the Arkell Bedrock Wells. The purpose of the OTP / AMP was to carry-out a detailed assessment of both the Arkell area aquifer and pumping conditions related to the aquifer to determine a sustainable capacity with respect to environmental considerations in the area over a three year period. Additional details may be obtained by contacting Water Services. Water Services is continuing to assess the sustainability of the bedrock water taking through conditions in the newly amended PTTW (permit-to-take-water). Additional monitoring and data collection / assessment is ongoing.

#### **Carter Monitoring Program – Operational Testing**

The Permit to Take Water for Carter Well 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 attempt to quantify impacts within this subwatershed.

**Arkell Well #15 has been reassessed as a GUDI WEF Source** (Groundwater Under the Direct Influence of Surface Water with Effective In Situ Filtration). A DWWP (Drinking Water Works Permit) Amendment Application has been approved by the MOECC with supporting documentation that demonstrates the appropriateness of the requested re-classification and the ability of the existing treatment system at F.M. Woods to treat this source.

**Membro Well** – In November 2014, fecal bacteria was found for a short period in untreated well water from the Membro municipal well which resulted in Water Services staff removing the well from service and performing an investigation to determine the bacteria source and identify actions to prevent a reoccurrence of this poor water quality event. At all times prior to the Membro well being removed from service, including during the past 19 years of operation, properly disinfected and safe water was provided to customers that met all regulatory guidelines. The investigation has included consultation with both the MOECC and Wellington-

Dufferin-Guelph Public Health, and has led Water Services to remove a defective nearby monitoring well, install a more secure replacement pumping well, and enhance the disinfection system for the Membro well water. The Membro well was returned to service in September 2016.

**Ontario's GUDI (Groundwater Under the Direct Influence of Surface Water) Terms of Reference** are under review and may result in classification changes to source waters. The revised GUDI Terms of Reference are expected in 2017 and are anticipated to require disinfection system upgrades for the Emma and Water Street wells.

### **Ontario's Watermain Disinfection Procedure**

Municipal operating authorities are required to use AWWA Standard C651 (Disinfecting Water Mains) for addition, replacement or repair of pipes forming the distribution system, as per condition 2.3.2 of Drinking Water Works Permits. Ontario's Watermain Disinfection Procedure outlines minimum requirements for compliance, and operating authorities will be able to use their discretion to adopt more stringent standard operating procedures. Requirements for disinfection will also apply to temporary watermains, as well as service pipes of 100 mm diameter or greater. Water Services implemented the procedure May 1, 2016.

**Municipal Drinking Water Licence Renewal** – the table below includes Licence documents' dates of issue and expiry.

## **Municipal Drinking Water Licensing documents**

### **1. Municipal Drinking Water Licence (#017-101)**

- a. Issue Date (yyyy-mm-dd): 2014-08-18
- b. Expiry Date (yyyy-mm-dd): 2019-08-17

### **2. Drinking Water Works Permit (#017-201)**

- a. Issue Date (yyyy-mm-dd): 2015-11-05
- b. Expiry Date (yyyy-mm-dd): 2019-08-17

### **3. Drinking Water Works Permit (#017-201) - Schedule C**

- a. Issue Date (yyyy-mm-dd): 2016-03-24
- b. Expiry Date (yyyy-mm-dd): 2019-08-17

### **4. Municipal Long Range Financial Plan (#017-301)**

- a. Issue Date (yyyy-mm-dd): 2014-02-25
  - b. Expiry Date (yyyy-mm-dd): 2019-08-17
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**5. DWQMS Certificate of Registration - Guelph Drinking Water System (017-OA1)**

- a. Issue Date (yyyy-mm-dd): 2016-08-04
- b. Expiry Date (yyyy-mm-dd): 2019-07-27

**6. Operational Plan Re-endorsement Guelph Drinking Water System (resolution)**

- a. Issue Date (yyyy-mm-dd): 2015-10-26
- b. Expiry Date (yyyy-mm-dd): 2019-10-31

**7. Agreement Regarding Water Services for the Gazer-Mooney Subdivision**

- a. Issue Date (yyyy-mm-dd): 2009-06-01
- b. Expiry Date (yyyy-mm-dd): 2019-05-31

**8. Municipal Drinking Water Licence (#104-103)**

- a. Issue Date (yyyy-mm-dd): 2016-01-28
- b. Expiry Date (yyyy-mm-dd): 2021-01-26

**9. Drinking Water Works Permit (#017-203)**

- a. Issue Date (yyyy-mm-dd): 2016-01-28
- b. Expiry Date (yyyy-mm-dd): 2021-01-26

**10. Operational Plan Re-endorsement Gazer Mooney Sub. Dist. System (resolution)**

- a. Issue Date (yyyy-mm-dd): 2015-07-14
- b. Expiry Date (yyyy-mm-dd): 2019-10-31

**11. DWQMS Certificate of Registration - Gazer Mooney (104-OA2)**

- a. Issue Date (yyyy-mm-dd): 2016-08-04
- b. Expiry Date (yyyy-mm-dd): 2019-07-27

**Permits to Take Water (PTTW) Renewals**

Five PTTWs were renewed in 2016 (January 1 to December 31):

- 1. Carter Wells PTTW (exp. 2021-05-31)
- 2. Helmar Well PTTW (exp. 2025-05-31)
- 3. Arkell Infiltration Gallery PTTW (exp. 2026-10-31)
- 4. Emma Well and Park Wells 1 & 2 PTTW (exp. 2021-05-31)

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5. Paisley Well PTTW (exp. 2026-05-31)

The Water St. Wellfield (Water, Dean, University, Membro) PTTW (exp. 2016 -10-31) is still in the active renewal process.

Three PTTWs are scheduled for renewal in 2017:

1. Edinburgh PTTW (exp. 2017-06-30)
2. Sacco PTTW (exp. 2017-06-30)
3. Smallfield PTTW (exp. 2017-06-30)

### Staff Certification

Table 24, Table 25 and Table 26 describe staff (Operators, Management, and other Technical staff) with various classes of provincial operator certificates and years' experience.

**Table 24: Water Services Staff with Certificates**

Certificate Class	Number of Employees (not including Management)
OIT	2
Class I	2
Class II	3
Class III	12
Class IV	12



**Table 25: Competency & Years' Experience of Management Directly Affecting Drinking Water**

<b>Role</b>	<b>Minimum Competency Required<sup>20</sup></b>	<b>Competency Achieved</b>	<b>Years' Experience</b>
Manager of Operations / ORO - Overall Responsible Operator	Class IV Certificate	Class IV Certificate	29+
Supervisor of Distribution / Construction	Class I Certificate or higher	Class IV Certificate	20+
Supervisor of Distribution / Metering	Class I Certificate or higher	Class IV Certificate	16+
Supervisor of Water Supply Operations	Class I Certificate or higher	Class IV Certificate	13+
Supervisor of Water Supply Maintenance	Class 1 Certificate or higher	Class IV Certificate	8+

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

**Table 26: Years' Experience of Water Services Operators Directly Affecting Drinking Water**

Role	<5 years	5-9 years	10-14 years	15-19 years	20-24 years	25+ years
Distribution Operators	1	8	4	1	0	3
Supply Operators	3	1	4	2	0	1
Technical Services Staff	1	0	1	0	1	0

## Changes Affecting the Quality Management System (QMS)

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

Management Review meetings were held on January 28 and September 12, 2016 and the following is a summary of results of the management review. Appendix "G" includes the action items from the meeting. The summary includes identified deficiencies, decisions and action items below:

#### Deficiencies

- Any non-compliance items identified in the Annual & Summary Report are discussed.
- 6 AWQI's occurred in 2016 (one related to lead, four related to TC, and one "unable to read" issue).
- 1 nonconformity from the last external audit re: Management Review meetings (deficiencies, decisions and action items) and reporting these to the Owner.

#### Decisions

- Risk assessment update:
  - Now includes a third risk rating, "capability of responding", edited "consequence" ratings to include amount of water impacted by the hazard, and "updated "control measures" to more accurately include all of Water Services' control measures.

- Decided to include (in the last risk assessment update) MOECC's "Potential Hazardous Events for Municipal Residential Drinking Water Systems to consider in the DWQMS Risk Assessment". Edited hazard / hazardous events categories to better align to MOECC's document.
- Added "aquifer cross-connections", "drought" and "aqueduct infrastructure failure" to hazardous events.
- Linked opportunities for improvement (OFI's) to emergency debriefs and management review meetings to better track progress on these OFI's.
- Added "sudden changes to raw water characteristics", "potential source water supply shortfall", "distribution system issues", "private property issues" to section m) of the A&S report.
- External audit timeline has changed from June to November every year due to busy construction season in June. The next external audit by NSF International Strategic Registrations is planned for Nov. 15-17, 2017.

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

Although not yet officially released, Guelph Water Services is working through the implementation of the updated DWQMS in its quality management system. Most significant edits are:

- Throughout: added "once every Calendar Year" where applicable in place of "once every year" or "once every 12 months".
  - **QMS 07:** includes consideration of potential hazardous events and associated hazards identified by the ministry. These hazardous events are identified in the document titled "Potential Hazardous Events for Municipal Residential Drinking Water Systems."
  - **QMS 12:** suppliers of essential supplies and services identified by Guelph Water Services are considered in the procedure for communications. This document will further describe this statement.
  - **QMS 14:** Outcomes of the risk assessment documented under QMS 08 will be considered in the procedure for reviewing the adequacy of the infrastructure necessary to operate and maintain the drinking water system.
  - **QMS 15:** Long-term forecast of major infrastructure maintenance, rehabilitation and renewal activities is already included as part of QMS 14 (but will elaborate the procedure to include this statement).
-

- **QMS 21:** includes consideration of BMP's (when available from the MOECC) in continual improvement; a documented process for identification & management of continual improvement reports (that are continual improvement items, corrective actions or preventive actions, where applicable).

## I) Consumer Feedback

The table below represents all customer calls received:

**Table 27: 2016 Customer Calls Received**

Type	# Calls <sup>21</sup> 2014	# Calls 2015	# Calls 2016
Discoloured Water	-	160	185
Distribution	-	72	77
Flushing	32	27	33
Frozen	-	695	5
Hydrant - Accident Report	-	2	3
Hydrant - Investigation	46	38	39
Hydrant Out-of-Service	-	65	108
Leak	-	52	88
Meter	-	36	11
Other	199	127	53

<sup>21</sup> This column generally represents the number of calls received, not necessarily the number of individual issues. Previous years' calls were not collected with the same level of detail as current year, and therefore dashes exist in the table.

Type	# Calls <sup>21</sup> 2014	# Calls 2015	# Calls 2016
Pressure	146	95	104
Private Issue	306	18	23
Service Box Repairs	-	254	205
Swabbing	32	47	59
Trench Investigation	-	9	6
Valve	-	27	46
Water Quality / Appearance	144	47	55
Watermain	124	67	5
Watermain Break Investigation	-	54	90
Well Interference Inquiries	2	2	4

## m) The Resources Needed to Maintain the DWS and QMS

Water Services currently has one full-time Quality Assurance Coordinator, who is also the Quality Management System Representative, a Compliance Coordinator, access to four Water Services Technicians, and a Customer Service Clerk for reporting and documentation requirements of the QMS.

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

- Sudden changes to raw water characteristics (e.g. Arkell #15, Membro Well, Carter Wells),
- Potential source water supply shortfall (e.g. current supplies not meeting future demand, drought),

- Distribution system issues (e.g. frozen city-side infrastructure, larger infrastructure failures or hits, Locates Program, Metering Program), and
- Private property issues (e.g. frozen services, Lead Program, water quality).

## **n) The Results of Infrastructure Review**

The review of infrastructure requirements is achieved by reviewing the needs of existing infrastructure and of new infrastructure requirements. This review is carried out for the infrastructure needs of distribution and supply & facilities.

### **Distribution Infrastructure Needs**

At annual specifications review meetings, Guelph's Engineering & Capital Infrastructure Services (Engineering Services) and Water Services staff update Water Services' infrastructure specifications.

During the annual budget preparation process, Engineering Services and Water Services review infrastructure conditions, inventory age, CAPS (capital asset prioritisation 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 & 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 & Capital Infrastructure Services (Engineering Services) department 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 retained C3 Water Inc.

to analyse and define construction sequencing of infrastructure upgrade recommendations, with specific focus to Pressure Zone 2 in the water distribution system. These works were completed in Q4 2015 with study outcomes to support field implementation of capital projects in 2016 and future capital programs needs through the 2017 Water and Wastewater Non-Tax Budget deliberations. Due to the success of the analysis undertaken in the Pressure Zone 2, the City initiated a similar analytical assessment of Pressure Zone 1 in Q3 of 2016 to determine construction sequencing of infrastructure upgrade recommendations. Findings of this analysis are expected in Q2 of 2017.

In Q1 2016, Water Services initiated development of the Water Facility Asset Management Master Plan. This Master Plan aimed to identify and prioritize the 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. Through interim products of the Master Plan a revised 10 year capital forecast for Facility and Plant Upgrades was presented to and endorsed by Council as part of the 2017 Non Tax Budget deliberations to address a backlog in infrastructure investment required to sustain operation of the City's critical water supply facilities and processes. This 10 year capital plan seeks to invest \$48.8 million in water supply asset renewal and maintenance between 2017 and 2026, an increase of just over \$26 million over prior planned investment over this period in comparison to planned Water Services Facility Upgrades defined through the 2016 Non-tax budget. Work on the Water Facility Asset Management Master Plan was ongoing in Q4 2016 with the final Water Facility Asset Management Master Plan document is anticipated to reach completion in Q1 2017.

### **Burke Well Station Upgrades**

Manganese concentrations in water from the Burke Well appear to be gradually increasing and are slightly above the MOECC'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 have been planned for a number of years. The upgrades will include construction of a building to house a pressure filtration system. In 2016 the Building Permit for the project was received and the capital budget approved. It is planned to begin construction of the upgrades in 2017 and be in operation by spring 2018. The upgrades are expected to result in the Burke Well Station being classified as a Water Treatment Subsystem.

## Clair Road Pumping Station

In Q3 of 2016, Water Services and Engineering Services initiated the commissioning of the Clair Road Pumping Station the intent of which was to commission a new water distribution pressure zone to accommodate growth in the south end of the City.

## 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.

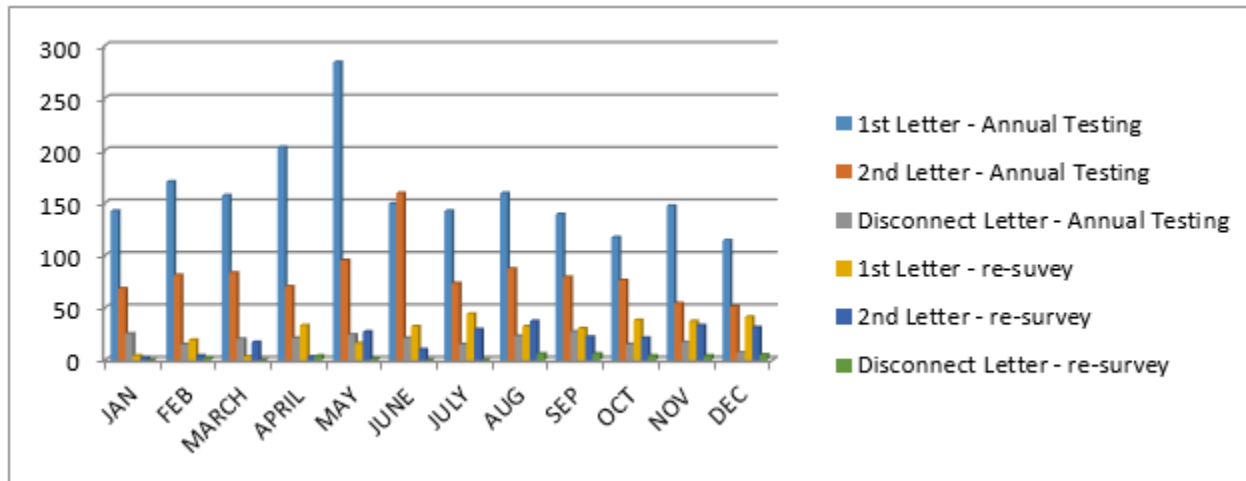
On a regular basis, Building Services provides the following "Backflow Report" included in the table below that tracks the number of letters sent out regarding annual testing and re-surveying requirements of the By-law.

The City of Guelph has a total of 2,774 properties (2,651 active and 123 inactive properties) that have a total of 6,293 backflow prevention devices installed. Of the total, 1,911 buildings have premise isolation and 968 buildings are without premise isolation (e.g. residential irrigation systems, plaza facility – plaza owner has premise isolation). New properties from January 1 to December 31: 21 with premise and 26 without premise isolation.





**Figure 5: Annual Backflow Prevention Device Re-Survey and Testing Letters from Building Services to Customers in 2016**



## **o) Operational Plan Currency, Content and Updates**

See agenda item “k) Expected Future Changes That Could Affect the DWS or the QMS” for Operational Plan updates.

## **p) Staff Suggestions**

Staff suggestions are discussed during staff and operational meetings and taken into account during annual budget processes. Appendix “H” Summary of Staff Suggestions includes a listing of various improvement items that were presented by staff from January 1 to December 31, 2016.

## **q) New or Other Business**

This section provides an update on new or other items of business beyond the scope of this report.

## **r) Next Meeting Dates**

The next Management Review Meetings scheduled to review the updated Annual & Summary Water Services Reports are planned for September 2017 and January 2018.

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## Appendix "A" – Summary of Critical Control Points and Control Limits

The section below contains descriptions of three critical control points.

### 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

##### Inadequate UV Dosage

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

#### Critical Control Limit (CCL)

##### Free Chlorine

- 0.05-4.0 mg/L (PDDW<sup>22</sup>, SDWA, O. Reg. 170/03)
- 0.2 mg/L (PDDW recommended optimal)

##### UV dose

- at FM Wood: 24 mJ/cm<sup>2</sup> (Drinking Water Works Permit, DWWP)
- at Emma and Water Street wells: 40 mJ/cm<sup>2</sup>(DWWP)
- at Membro well: 20 mJ/cm<sup>2</sup>(DWWP)

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22 PDDW – Procedure for Disinfection of Drinking Water in Ontario as adopted by reference by O. Reg. 170/03 under the Safe Drinking Water Act.

## Monitoring Process & / or Procedures

- Certified and competent operators
- Daily operational sampling, testing and monitoring of control limits, as applicable
- 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

## Response Procedures

- Supply Standard Operating Procedures
- Water Services Emergency Plan procedures

## Critical Control Point (CCP) - Secondary Disinfection

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

## Hazard Description

### Deterioration of chlorine residual, from:

- Reduced water flows
- Occurrence of dead ends
- Increased water temperature (causing low chlorine residual)

## Critical Control Limit (CCL)

### Free Chlorine

- 0.05-4.0 mg/L (PDDW, SDWA, O. Reg. 170/03)
- 0.2 mg/L (PDDW recommended optimal)

### pH

- 6.5-8.5 (operational criteria)

### **Turbidity**

- 5 NTU (operational criteria)

### **Monitoring Process & / or Procedures**

- Certified and competent operators
- Sampling, testing and monitoring of control limits, as applicable
- Main flushing programs
- Installation of blow-offs in dead ends
- Regular samples taken and analyzed for chlorine residual and temperature

### **Response Procedures**

- Distribution Standard Operating Procedures
- Response to customer calls
- 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**

- 275-550 kPa (industry standard for operating pressure)

### **Consumer complaints**

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

## **Monitoring Process & / or Procedures**

- Backflow Prevention program
- Where possible, implementation of backflow prevention devices and small mains
- Proactive Watermain and substandard service replacement program

## **Response Procedures**

- Distribution Standard Operating Procedures
- Response to customer calls
- Water Services Emergency Plan procedures

## Appendix “B” – Executive Summary of Risk Assessment Outcomes

**Table 29: Executive Summary of Risk Assessment Outcomes**

Process	Hazardous Event	Risk Rating
Water Supply	Source Degradation and Contamination	High
	Sudden Changes in Raw Water Characteristics	Moderate
	Source Water Infrastructure Failures	Moderate
	Water Supply/Demand (including drought)	Moderate
Treatment	Inadequate Chemical Supply	Low
	Treatment Infrastructure Failure	Low
	Reservoir / Contact Chamber Failure	Low
	PLC Failure	Low
Storage	Insufficient Secondary Disinfection	Low
	Storage Infrastructure Failure	Moderate
Distribution	Distribution Infrastructure Failure or Damage	Moderate
	Cross-connection or backflow	Low
	Degradation of Treated Water Quality	Moderate
	Conditions of Services	Moderate
Security	Unauthorized Entry, Vandalism, Terrorism	Low
Monitoring and Reporting	Failure of Monitoring Equipment	Low
	Failure of Communications Equipment	Moderate
Power	Power Failure	Moderate
	MCC Failure	High

## Appendix “C” – Internal and External Audit Plans

**Table 30: Internal and External Audit Plans**

Guelph Water Services Process or Program	2014 Audit Plan	2014 Audit Plan	2015 Audit Plan	2015 Audit Plan	2016 Audit Plan	2016 Audit Plan
	Internal	External	Internal	External	Internal	External
Source Water – Source Water Protection (Engineering)	X	X	X	X	n/a	
Source Water – Tap Water Promotion, Education & Outreach	n/a	n/a	n/a	n/a	n/a	n/a
Source Water – Water Conservation (incl. Leak Detection and Water Loss Management)	n/a	X	X	n/a	n/a	X
Supply – Source & Treated Water Sampling, Testing, Monitoring	n/a	X	X	X	n/a	X
Supply – Operational Control: Disinfection, Minimum Storage, SCADA / Security, DMA’s	X	X	X	X	n/a	X
Supply – Instrumentation Calibration / Verification	X	X	X	X	n/a	X



Guelph Water Services Process or Program	2014 Audit Plan	2014 Audit Plan	2015 Audit Plan	2015 Audit Plan	2016 Audit Plan	2016 Audit Plan
	Internal	External	Internal	External	Internal	External
Supply – Reliability-Centered Maintenance Program (RCMP) & Supply Maintenance	X	n/a	X	X	n/a	X
Supply – Infrastructure (facility and tower) Inspections Program	X	n/a	n/a	n/a	n/a	X
Distribution – Watermain Maintenance and Service Connections Improvement	X	X	X	n/a	n/a	X
Distribution – Appurtenance Maintenance (valves, hydrants, meters)	n/a	n/a	X	n/a	n/a	X
Distribution – Backflow Prevention (Building Services)	n/a	n/a	n/a	X	X	n/a
Distribution – Watermain Flushing & Swabbing	n/a	n/a	X	n/a	n/a	X
Distribution – Infrastructure Locates	X	X	X	X	n/a	X
Distribution – Temporary Connections	X	X	X	n/a	X	X

Guelph Water Services Process or Program	2014 Audit Plan	2014 Audit Plan	2015 Audit Plan	2015 Audit Plan	2016 Audit Plan	2016 Audit Plan
	Internal	External	Internal	External	Internal	External
Major Works & New Infrastructure – Engineering / Water: Review of Infrastructure (Specifications and Design)	n/a	X	X	n/a	X	n/a
Major Works & New Infrastructure – Engineering: Infrastructure Reconstruction and Replacement	n/a	X	X	n/a	X	X
Major Works & New Infrastructure – Engineering: New Construction (new subdivisions development)	n/a	n/a	X	n/a	n/a	X
Management – Owner (Council & CAO) Standard of Care	X	X	X	X	X	X
Management – Customer Service (Administration, Distribution, Supply)	X	X	X	X	X	X
Management – Risk & Emergency Management (incl. Water Advisory, EPO Response)	X	X	X	X	X	X

Guelph Water Services Process or Program	2014 Audit Plan	2014 Audit Plan	2015 Audit Plan	2015 Audit Plan	2016 Audit Plan	2016 Audit Plan
	Internal	External	Internal	External	Internal	External
Management – Human Resources (incl. Operator Certification) & Supplier Management	X	X	X	X	X	X
Management – Communications	n/a	X	n/a	X	X	X
Management – Continual Improvement	X	X	X	X	X	X

## Appendix “D” – Total Water Pumped and Instantaneous Flows

### **Note on Capacity:**

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.

## City of Guelph Water Services

Table 31: Pumpage to System – Jan. 1 – Dec. 31, 2016

Month	Facility	Burke Discharge	Calico Discharge	Dean Discharge	Downey Discharge	Emma Street Discharge	Helmar Discharge	Membro Discharge	Paisley Net Discharge	Park Discharge	Queensdale Discharge	University Net Discharge	Water Street Discharge	F.M. Woods Discharge	Total System Discharge
	Units Regulatory Limit	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3
		6,546	5,237	2,300	5,237	3,100	3,273	6,050	13,738	10,300	5,273	5,108	3,400	65,000	n/a
Jan	Maximum	3,842	860	0	4,151	2,555	955	0	1,015	6,196	0	2,256	2,371	29,813	49,054
	Average	3,148	803	0	3,953	2,421	914	0	758	3,806	0	1,743	1,179	26,572	45,297
	Total	97,592	24,891	0	122,534	75,045	28,343	0	23,496	117,985	0	54,046	36,537	823,746	1,404,215
Feb	Maximum	4,060	790	0	4,792	2,392	1,095	0	1,008	7,906	0	2,241	2,313	29,070	49,452
	Average	3,449	773	0	4,236	1,205	966	0	975	5,501	0	1,877	1,270	26,870	47,123
	Total	100,016	22,425	0	122,857	34,954	28,025	0	28,268	159,527	0	54,442	36,824	779,230	1,366,568
Mar	Maximum	5,198	831	146	3,978	2,891	1,093	0	1,015	6,680	0	2,239	2,765	29,950	49,389
	Average	3,692	764	16	3,947	2,618	1,085	0	927	4,816	0	1,738	1,414	25,724	46,742
	Total	114,459	23,685	500	122,351	81,155	33,645	0	28,748	149,306	0	53,878	43,820	797,446	1,448,993
Apr	Maximum	3,801	828	0	3,947	2,848	1,094	0	989	7,491	1,647	2,248	2,170	29,233	50,473
	Average	3,558	806	0	3,928	2,716	1,087	0	983	3,712	1,290	1,826	1,173	26,551	47,630
	Total	106,746	24,175	0	117,829	81,468	32,614	0	29,478	111,359	38,713	54,785	35,182	796,538	1,428,887
May	Maximum	4,969	819	0	4,036	2,849	1,205	0	980	9,092	1,674	2,248	2,152	29,995	55,888

Month	Facility	Burke Discharge	Calico Discharge	Dean Discharge	Downey Discharge	Emma Street Discharge	Helmar Discharge	Membro Discharge	Paisley Net Discharge	Park Discharge	Queensdale Discharge	University Net Discharge	Water Street Discharge	F.M. Woods Discharge	Total System Discharge
	Units Regulatory Limit	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3
	6,546	5,237	2,300	5,237	3,100	3,273	6,050	13,738	10,300	5,273	5,108	3,400	65,000	n/a	
May	Average	3,365	788	0	3,977	2,586	898	0	975	5,493	1,639	585	1,547	26,611	48,465
	Total	104,307	24,429	0	123,297	80,156	27,847	0	30,225	170,290	50,805	18,148	47,970	824,931	1,502,406
Jun	Maximum	5,317	936	0	4,017	2,735	977	0	974	8,892	1,677	52	2,056	33,875	56,498
	Average	3,875	827	0	3,986	2,648	926	0	966	4,513	1,301	2	1,942	30,503	51,488
	Total	116,245	24,808	0	119,566	79,433	27,789	0	28,973	135,400	39,038	52	58,255	915,076	1,544,635
Jul	Maximum	5,389	936	0	4,721	2,815	958	0	970	7,693	1,084	2,182	2,184	33,108	56,309
	Average	3,759	906	0	4,670	2,712	77	0	931	3,130	790	1,398	1,243	27,273	47,325
	Total	116,530	28,096	0	144,766	84,057	2,398	0	28,868	97,018	24,475	43,343	38,525	845,473	1,467,076
Aug	Maximum	5,389	936	0	4,721	2,815	958	302	960	5,131	0	2,052	2,194	31,795	51,525
	Average	3,759	906	0	4,670	2,712	77	12	865	2,494	0	1,750	1,029	27,553	45,828
	Total	116,530	28,096	0	144,766	84,057	2,398	383	26,824	77,305	5	54,262	31,909	854,137	1,420,669
Sept	Maximum	4,048	880	0	4,713	2,752	1,140	3,571	957	6,770	0	2,031	2,152	31,175	51,445
	Average	3,451	856	0	4,659	2,678	894	1,912	952	2,718	0	1,487	842	26,112	46,561
	Total	103,532	25,692	0	139,756	80,335	26,830	57,362	28,559	81,531	7	44,612	25,245	783,353	1,396,815

Month	Facility	Burke Discharge	Calico Discharge	Dean Discharge	Downey Discharge	Emma Street Discharge	Helmar Discharge	Membro Discharge	Paisley Net Discharge	Park Discharge	Queensdale Discharge	University Net Discharge	Water Street Discharge	F.M. Woods Discharge	Total System Discharge
	Units Regulatory Limit	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3
	6,546	5,237	2,300	5,237	3,100	3,273	6,050	13,738	10,300	5,273	5,108	3,400	65,000	n/a	
Oct	Maximum	5,410	897	0	4,669	2,699	1,132	3,544	947	9,618	1,388	1,940	2,006	26,318	49,426
	Average	3,507	864	0	4,594	2,424	918	2,424	938	3,234	1,099	1,265	392	22,442	44,102
	Total	108,720	26,787	0	142,421	75,129	28,469	75,149	29,073	100,261	34,058	39,221	12,164	695,712	1,367,164
Nov	Maximum	3,770	884	0	4,616	2,630	1,186	3,268	974	4,894	1,226	1,760	1,962	28,520	47,012
	Average	3,111	844	0	4,533	2,403	1,003	2,639	926	2,027	1,180	1,488	776	22,756	43,687
	Total	93,333	25,324	0	135,992	72,102	30,096	79,158	27,767	60,815	35,414	44,654	23,285	682,683	1,310,623
Dec	Maximum	3,924	850	0	4,673	2,519	1,133	3,103	931	3,310	1,182	2,114	1,878	24,720	45,583
	Average	2,900	723	0	4,556	2,460	1,106	3,059	919	1,270	1,175	1,088	465	21,655	41,376
	Total	89,915	22,427	0	141,224	76,253	34,288	94,823	28,480	39,375	36,410	33,739	14,429	671,305	1,282,669
2016 Year	Maximum	5,410	936	4,473	4,721	2,849	3,103	3,571	1,052	9,618	2,114	2,248	24,720	45,583	56,498
	Average	3,699	834	0	4,374	2,598	844	837	958	4,114	706	1,469	1,405	26,691	47,030
	Total	1,267,923	300,835	0	1,577,359	904,143	302,742	306,875	338,759	1,300,172	258,927	495,182	404,145	9,469,628	16,940,220
	Average Capacity	53%	16%	0%	83%	80%	25%	14%	n/a	35%	13%	n/a	33%	40%	n/a

**Table 32: Permit to Take Water Pumpages – Jan. 1 – Dec. 31, 2016**

Month	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 Spring Collector System	Burke Well	Calico Well	Carter Wells #1and #2
	Units	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3
	Regulatory Limit	N/O23	3,273	9,600	9,600	9,600	9,600	9,600	m3	9,092	25,000	6,546	5,237	6,547
<b>Jan</b>	<b>Maximum</b>	N/O	145	7,382	7,565	6,629	7,219	7,075	26,209	0	4,959	3,806	851	6,368
	<b>Average</b>	N/O	14	5,777	6,385	1,398	2,778	5,613	21,951	0	4,725	3,157	795	6,093
	<b>Total</b>	N/O	427	179,082	197,948	43,341	86,111	174,010	680,492	0	146,465	97,857	24,660	188,898
<b>Feb</b>	<b>Maximum</b>	N/O	229	7,322	7,256	3,656	6,476	6,831	24,100	0	5,273	4,088	799	6,112
	<b>Average</b>	N/O	20	4,879	7,149	487	2,731	6,692	21,937	0	4,926	3,458	733	6,060
	<b>Total</b>	N/O	583	141,488	207,316	14,135	79,191	194,056	636,185	0	142,858	100,289	22,407	175,744
<b>Mar</b>	<b>Maximum</b>	N/O	7	7,424	7,395	6,772	6,880	6,980	26,277	0	6,297	5,127	818	6,039
	<b>Average</b>	N/O	1	4,628	7,190	1,764	2,495	4,874	20,951	0	5,343	3,686	750	5,365
	<b>Total</b>	N/O	25	143,468	222,893	54,673	77,358	151,095	649,487	0	165,630	114,279	23,244	166,313
<b>Apr</b>	<b>Maximum</b>	N/O	318	7,027	7,406	4,483	7,484	7,135	24,797	0	10,870	3,776	815	5,209
	<b>Average</b>	N/O	28	3,404	7,278	1,061	2,988	4,837	19,568	0	8,843	3,530	797	3,591
	<b>Total</b>	N/O	852	102,129	218,348	31,822	89,638	145,104	587,041	0	265,275	105,914	23,920	107,724

23 N/O – not operational



Annual and Summary Report

Month	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 Spring Collector System	Burke Well	Calico Well	Carter Wells #1and #2
	Units	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3
	Regulatory Limit	N/O23	3,273	9,600	9,600	9,600	9,600	9,600	m3	9,092	25,000	6,546	5,237	6,547
May	Maximum	N/O	333	7,277	7,386	3,167	5,998	7,250	24,916	0	10,341	4,953	808	5,197
	Average	N/O	44	1,941	7,268	341	2,075	5,291	16,916	0	9,913	3,374	784	4,715
	Total	N/O	1,377	60,165	225,305	10,573	64,330	164,024	524,398	0	307,314	104,593	24,293	146,159
Jun	Maximum	N/O	331	6,878	7,310	3,424	6,376	7,088	26,970	0	9,960	5,302	957	5,151
	Average	N/O	35	4,233	7,041	961	3,405	5,630	21,268	0	9,401	3,877	828	960
	Total	N/O	1,039	126,977	211,217	28,823	102,144	168,888	638,049	0	282,038	116,297	24,844	28,792
Jul	Maximum	N/O	285	6,522	7,299	2,157	5,068	6,939	24,713	0	9,078	105	4,437	966
	Average	N/O	24	4,201	7,095	440	1,951	5,374	19,062	0	8,331	96	3,791	918
	Total	N/O	741	130,240	219,959	13,362	60,485	166,592	590,909	0	258,253	2,989	117,513	28,465
Aug	Maximum	N/O	468	7,140	7,182	5,500	7,270	6,815	28,376	0	8,272	5,409	941	0
	Average	N/O	53	5,037	6,783	896	4,501	3,330	20,545	0	7,369	3,766	905	0
	Total	N/O	1,630	156,132	210,258	27,761	139,520	103,220	636,892	0	228,447	116,740	28,064	0
Sept	Maximum	N/O	245	7,224	7,174	2,310	7,078	6,838	24,275	68	7,135	4,036	892	16
	Average	N/O	9	4,776	5,398	690	4,703	4,010	19,577	2	6,538	3,453	866	1
	Total	N/O	266	143,227	161,940	20,688	141,103	120,304	587,313	68	196,125	103,586	25,993	16

Month	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 Spring Collector System	Burke Well	Calico Well	Carter Wells #1and #2
	Units	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3
	Regulatory Limit	N/O23	3,273	9,600	9,600	9,600	9,600	9,600	m3	9,092	25,000	6,546	5,237	6,547
<b>Oct</b>	<b>Maximum</b>	N/O	203	7,227	7,180	4,217	7,517	5,572	20,675	8	6,066	5,393	911	5
	<b>Average</b>	N/O	22	3,686	4,526	715	5,569	2,210	16,706	0	5,715	3,476	873	0
	<b>Total</b>	N/O	690	114,262	140,309	22,150	172,652	68,499	517,872	8	117,151	107,764	27,075	5
<b>Nov</b>	<b>Maximum</b>	N/O	253	7,127	5,007	6,566	7,728	5,916	23,347	0	5,654	3,734	913	0
	<b>Average</b>	N/O	25	4,117	545	2,136	7,133	3,671	17,602	0	5,287	3,091	850	0
	<b>Total</b>	N/O	736	123,500	16,353	64,076	214,000	110,132	528,061	0	158,617	92,718	25,509	0
<b>Dec</b>	<b>Maximum</b>	N/O	262	6,621	7,234	4,469	7,556	5,609	20,063	0	6,050	3,862	862	0
	<b>Average</b>	N/O	26	3,988	4,698	492	6,401	1,698	17,277	0	4,901	2,874	718	0
	<b>Total</b>	N/O	809	123,623	145,640	15,258	198,431	52,630	535,581	0	151,928	89,093	22,252	0
<b>2016 Year</b>	<b>Maximum</b>	N/O	468	7,424	7,565	6,772	7,728	7,250	28,376	0	10,870	5,409	966	6,368
	<b>Average</b>	N/O	25	4,222	5,946	948	3,894	4,436	19,447	0	6,774	3,461	822	2,264
	<b>Total</b>	N/O	9,174	1,544,345	2,177,486	346,932	1,424,964	1,618,533	7,112,280	0	2,480,101	1,266,642	300,724	825,397
	<b>Average Pumped</b>	N/O	1%	44%	62%	10%	41%	46%	68%	0%	27%	53%	16%	35%

**Table 33: Permit to Take Water Pumpages – Jan. 1 – Dec. 31, 2016 continued**

Month	Facility	Clythe Well	Dean Well	Downey Well	Edinburgh Well	Emma Street Well	Helmar Well	Membro Well	Paisley Well	Park Wells #1 and #2	Queensdale Well	Sacco Well	Smallfield Well	University of Guelph Well	Water Street Well
	Units	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3
	Regulatory Limit	N/O	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	<b>Maximum</b>	N/O	2	4,207	N/O	2,555	934	0	1,015	6,204	1,390	N/O	N/O	2,256	2,3713
	<b>Average</b>	N/O	0	4,006	N/O	2,421	896	0	758	3,769	428	N/O	N/O	1,743	1,179
	<b>Total</b>	N/O	2	124,182	N/O	75,045	27,769	0	23,496	116,829	13,265	N/O	N/O	54,046	36,537
Feb	<b>Maximum</b>	N/O	0	4,856	N/O	2,392	1,087	0	1,008	7,873	1,482	N/O	N/O	2,241	2,313
	<b>Average</b>	N/O	0	4,293	N/O	1,205	947	0	975	5,462	1,368	N/O	N/O	1,877	1,270
	<b>Total</b>	N/O	0	124,500	N/O	34,945	27,463	0	28,268	158,398	39,670	N/O	N/O	54,442	36,824
Mar	<b>Maximum</b>	N/O	0	4,000	N/O	2,891	1,092	0	927	6,533	204	N/O	N/O	2,239	2,765
	<b>Average</b>	N/O	0	4,031	N/O	2,618	1,065	0	1,015	4,732	9	N/O	N/O	1,738	1,413
	<b>Total</b>	N/O	0	123,990	N/O	81,155	33,002	0	28,748	146,696	264	N/O	N/O	53,878	43,815
Apr	<b>Maximum</b>	N/O	134	3,999	N/O	2,848	1,088	138	989	7,422	1,677	N/O	N/O	2,248	2,170
	<b>Average</b>	N/O	5	3,979	N/O	2,716	1,067	5	983	3,681	1,288	N/O	N/O	1,826	1,173
	<b>Total</b>	N/O	152	119,364	N/O	81,468	32,020	138	29,478	110,420	38,638	N/O	N/O	54,785	35,180
May	<b>Maximum</b>	N/O	0	4,085	N/O	2,849	1,166	4,563	980	9,046	1,709	N/O	N/O	2,248	2,152

Annual and Summary Report

Month	Facility	Clythe Well	Dean Well	Downey Well	Edinburgh Well	Emma Street Well	Helmar Well	Membro Well	Paisley Well	Park Wells #1 and #2	Queensdale Well	Sacco Well	Smallfield Well	University of Guelph Well	Water Street Well
	Units	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3
	Regulatory Limit	N/O	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
May	<b>Average</b>	N/O	0	4,027	N/O	2,586	881	1,817	975	5,437	1,634	N/O	N/O	585	1,547
	<b>Total</b>	N/O	0	124,834	N/O	80,156	27,305	56,342	30,225	168,534	50,667	N/O	N/O	18,148	47,969
Jun	<b>Maximum</b>	N/O	0	4,067	N/O	2,735	978	4,430	974	8,867	1,665	N/O	N/O	52	2,056
	<b>Average</b>	N/O	0	4,035	N/O	2,648	908	2,288	966	4,467	1,300	N/O	N/O	2	1,942
	<b>Total</b>	N/O	0	121,047	N/O	79,433	27,230	68,631	28,973	134,018	39,007	N/O	N/O	52	58,255
Jul	<b>Maximum</b>	N/O	122	4,790	N/O	2,779	983	0	970	7,885	1,065	N/O	N/O	2,182	2,184
	<b>Average</b>	N/O	4	4,663	N/O	2,633	614	0	931	3,094	776	N/O	N/O	1,398	1,243
	<b>Total</b>	N/O	122	144,563	N/O	81,618	19,021	0	28,868	95,928	24,042	N/O	N/O	43,343	38,523
Aug	<b>Maximum</b>	N/O	0	4,797	N/O	2,815	940	281	960	4,974	0	N/O	N/O	2,052	2,194
	<b>Average</b>	N/O	0	4,747	N/O	2,712	81	23	865	2,464	0	N/O	N/O	1,750	1,029
	<b>Total</b>	N/O	0	147,148	N/O	84,057	2,497	699	26,824	76,390	0	N/O	N/O	54,262	31,908
Sept	<b>Maximum</b>	N/O	0	4,793	N/O	2,752	1,129	3,571	957	6,673	99	N/O	N/O	2,031	2,152
	<b>Average</b>	N/O	0	4,740	N/O	2,678	876	1,912	952	2,681	5	N/O	N/O	1,487	841
	<b>Total</b>	N/O	0	142,190	N/O	80,335	26,281	57,362	28,559	80,424	161	N/O	N/O	44,612	25,243

Month	Facility	Clythe Well	Dean Well	Downey Well	Edinburgh Well	Emma Street Well	Helmar Well	Membro Well	Paisley Well	Park Wells #1 and #2	Queensdale Well	Sacco Well	Smallfield Well	University of Guelph Well	Water Street Well
	Units	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3
	Regulatory Limit	N/O	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
Oct	Maximum	N/O	0	4,751	N/O	2,699	1,126	3,487	947	9,555	1,453	N/O	N/O	1,940	2,006
	Average	N/O	0	4,678	N/O	2,424	895	2,379	938	3,195	1,133	N/O	N/O	1,265	392
	Total	N/O	0	145,016	N/O	75,129	27,758	73,734	29,073	99,049	35,133	N/O	N/O	39,221	12,156
Nov	Maximum	N/O	0	4,703	N/O	2,630	1,181	3,213	974	4,708	1,254	N/O	N/O	1,760	1,962
	Average	N/O	0	4,618	N/O	2,403	985	2,552	926	2,003	1,187	N/O	N/O	1,488	776
	Total	N/O	0	138,548	N/O	72,102	29,533	76,553	27,767	60,102	35,602	N/O	N/O	44,654	23,282
Dec	Maximum	N/O	0	4,762	N/O	2,519	1,126	3,052	931	3,267	1,262	N/O	N/O	2,114	1,878
	Average	N/O	0	4,642	N/O	2,460	1,083	3,009	919	1,255	1,179	N/O	N/O	1,088	465
	Total	N/O	0	143,893	N/O	76,253	33,564	93,271	28,480	38,908	36,541	N/O	N/O	33,739	14,429
2016 Year	Maximum	N/O	134	4,856	N/O	2,891	1,181	4,563	1,015	9,555	1,709	N/O	N/O	2,256	2,765
	Average	N/O	1	4,369	N/O	2,458	858	1,165	926	3,520	859	N/O	N/O	1,354	1,106
	Total	N/O	276	1,599,275	N/O	901,696	313,463	426,729	338,759	1,285,695	312,989	N/O	N/O	495,182	404,120
	Average Pumped	N/O	0%	84%	N/O	80%	26%	19%	29%	34%	16%	N/O	n/O	41%	33%

Table 34: Instantaneous Flows Summary (PTTW) – Jan. 1 – Dec. 31, 2016

Month	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 Spring Collector System	Burke Well	Calico Well	Carter Wells #1 and #2
	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
	Regulatory Limit	n/a	37.9	111.0	111.0	111.0	111.0	111.0	n/a	157.8	290.0	83.7	60.6	90.9
Jan	Maximum	N/O	12.8	86.4	85.1	78.8	88.2	82.1	420.7	0.0	57.4	64.8	13.4	71.1
	Average	N/O	0.2	65.9	71.7	16.2	32.0	64.7	250.4	0.0	54.7	36.3	9.2	68.7
Feb	Maximum	N/O	12.6	86.7	85.2	77.9	88.3	80.8	418.9	0.0	61.0	68.4	13.3	71.1
	Average	N/O	0.2	56.0	82.3	5.6	31.5	77.1	252.6	0.0	57.0	39.7	9.0	69.9
Mar	Maximum	N/O	12.5	102.4	86.7	79.8	89.0	84.3	442.3	0.0	72.9	71.6	13.4	70.2
	Average	N/O	0.0	53.6	82.9	20.4	28.9	56.5	242.4	0.0	61.8	42.8	8.7	62.2
Apr	Maximum	N/O	12.9	85.6	87.2	93.7	91.3	85.9	443.8	0.0	125.8	70.9	13.2	60.5
	Average	N/O	0.3	39.3	81.8	12.2	33.4	55.1	221.8	0.0	102.3	41.2	9.2	41.6
May	Maximum	N/O	13.0	85.3	86.0	84.8	89.7	87.4	433.2	0.0	119.7	75.0	13.2	60.4
	Average	N/O	0.5	22.5	83.6	4.0	24.0	61.2	195.2	0.0	114.7	38.9	9.1	54.6
Jun	Maximum	N/O	12.7	84.5	85.1	78.3	89.0	86.0	422.9	0.0	115.3	68.0	13.8	59.8
	Average	N/O	0.4	49.0	81.6	11.1	39.4	65.1	246.2	0.0	108.8	44.7	9.6	11.1
Jul	Maximum	N/O	12.5	84.6	85.1	78.2	88.2	86.3	422.4	0.0	105.1	66.1	12.6	55.4

Month	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 Spring Collector System	Burke Well	Calico Well	Carter Wells #1 and #2
	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
	Regulatory Limit	n/a	37.9	111.0	111.0	111.0	111.0	111.0	n/a	157.8	290.0	83.7	60.6	90.9
Jul	Average	N/O	0.3	48.7	82.0	5.1	22.6	62.2	220.6	0.0	96.4	43.7	10.6	4.4
Aug	Maximum	N/O	12.4	84.4	84.5	79.2	88.3	85.0	421.5	0.0	95.7	72.4	12.5	0.0
	Average	N/O	0.6	58.2	78.7	10.3	52.1	38.5	237.9	0.0	85.3	43.4	10.6	0.0
Sept	Maximum	N/O	11.5	84.5	85.3	78.5	87.0	84.4	419.6	119.1	82.6	66.3	12.6	56.0
	Average	N/O	0.1	55.3	62.6	8.0	54.4	46.4	226.7	0.0	75.7	39.9	10.0	0.0
Oct	Maximum	N/O	12.6	84.9	85.2	79.7	88.9	86.0	424.7	0.0	70.2	73.8	15.7	0.0
	Average	N/O	0.3	42.5	52.3	8.3	64.4	25.5	193.0	0.0	66.1	40.4	10.0	0.0
Nov	Maximum	N/O	10.4	85.5	85.0	80.5	89.1	85.9	426.1	0.0	65.4	66.4	12.7	0.0
	Average	N/O	0.3	47.6	6.2	24.7	82.2	42.3	203.0	0.0	61.2	35.8	9.7	0.0
Dec	Maximum	N/O	12.6	85.8	87.3	80.7	89.5	87.2	430.6	0.0	70.0	66.9	18.9	0.0
	Average	N/O	0.3	46.1	54.2	5.6	73.9	19.6	199.4	0.0	56.7	33.3	8.3	0.0

Table 35: Instantaneous Flows Summary (PTTW) – Jan. 1 – Dec. 31, 2016 continued

Month	Facility	Clythe Well	Dean Well	Downey Well	Edinburgh Well	Emma Street Well	Helmar Well	Membro Well	Paisley Well	Park Wells	Queensdale Well	Sacco Well	Smallfield Well	University of Guelph Well	Water Street 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	n/a	39.9	90.9	n/a	40.9	37.9	105.0	42.0	127.2	60.6	n/a	n/a	57.3	59.0
Jan	Maximum	0.0	0.0	58.0	N/O	30.0	15.0	0.0	12.5	109.9	37.1	N/O	N/O	27.0	35.2
	Average	0.0	0.0	46.9	N/O	28.0	10.4	0.0	8.7	43.0	5.0	N/O	N/O	20.2	13.6
Feb	Maximum	0.0	0.0	61.4	N/O	29.3	14.7	0.0	12.9	114.6	50.0	N/O	N/O	26.9	34.8
	Average	0.0	0.0	50.2	N/O	13.8	11.0	0.0	11.2	62.8	15.9	N/O	N/O	21.6	14.6
Mar	Maximum	0.0	0.0	51.9	N/O	33.9	14.5	0.0	12.6	117.1	21.2	N/O	N/O	27.0	41.2
	Average	0.0	0.0	47.0	N/O	30.3	12.5	0.0	10.7	55.1	0.1	N/O	N/O	20.1	16.4
Apr	Maximum	0.0	21.0	49.3	N/O	34.3	14.7	33.3	12.3	122.3	20.9	N/O	N/O	27.0	32.6
	Average	0.0	0.1	46.7	N/O	31.3	12.5	0.1	11.4	42.6	15.0	N/O	N/O	21.1	13.6
May	Maximum	0.0	0.0	56.2	N/O	33.8	15.1	58.6	11.9	122.8	21.6	N/O	N/O	27.1	38.9
	Average	0.0	0.0	47.2	N/O	30.0	10.3	10.9	11.3	62.9	18.9	N/O	N/O	6.8	17.9
Jun	Maximum	0.0	0.0	49.6	N/O	32.4	14.7	52.2	12.6	118.6	20.6	N/O	N/O	26.3	38.5
	Average	0.0	0.0	47.4	N/O	30.6	10.6	26.9	11.4	26.8	15.2	N/O	N/O	0.0	22.5
Jul	Maximum	0.0	19.7	58.4	N/O	33.3	15.2	0.0	12.5	118.0	15.2	N/O	N/O	31.7	33.9



Month	Facility	Clythe Well	Dean Well	Downey Well	Edinburgh Well	Emma Street Well	Helmar Well	Membro Well	Paisley Well	Park Wells	Queensdale Well	Sacco Well	Smallfield Well	University of Guelph Well	Water Street 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	n/a	39.9	90.9	n/a	40.9	37.9	105.0	42.0	127.2	60.6	n/a	n/a	57.3	59.0
Jul	Average	0.0	0.0	54.7	N/O	30.5	7.2	0.0	10.8	35.8	9.0	N/O	N/O	16.2	14.4
Aug	Maximum	0.0	0.0	60.0	N/O	33.8	21.9	56.0	11.3	118.0	0.0	N/O	N/O	24.6	33.7
	Average	0.0	0.0	55.7	N/O	31.6	0.9	0.3	10.0	28.6	0.0	N/O	N/O	20.3	11.9
Sept	Maximum	0.0	0.0	57.6	N/O	33.6	22.0	57.3	11.2	121.2	23.9	N/O	N/O	24.5	39.4
	Average	0.0	0.0	55.7	N/O	31.2	10.2	21.7	11.0	31.0	0.1	N/O	N/O	17.2	9.7
Oct	Maximum	0.0	0.0	58.1	N/O	31.5	15.3	49.8	11.7	121.7	20.4	N/O	N/O	26.0	33.0
	Average	0.0	0.0	54.9	N/O	28.1	10.5	27.5	10.8	37.0	13.1	N/O	N/O	14.6	4.5
Nov	Maximum	0.0	0.0	63.4	N/O	30.4	20.1	44.5	11.7	121.7	16.1	N/O	N/O	25.5	39.8
	Average	0.0	0.0	54.2	N/O	27.8	11.5	29.5	10.7	25.1	13.7	N/O	N/O	17.2	9.0
Dec	Maximum	0.0	0.0	58.7	N/O	29.3	15.7	41.9	12.1	117.9	15.5	N/O	N/O	25.6	40.2
	Average	0.0	0.0	54.4	N/O	28.4	12.6	34.8	10.6	14.5	13.6	N/O	N/O	12.5	5.3

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## Appendix "E" – Treated Water Quality Statistics

Table 36: O. Reg. 170/03 Schedule 23, 13-2b – "Three Year" Results Summary (Jan. 01 to Dec. 31, 2016)

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

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**Table 37: O. Reg. 170/03 Schedule 24, 13-4b – “Three Year” Results Summary (Jan. 01 to Dec. 31, 2016)**

Parameter	ODWQS MAC mg/L	½ MAC mg/L	Total Sample s	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

Parameter	ODWQS MAC mg/L	½ MAC mg/L	Total Sample s	Samples Above MDL	# Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
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
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

Parameter	ODWQS MAC mg/L	½ MAC mg/L	Total Sample s	Samples Above MDL	# Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
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
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

Parameter	ODWQS MAC mg/L	½ MAC mg/L	Total Sample s	Samples Above MDL	# Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
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
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

Parameter	ODWQS MAC mg/L	½ MAC mg/L	Total Sample s	Samples Above MDL	# Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
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

**Table 38: Operational VOC Scan Results Summary (Jan. 01 to Dec. 31, 2016)**

Parameter	ODWQS MAC mg/L	½ MAC mg/L	Total Sample s	Samples Above MDL	# Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
1,1-Dichloroethane	n/a	n/a	152	0	n/a	< 0.0001	< 0.0001	n/a
1,1-Dichloroethylene	0.014	0.007	169	0	0	< 0.0001	< 0.0001	n/a
1,1,1-Trichloroethane	n/a	n/a	152	0	n/a	< 0.0001	0.00018	n/a
1,1,2-Trichloroethane	n/a	n/a	152	0	n/a	< 0.0002	< 0.0002	n/a

Parameter	ODWQS MAC mg/L	½ MAC mg/L	Total Sample s	Samples Above MDL	# Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
1,1,2,2-Tetrachloroethane	n/a	n/a	152	0	n/a	< 0.0001	< 0.0001	n/a
Ethylene Dibromide	n/a	n/a	152	0	n/a	< 0.0002	< 0.0002	n/a
1,2-Dichlorobenzene	0.2	0.1	169	0	0	< 0.0002	< 0.0002	n/a
Cis-1,2-Dichloroethylene	n/a	n/a	152	62	n/a	< 0.0001	0.00423	0.00154 6
Trans-1,2-Dichloroethylene	n/a	n/a	152	1	n/a	< 0.0001	0.00011	0.00011
1,2-Dichloropropane	n/a	n/a	152	0	n/a	< 0.0001	< 0.0001	n/a
1,3-Dichlorobenzene	n/a	n/a	152	0	n/a	< 0.0002	< 0.0002	n/a
1,4-Dichlorobenzene	0.005	0.0025	169	0	0	< 0.0002	< 0.0002	n/a
Acetone	n/a	n/a	152	0	n/a	< 0.01	< 0.01	n/a
Benzene	0.005	0.0025	169	0	0	< 0.0001	< 0.0001	n/a



Parameter	ODWQS MAC mg/L	½ MAC mg/L	Total Sample s	Samples Above MDL	# Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Bromodichloromethane	0.1	0.05	159	53	0	< 0.0001	0.0271	0.004969
Bromoform	0.1	0.05	159	51	0	< 0.0002	0.00440	0.001550
Carbon Tetrachloride	0.005	0.0025	169	0	0	< 0.0001	< 0.0001	n/a
Chloroethane	n/a	n/a	152	0	n/a	< 0.0002	< 0.0002	n/a
Chloroform	0.1	0.05	159	84	0	< 0.0001	0.0331	0.002670
Dibromochloromethane	0.1	0.05	159	55	0	< 0.0002	0.0140	0.005248
Dichloromethane	0.05	0.025	169	0	0	< 0.0005	< 0.0005	n/a
Ethylbenzene	0.0024	n/a	152	0	0	< 0.0001	< 0.0001	n/a
Methyl Ethyl Ketone	n/a	n/a	152	0	n/a	< 0.0005	< 0.0005	n/a

Parameter	ODWQS MAC mg/L	½ MAC mg/L	Total Sample s	Samples Above MDL	# Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Styrene	n/a	n/a	152	0	n/a	< 0.0002	< 0.0002	n/a
Tetrachloroethylene (perchloroethylene)	0.03	0.015	169	2	0	< 0.0001	0.00011	0.00011
Tolulene	0.024	n/a	169	0	0	< 0.0002	< 0.0002	n/a
Trichloroethylene	0.005	0.0025	169	63	0	< 0.0001	0.00167	0.00055
Trichlorofluoromethane	n/a	n/a	152	0	0	< 0.0002	< 0.0002	n/a
Vinyl Chloride	n/a	n/a	169	0	0	< 0.0002	< 0.0002	n/a
o-Xylene	n/a	n/a	152	0	0	< 0.0001	< 0.0001	n/a
m- + p- Xylene	n/a	n/a	152	1	0	< 0.0001	0.00016	0.00016
Total Xylene	0.3	n/a	152	1	0	<0.0001	0.00016	0.00016
Trihalomethanes	0.100	n/a	159	63	0	< 0.0002	0.0739	0.01352

**Table 39: General Chemistry Results Summary (Jan. 01 to Dec. 31, 2016)**

Parameter	ODWQS MAC	ODWQS AO	ODWQS OG	Total Sample s	Sample s Above MDL	# Above Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Aluminum	n/a	n/a	0.1	26	2	0	< 0.005	0.011	n/a
Alkalinity (as CaCO <sub>3</sub> )	n/a	n/a	30-500	13	13	0	250	340	292.3
Ammonia-N	n/a	n/a	n/a	13	0	n/a	< 0.05	< 0.05	n/a
Anion Sum	n/a	n/a	n/a	13	13	n/a	7.85 <sup>24</sup>	15.524	11.71424
Antimony	0.014	n/a	n/a	26	10	0	< 0.0005	0.0013	0.00085
Arsenic	0.025	n/a	n/a	26	6	0	< 0.001	0.0033	0.0022
Barium	1.0	n/a	n/a	26	26	0	0.035	0.096	0.066
Beryllium	n/a	n/a	n/a	26	0	n/a	<0.0005	<0.0005	n/a
Boron	5.0	n/a	n/a	26	26	0	0.013	0.048	0.030

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24 Units in mEq/L

Parameter	ODWQS MAC	ODWQS AO	ODWQS OG	Total Sample s	Sample s Above MDL	# Above Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Cadmium	0.005	n/a	n/a	26	6	0	< 0.0001	0.00016	0.00013
Calcium	n/a	n/a	n/a	26	26	n/a	93	160	117.538
Cation Sum	n/a	n/a	n/a	13	13	n/a	8.3924	16.024	12.13824
Chloride	n/a	250	n/a	13	13	0	41	240	130.154
Chromium	0.05	n/a	n/a	26	0	0	< 0.005	< 0.005	n/a
Cobalt	n/a	n/a	n/a	26	12	n/a	< 0.0005	.011	.00221
Copper	n/a	1	n/a	26	17	0	< 0.001	0.053	0.0062
Dissolved Organic Carbon (DOC)	n/a	5	n/a	29	29	0	0.62	2.4	1.150
1,4 Dioxane	n/a	n/a	n/a	7	0	n/a	<0.0001	<0.0001	n/a

Parameter	ODWQS MAC	ODWQS AO	ODWQS OG	Total Samples	Samples Above MDL	# Above Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Hardness (Calculated as CaCO <sub>3</sub> )	n/a	n/a	80-100	13	13	13	360	550	442.3
Ion Balance (% difference)	n/a	n/a	n/a	13	13	n/a	0.94 <sup>25</sup>	3.3325	1.78825
<u>Iron</u>	n/a	0.3	n/a	26	9	5	< 0.1	0.65	0.321
Langalier's Index at 4°C	n/a	n/a	n/a	13	13	n/a	0.537 <sup>26</sup>	8.4426	0.70226
Langalier's Index at 20°C	n/a	n/a	n/a	13	13	n/a	0.78526	1.0926	0.94826
Lead	0.01	n/a	n/a	26	6	0	<0.0005	0.0020	0.00114
Magnesium	n/a	n/a	n/a	26	26	n/a	27	48	37.5

25 Units in %

26 Units in Langalier's Index

Parameter	ODWQS MAC	ODWQS AO	ODWQS OG	Total Sample s	Sample s Above MDL	# Above Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Manganese	n/a	0.05	n/a	26	22	1	<0.002	0.066	0.0176
Molybdenum	n/a	n/a	n/a	26	25	n/a	<0.0005	0.0043	0.0020
Nickel	n/a	n/a	n/a	26	21	n/a	<0.001	0.024	0.006052
o-Phosphate	n/a	n/a	n/a	13	10	n/a	<0.01	0.013	0.011
pH	n/a	n/a	6.5-8.5	13	13	0	7.64	8.07	7.923
Phosphorus	n/a	n/a	n/a	26	0	n/a	<0.1	<0.1	n/a
Potassium	n/a	n/a	n/a	26	26	n/a	1.5	3.4	2.142
Saturation pH at 4°C	n/a	n/a	n/a	13	13	n/a	7.11	7.31	7.222
Saturation pH at 20°C	n/a	n/a	n/a	13	13	n/a	6.86	7.07	6.975
Selenium	0.01	n/a	n/a	26	0	0	<0.002	< 0.002	n/a
Silicon	n/a	n/a	n/a	26	26	n/a	3.4	9.3	5.665

Parameter	ODWQS MAC	ODWQS AO	ODWQS OG	Total Sample s	Sample s Above MDL	# Above Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Silver	n/a	n/a	n/a	26	0	n/a	<0.0001	<0.0001	n/a
Sodium	n/a	20 and 200	n/a	27	27	27	24	150	73.6
Strontium	n/a	n/a	n/a	26	26	n/a	0.41	5.40	2.470
Sulphate	n/a	550	n/a	13	13	0	49	240	103.615
Thallium	n/a	n/a	n/a	26	10	n/a	<0.0000 5	0.00025	0.000088
Titanium	n/a	n/a	n/a	26	0	n/a	<0.005	<0.005	n/a
Total Dissolved Solids	n/a	n/a	n/a	13	13	n/a	430	880	654.6
Uranium	0.02	n/a	n/a	26	24	0	<0.0001	0.0024	0.00124
Vanadium	n/a	n/a	n/a	25	0	n/a	<0.0005	<0.0005	n/a
Zinc	n/a	5	n/a	26	24	0	<0.005	0.19	0.0783

## Appendix “F” – Legal and Other Requirements Update

**Table 40: Legal and Other Requirements Update**

Date - 2016	Source of Posting / Reference	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Effective Jan. 1	EBR	<p><u>Regulatory Amendments to Update Ontario Drinking Water Quality Standards, and Testing and Reporting Requirements</u> – changes include:</p> <p>The addition of MCPA sampling (added to Schedule 24 and therefore simply an addition to the Schedule 24 bottle set which Maxxam will look after). There is also 13 Pesticide analysis being removed from Schedule 24 so the total number of sample bottles may even be less. This sampling takes place annually at Woods’ (GUDIWEF) and every three years at all other treated sources (groundwater).</p> <p>The addition of HAA sampling every 3 months. Sampling will take place at the same locations where TTHM sampling occurs, at the same frequency and using the same methodology. The next 3 Month event is scheduled for the week of January 18th – 22nd</p> <p>Also, the existing standards for carbon tetrachloride; benzene and vinyl chloride are being lowered but this doesn’t take effect until January 1, 2017 and for arsenic, January 1, 2018.</p>	<p>Compliance Coordinator forwarded the summary of changes to Water Supply staff.</p> <p>Water Supply Technician updated related Chains of Custody, Compliance Records and 3-month bottle order from lab. She also updated the ½ MAC Alert in WaterTrax.</p>



Date - 2016	Source of Posting / Reference	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Feb. 8	MOECC e-mail	<p>Visit the new <a href="#">Source Water Protection Map</a> now available on Ontario.ca.</p> <p>This interactive map provides the first provincial view of the more than 970 wellhead protection areas and 150 intake protection zones within the source protection areas in Ontario. You can access over 20 layers of information every time you do a customised search.</p> <p>For the first time, the public will be able to see the wellhead protection areas and intake protection zones of the lakes, rivers and aquifers that supply their drinking water. This tool provides them with information needed to make informed property-based decisions. As well, this tool will help ministries and other agencies implement source protection plan policies.</p> <p>A link to the map can be found in the updated <a href="#">General Messages page</a> of the Source Water Protection Resource Catalogue available on Conservation Ontario's website.</p> <p>Assist us in promoting the <a href="#">map</a> and <a href="#">catalogue page</a> by posting links on your respective websites and on your social media platform such as Facebook and Twitter.</p>	No action required.

Date - 2016	Source of Posting / Reference	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Feb. 26	OMWA newswire	<p><u>Canadian disaster relief to cost \$900M a year over next 5 years, new PBO report says</u> – Storms, hurricanes and floods driven in part by climate change will cost the federal disaster fund \$902 million a year over the next five years, well above past averages, the parliamentary budget officer predicted Thursday. The average cost to the federal disaster fund has risen from \$54 million a year (in adjusted 2014 dollars) for the 1970-94 period to \$291 million between 1995 and 2004 and \$410 million between 2005 and 2014.</p>	No action required.
Mar. 10	Willms & Shier e-mail	<p>The Ministry of the Environment and Climate Change has posted the Proposed Excess Soil Management Policy Framework on the Environmental Registry for review and comment. The Framework seeks to address gaps in the management of excess soil, including issues raised since the MOECC introduced Management of Excess Soil – A Guide for Best management Practices in January 2014. Click <a href="#">here</a> to read the full article.</p>	Engineering staff (Prasoon Adhikari) made a submission to the MOECC on behalf of the City of Guelph before the March 25 deadline.

Date - 2016	Source of Posting / Reference	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Mar. 21	MOECC e-mail	<p>Keep your eyes open for the new Drinking Water Protection Zone signs!</p> <p>They are appearing across Ontario to protect public health and raise awareness of the sensitivity of our drinking water sources.</p> <p>More information is available in the Drinking Water Protection Zone Road Signs catalogue page in the Source Water Protection Education and Outreach catalogue on Conservation Ontario's website.</p> <p>A page on <u>Water Conservation</u> has also been posted. It helps homeowners and businesses understand their water use and gives tips on how to use less.</p> <p>We encourage you to view the new catalogue pages and promote them through social media at #SourceWaterON.</p>	No action required.
Mar. 23	OMWA newswire	<p><u>Ontario Moves to Track Water Usage in Large Buildings</u></p> <p>Ontario is pushing to get to large building owners measure and track water usage. The Ontario Ministry of Energy has made a proposal that requires large building owners to collect and submit data on their building's water and energy usage each year.</p>	No action required.

Date - 2016	Source of Posting / Reference	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Apr. 5	<u>EBR</u>	<p><u>Regulations prescribing certain short term water takings as EASR activities</u> – MOECC posted a discussion paper on the Environmental Activity and Sector Registry and Short-Term Water Takings on March 6, 2015. On November 20, 2015 the ministry posted a proposal for a regulation under the Environmental Protection Act that would prescribe the following activities for the purposes of section 20.21 of the Act – the Environmental Activity and Sector Registry (EASR):</p> <p>Water takings for Construction Site Dewatering</p> <p>Water takings for Road Construction Purposes</p> <p>A decision has been made to prescribe the two activities noted above for the purposes of subsection 20.21 (1) of the Act. The new EASR regulation made under the Environmental Protection Act is O. Reg. 63/16 Registrations Under Part II.2 of the Act –Water Takings.</p>	Forwarded information to Water Services' Manager of Technical Services and Project Manager.
Apr. 5	NSERC e-mail	<p><u>Flint Water Advisory Task Force's final report</u> is now available online at no cost. The task force arrived at 36 findings and has provided 42 recommendations for a variety of agencies/governing bodies.</p> <p>Here are links to the <u>Walkerton</u> and <u>North Battleford</u> inquiries if interested in comparing these to the Flint Water Advisory Task Force findings.</p>	Plant Manager forwarded the e-mail to Top Management, Technicians and Coordinators.

Date - 2016	Source of Posting / Reference	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Apr. 14	MOHLTC Letter (Jan. 7)	<p><u>Information on Fluoride and Guelph Tap Water</u>  - ...recent correspondence from the Provincial Minister of Health requests that municipalities doing so continue to add fluoride to their municipal water supplies to support the dental health of customers.</p> <p>Over the history of Guelph Water Services, fluoride has not been added to the municipal water system. In 1972, the community rejected a proposal for the addition of fluoride to Guelph tap water through a plebiscite that was defeated by 77% of voters.</p> <p>In the absence of direction from either Wellington-Dufferin-Guelph Public Health or the Province on this health issue, staff is not considering the addition of fluoride to Guelph's tap water at this time...</p>	Plant Manager prepared a Memo dated Apr. 14 to Guelph City Council re: Fluoride in Guelph.

Date - 2016	Source of Posting / Reference	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Apr. 16	<u>Ontario Gazette</u>	The Government of Ontario has filed new regulations intended to streamline the permitting process for specific types of water takings, including construction site dewatering, in-stream diversions, and road construction. Ontario Regulation 64/16 amends the existing <u>Water Taking and Transfer Regulation (O.Reg. 387/04)</u> to provide additional clarification on activities that are considered to be water takings. <u>Ontario Regulation 63/16</u> identifies specific low-risk water takings eligible for online registration through the Environmental Activity Sector Registry (EASR) system, rather than applying for a Permit to Take Water (PTTW) from the Ontario Ministry of the Environment and Climate Change (MOECC).	Gazette printing of earlier information posted on EBR on Apr. 5. No further action required.
Apr. 20	OMWA newswire	<u>Government officials: 3 to be charged in Flint water crisis</u> – The charges — the first levied in a probe that is expected to broaden — will be filed against a pair of state Department of Environmental Quality officials and a local water treatment plant supervisor, two officials told The Associated Press late Tuesday. They spoke on the condition of anonymity because they were not authorized to discuss the investigation publicly.	QA Coordinator forwarded to Top Management. No other action required.

Date - 2016	Source of Posting / Reference	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
May 1	Water Services e-mails	<p><u>MOECC Watermain Disinfection Procedure</u> implemented at the City of Guelph. Water Services' Supervisor of Distribution e-mailed (May 1) all impacted Engineering and Water Services staff regarding a summary of changes. The Compliance Coordinator also e-mailed with the updated "QMS 12-05 Alterations to the DWS and Related DWWP and MDWL Amendments" document.</p>	No further action required.
May 30	Guelph news	<p><u>Council appoints risk management staff to protect Guelph's drinking water</u> - Source water protection policies take effect July 1. Council has officially appointed Guelph's Risk Management Official (RMO) and Risk Management Inspector (RMI). These position appointments will ensure Guelph continues to deliver safe, reliable drinking water.</p> <p>Council appointed Peter Rider, registered Professional Geoscientist, as the City's RMO, and Prasoon Adhikari, registered Professional Engineer and the City's Environmental Engineer, as RMI. RMOs and RMIs have the authority under the Clean Water Act to implement and enforce Source Protection Plan (SPP) policies that protect local drinking water sources.</p>	No further action required.

Date - 2016	Source of Posting / Reference	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Jun. 2	MOECC e-mail	<p>The <u>2016 Spring Operator Certification Bulletin</u> has just been launched. Some highlights include:</p> <p>Ontario's Water and Wastewater Certification Program receives North American awards</p> <p>MOECC's new watermain disinfection procedure and implications to operators and system owners</p> <p>Changes to Ontario's Drinking Water Quality Standards, testing and reporting requirements</p> <p>OWWCO's new and improved website and Director approved course listing</p> <p>New easy-to-use 'smart' program forms coming in July 2016</p> <p>...and more.</p> <p>Operator bulletins are posted on the program administrator's website at <a href="http://www.owwco.ca">www.owwco.ca</a>.</p>	No action required.



Date - 2016	Source of Posting / Reference	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Jun. 2	MOECC e-mail	<p>Clarification on <u>Watermain Disinfection Procedure</u></p> <p>We have received several inquiries regarding the effective date that drinking water system owners will have to implement the new Watermain Disinfection Procedure.</p> <p>As stated in our email of December 8, 2015, your Drinking Water Works Permit (DWWP) will be revised to reflect the requirements outlined in the Watermain Disinfection Procedure. You will be required to implement the Watermain Disinfection Procedure prior to the date listed in condition 2.3.2 of your DWWP.</p> <p>If your DWWP does not already include a condition that references the Watermain Disinfection Procedure, your permit will be updated in the near future to include this information (and your required implementation date).</p> <p>If you have any further questions regarding the document, or its implementation for compliance with your DWWP, please feel free to contact me.</p> <p>Aziz S. Ahmed, P.Eng., Director, Part V, SDWA</p> <p>Tel: 416.314.4625   Fax: 416.314.1037   *: Aziz.Ahmed@ontario.ca</p>	No action required. Guelph Water Services chose to implement the Watermain Disinfection Procedure on May 1, 2016.

Date - 2016	Source of Posting / Reference	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Jun. 6	Guelph news	<p><u>City move Outside Water Use to Level 1 Yellow</u> - Enforced watering restrictions now in effect - Due to local weather conditions, the City of Guelph is moving to Level 1 Yellow watering restrictions under the Outside Water Use Program effective immediately.</p>	No further action required.
Jun. 29	Guelph news	<p><u>Policies to safeguard Guelph's drinking water take effect July 1</u> - City to work with landowners, businesses, developers to ensure compliance. The City's 72 Source Water Protection policies come into effect Friday. The provincially-legislated policies are part of the Lake Erie Source Protection Region's Source Protection Plan designed to identify and manage threats to Guelph's municipal drinking water.</p>	No further action required.
Jul. 5	Guelph news	<p><u>City moves Outside Water Use to Level 2 Red</u> - Due to local weather conditions, the City of Guelph is moving to Level 2 Red watering restrictions under the Outside Water Use Program, effective immediately.</p> <p>At Level 2 Red, residents and businesses are asked to reduce and stop nonessential water use, such as lawn watering and at-home vehicle washing.</p>	No further action required.

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<b>Date - 2016</b>	<b>Source of Posting / Reference</b>	<b>Title of Legal &amp; Other Requirement Highlights of posting</b>	<b>Action and Status Update</b>
Jul. 13	MOECC e-mail	<u>Review of the Environmental Bill of Rights – A Provincial Dialogue</u> - The purpose of this notice is to inform the public of the Ministry of the Environment and Climate Change's review of components of the Environmental Bill of Rights and to seek public feedback.	No further action required.
Jul. 20	MOECC	<u>Link to Watermain Disinfection Procedure Document on MOECC Website</u>	No further action required.

Date - 2016	Source of Posting / Reference	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Aug. 23	MOECC e-mail	<p>Changes Proposed to Ontario's Drinking Water Regulations – The The Ministry of the Environment and Climate Change is proposing amendments to:</p> <p>O. Reg. 169/03 Ontario's Drinking Water Quality Standards and the Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines;</p> <p>O. Reg. 170/03 Drinking Water Systems;</p> <p>O. Reg. 243/07 Schools, Private Schools and Day Nurseries;</p> <p>O. Reg. 248/03 Drinking Water Testing Services; and</p> <p>O. Reg. 128/04 Certification of Drinking Water System Operators and Water Quality Analysts.</p> <p>Provide your input on the proposed amendments to Ontario's drinking water regulations by October 7, 2016. View the full proposal and provide your feedback on the <a href="#">Environmental Registry</a> (#012-8244).</p>	<p>Water Services' Compliance Coordinator assessed the impact of the proposed changes by reviewing analytical results for all chemicals from 2010 to present. This review has confirmed that none of the proposed standards are expected to be an issue.</p> <p>WaterTrax alerts were updated for January 1, 2017 implementation.</p> <p>No further action required.</p>

Date - 2016	Source of Posting / Reference	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Oct. 21	MOECC e-mail	<p><u>Ontario Proposes Two Year Moratorium on New and Expanded Water Bottling Operations</u> - Ontario is taking action to protect the province's water resources for future generations by proposing a two-year moratorium on new or expanded water takings from groundwater by bottling companies, as well as stricter rules for renewals of existing permits.</p>	City of Guelph submission to the MOECC was made on Nov. 30 via e-mail and via the EBR Registry 012-8783.
Nov. 2	Guelph news	<p>Outside water use moves down to Level 1 Yellow as season ends - the City is reducing outside water use restrictions to <u>Level 1 Yellow</u> as the season ends. That means time and date lawn watering restrictions remain in effect until the situation is reassessed next spring.</p>	No further action required.
Nov. 16	OMWA newswire	<p><u>Ontario Environment Commissioner Released Report on Stormwater Pricing</u> The Environment Commissioner of Ontario (ECO) has released a report today noting that Ontario's municipalities face a \$6.8 billion deficit to fix existing stormwater infrastructure and to accommodate future growth. This financial gap could get even bigger as municipalities deal with larger flows and more polluted runoff, as landscapes are paved over to meet growth pressures.</p>	

Date - 2016	Source of Posting / Reference	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Nov. 28	MOECC e-mail	Notice of Release of the Chief Drinking Water Inspector's Annual Report 2015-2016 - the Ministry of the Environment and Climate Change released the <u>Chief Drinking Water Inspector's Annual Report 2015-2016</u> .	No further action required.
Dec. 2	EBR	<u>Bottled Water Technical Guidance Document</u> - MOECC has proposed a regulation (EBR Registry Number <u>012-8783</u> ) that would establish a moratorium on the issuance of new or increasing permits for water bottling by prohibiting a person from using groundwater for the purpose of manufacturing bottled water or manufacturing water as a product that is sold in other types of portable containers. The moratorium would apply in all of Ontario and would be in effect until January 1, 2019.	Members of top management are preparing a submission.
Dec. 19	MOECC e-mail	<u>Updates To Ontario's Drinking Water Regulations</u> - Amendments to Ontario's Drinking Water Quality Standards, aesthetic objectives and regulations come into effect on July 1, 2017, with additional requirements for licensed laboratories beginning January 1, 2018.	No further action required.

Date - 2016	Source of Posting / Reference	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Dec. 21	MOECC e-mail	<p>Notice of Release of the Minister's Annual Report on Drinking Water 2016 – Please be advised that today the Ministry of the Environment and Climate Change released the <u>Minister's Annual Report on Drinking Water 2016</u>. It is available online at <a href="http://ontario.ca/drinkingwater">ontario.ca/drinkingwater</a>.</p> <p>The Minister's Annual Report on Drinking Water 2016 highlights the work Ontario is doing to protect our drinking water. This year's report includes information on the effects of climate change on our water resources and specific actions we are undertaking to address these challenges.</p>	No further action required.

## Appendix “G” Management Review Action Items

**Table 41: Management Review Action Items**

<b>Item #</b>	<b>Status</b>	<b>Description</b>
<b>1</b>	CIR #398	Check-in EDMS SOP’s for A&S Report preparation and MOECC Inspection preparation.
<b>2</b>	CIR #399 Closed 2016-09-14	With Admin. staff, explore Amanda’s ability to link to GIS mapping for customer notifications. Also would be good for emergency preparedness. Through business licensing process, e-mails (among other contact information) is collected.
<b>3</b>	CIR #400 Plan for 2017/2018	Water Services should update Water By-law to better address water use at hydrants; water theft and prevention of cross connections at hydrants.
<b>4</b>	CIR #401 Closed 2016-06-15	Consider pumpage recommendation to use Emma, Calico and Helmar only as seasonal peaking wells to save \$94,000 per year in operating costs.
<b>5</b>	CIR #402	Consider moving Paisley and University raw water sampling to 5-year sampling (with F.M. Woods, Burkes, Downey, Queensdale, Helmare and Calico) since 1,4 Dioxane has never been detected at these wells (Paisley & University)
<b>6</b>	CIR #403	Consider reducing the frequency of sampling to once per year of treated sources only for sites not located in industrial / commercial areas and where VOC’s have never been detected (prior to seeking Council approval of the VOC Management Plan).



Item #	Status	Description
7	CIR #404 Closed 2016-08-11	Consider VOC Management Plan Level 0 edits. Level 0 currently calls for raw and treated sampling at least once every 3 months for sources with TCE $\leq$ 40% of the ODWQS. This statement should be revised to $> 0\%$ and $\leq$ 40% of the ODWQS.
8	CIR #405 Closed 2016-09-14	Consider using contractor tender process to address city-side lead issues for 30-40 locations.
9	CIR #409 Closed 2017-02-01	Follow-up with an analysis of past years' Glen Collector flows (compare wet seasons vs. "normal" seasons and collector flows – any correlations?)
10	CIR #410 Closed 2016-03-02	Map locations of all bleeders / blow-offs (eventually to be included in On-Point)
11	CIR #412	Note any changes that affect data results (e.g. improving the accuracy of sample results by choosing a more representative sample location – which may change the trend of data results).
12	CIR #413 Closed 2016-02-26	Add section in the Staff Report to cover Operational Challenges (e.g. Water Supply Issues – e.g. Membro Well, Arkell #15, Carters; and Distribution System Issues – e.g. Frozen Services, Dodds Valve and related expenses; Locates Program, etc.)
13	CIR #414 Closed 2016-02-26	Add "Water Quality on Private Property" section of the annual version of this report.

Item #	Status	Description
14	CIR #415 Closed 2017-02-01	Schedule annual Water Quality Monitoring Schedule (WQMS) meeting with Water Supply Supervisors.
15	CIR #416 Closed 2016-05-01	Follow-up on implementation date of Watermain Disinfection Procedure
16	CIR #417 Closed 2016-02-26	Follow-up with Aziz at MOECC re: possible GUDI WEF designation for Arkell #15
17	CIR #418 Closed 2016-08-11	...to annual version of A&S Report the New Source Protection Compliance issue with respect to new sewer installations (if in certain wellhead protection zone).
18	CIR #421 Closed 2016-09-14	Follow-up re: the number of information / service requests from other departments.
19	CIR #423 Closed 2016-08-24	Place key document expiries in Outlook (with main and back-up people identified).
20	Completed January 2016	To Risk Assessment: Add hazardous events: aquifer cross-connections (potentially linked already to sudden changes in raw water characteristics. Add extra text?); drought, aqueduct infrastructure failure. Also consider dividing the section re: source water to be site-specific.

Item #	Status	Description
21	CIR #454 Closed 2016-08-11	Further develop documenting and tracking progress on improvement ideas (from emergency debriefs, internal/external audits, meetings, etc.)
22	CIR #503 Closed 2017-01-31	For 2016 A&S Report, add the following to the report: <ul style="list-style-type: none"> <li>- % compliance to Locates section</li> <li>- valve turning</li> <li>- hydrant repair</li> <li>- swabbing / flushing</li> <li>- service box repairs</li> </ul>
23	CIR #504 Closed 2017-01-30	For 2016 A&S Report, add SCADA section of the report, including % uptime, categories of SCADA maintenance, etc.
24	CIR #505	For 2016 A&S Report, explain water pumpages section of the report.
25	CIR #506 Closed 2017-01-31	In A&S Report, verify source of service repair stats
26	CIR #507 Closed 2016-02-05	Change text around Membro. Consider adding Dolime text.
27	CIR #508 Closed 2016-08-24	For 2016 A&S Report, review that A&S section titles to correspond with updates in DWQMS. Also review that these section titles are correct for the QMS 20-01 agenda document.

Item #	Status	Description
28	CIR #509 Closed 2016-02-05	Verify that newest OIT certificates are included in the existing numbers.
29	CIR #510 Closed 2016-04-22	Schedule Watermain Disinfection Procedure review meeting with staff so that everyone understands latest requirements by May 1st.
30	CIR #511 Closed 2016-06-07	Discuss with Certification Specialist opportunity for technical staff to obtain WQA's or other cert's.
31	CIR #512 Closed 2016-02-05	Include past two years' information for customer feedback section of A&S Report.
32	CIR #513 Closed 2016-02-05	Include link to full Frozen Services report already presented to council.
33	CIR #514 Closed 2016-04-20	Consider viability of lowering chlorine residual levels following completion of Burkes upgrade and associated infrastructure.
34	CIR #554 Closed 2017-02-01	Consider separating microbiological and chemical sampling contracts (e.g. use IDEXX at ALS, which is simpler and less potential for error). Also consider potential to carry-out this (IDEXX) methodology internally.

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Item #	Status	Description
<b>35</b>	CIR #555 Closed 2016-09-26	Invite D/CAO to next emergency test exercise with MOECC / WDGPH, and make the exercise about water supply shortfall and link distribution into exercise if possible.
<b>36</b>	CIR #556	Form 1's and Form 2's should more immediately be completed and submitted to the Compliance Coordinator.

## Appendix “H” Summary of Staff Suggestions

**Table 42: Summary of Staff Suggestions**

CIR #	Suggestion Title	Description of Staff Suggestion
475-477	Emergency Test Exercise more time for discussion	More time to discuss and more specific facts of the incident as the information unfolds. Site specific.
478-481	Emergency Test Exercise Set-up	Practice Emergency Operations Centre set-up as part of the exercise. Include active electronic event logs and online mapping tools. Ensure all staff are participants.
483	Emergency Test Exercise Topics	Other Emergency Test topics to consider: backflow event causing contamination, chemical contamination, failure of F.M. Woods pumping to system, Guelph Lake Dam burst (done corporately, but could do Water-specific?), Climate Change / Severe Drought - level Black (or drought with a large water loss event - loss of water tower - that would bring a large portion of the system close to zero pressure?), frozen services, simple AWQI with poor bacti results from routing sampling
484	Emergency Test Exercise Communication of News	News stories about water emergencies, especially in Ontario should be e-mailed to staff for awareness that stuff really does happen and possibly more frequently than thought.
489/493	Frozen Services Pre-screening	Consider Administration’s and Extend Communication’s role in pre-screening with customer preparation checklist – to prepare for temporary line installation (and minimize wasted Operator time to attend to sites not prepared).
491	Frozen Services Meter Reads	Coordinate meter reads by Guelph Hydro at an earlier-than-frozen trigger of freeze prevention monitoring program.

CIR #	Suggestion Title	Description of Staff Suggestion
497	Frozen Services – Fill station locations	Should identify locations of fill stations (e.g. sheds with sinks and taps) – one at F.M. Woods, one at an alternate site.
501	Fibre Network Failure	<p>A number of opportunities presented, including: 1. An immediate “freeze on changes” has been implemented with the fibre network provider. 2. A new workflow / checklist is being developed for any SCADA network changes or upgrades, to ensure potential impacts are carefully considered and contingency plans are put into place prior to each change. 3. Discussions have started with the fibre provider and City IT to bring about changes in how the fibre provider operates, to make sure that mistakes made during this outage are not repeated. 4. The SLA (Service Level Agreement) with the fibre provider is being reviewed to ensure it clearly reflects Water Services' requirements in terms of uptime and time-to-repair-on-outage for the SCADA system network. 5. A direct support phone number for the fibre provider for SCADA network outages, and an escalation tree, are in the process of being put into place. 6. The service contract with the fibre provider is up for renewal in mid-2017. When negotiations begin in mid-2016, how uptime and problem resolution are handled will be carefully reviewed in the draft contract. 7. A fast-tracked project has been started to update the SCADA network drawings and network documentation. 8. Installation of diagnostic software on our SCADA network. 9. Implementation of network equipment shelf-spares that we can use as a hot replacements. 10. Secondary backup SCADA network is being investigated. 11. Installing another layer of backup data logging is being investigated. 12. The feasibility of deploying a set of continuously-online backup SCADA servers at Clair Booster Station is being explored. 13. Implementing network diagnostic tools and having a set of continuously-online backup servers. 14. Emergency Preparedness: Pre-set BBM Groups; #15. SOP's for "Operating During a SCADA Outage" (including reference to handheld radios, staff call-out rules); "Calculating Verney Tower Levels"; site monitoring checklists - included in emergency plan.</p>

CIR #	Suggestion Title	Description of Staff Suggestion
502	Inspection Preparation	Create a 52-week compliance logbook (one for each: North, West, East) that includes all sampling, maintenance, other planned items.
515	Well Improvements	Implement operational (SOP's, WI's, checklist, training, valve exercise program) and physical control measures (e.g. double isolation valving, drain lines for physical confirmation that the valves are holding, install hardwire interlocks) for improved recirculation or wasting processes at any station.
516	Call Logging Database	Track the number of water pressure complaints (high and low); the number of water quality complaints (e.g. taste, odour, colour, temperature). Also track the follow-up action taken, and whether it was a source water issue or not.
517-518, 520-521	Improved Water Use tracking	Consider tracking the total volume of water on inactive accounts, manual back-billing, for certain bulk water accounts, construction projects, temporary lines, special events, etc.
519	Meter tracking	Improve meter tracking for those that are part of demolition projects.
523	Reservoir Overflow	Implement an in-place system that will ensure de-chlorination of overflow water.
524	SCADA Connectivity / Network Failure	An extended power outage at Arkell Spring Grounds caused a Rogers router to "forget" part of its configuration, plus all individual well house routers, to power down and reboot. The UPS battery ran out after 9 minutes and the active configuration of the router had not been saved into the router's backup memory. The UPS in the PLC Panel at the Diversion Chamber has been replaced and updated back-up configuration will now reload to the router in question.



CIR #	Suggestion Title	Description of Staff Suggestion
525	Licence Renewal	Write up a licence renewal document that outlines all of the documents and records required for each 5-year licence renewal.
526	Track Licence Document Expiries	Include standard language in the A&S Report (as we do for PTTW's) about aspects of the Licence, locations of files, updates to these documents and their expiries (e.g. Licence, 1. DWWP, 2. PTTW's 3. Operational Plan, 4. Accreditation, 5. Financial Plan)
527	City-owned sampling stations	Move towards City owned, permanent sampling stations for now and future - look to improve existing distribution sampling sites.
541-552	Temporary Water Services (in Construction)	Review / update process, SOP / WI: Leave the temporary main to flush (to better maintain and represent the conditions of the water that the customers are using) – don't shutdown of temporary watermain in between samples; implement second review of lab results; improve communications aspects.
553	POE Meters and piping	Improvement recommendation on locations of POE Meters.
558-573	Large Watermain Break Event	Improve construction visible markers and standard for working around critical infrastructure; ensure repair pieces and supplies / service providers related to critical infrastructure are available in advance; improve field communications and acoustic monitoring; improve return to service processes; improve communications to agencies when news releases are publicly available; improve critical customer notifications processes; forward updated system pressures / zones map to Fire Services.
575	Emergency Test Exercise	Clarify IMS roles within EOC; invite certain team members not already involved; consider practicing one part of the activation; other topics as suggested (e.g. water advisory, pressure zone failures, backflow / cross-contamination, human illness, tornado, extensive local flooding)

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## Appendix “I” – Water Conservation & Efficiency Program

2016 Annual Progress Report (updated annually).

### 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 source for our drinking water needs, our ability to reclaim precious water and wastewater serving capacity through conservation initiatives offers numerous benefits to our community and local ecosystem.

In 2006, City Council endorsed the Water Supply Master Plan (WSMP). This detailed Master Plan evaluated the projected water demand and preferred sources of new water supply in meeting the needs of anticipated community growth over a 50-year planning horizon. Through this study, servicing capacity reclaimed through water conservation was identified as the most cost-effective and immediately available source of new water supply and was ranked as the top priority, with the following time-based water reduction targets endorsed by Council through the plan to direct the City’s water conservation program:

- 10 per cent (5,300 m<sup>3</sup>/day) in 2006 average day water use by 2010;
- 15 per cent (7,950 m<sup>3</sup>/day) in 2006 average day water use by 2017; and
- 20 per cent (10,600 m<sup>3</sup>/day) in 2006 average day water use by 2025

Since Council’s approval of the 2006 WSMP, 9,520 m<sup>3</sup>/day of average day water/wastewater capacity has been reclaimed as a result of the City’s Water Conservation Programs, allowing 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 (2006-2016).

Water conservation has also led to a reduction in the amount of electricity and water treatment chemical investments used to treat and convey water and wastewater. This results in a cumulative daily operational savings of over \$625,000 per year, creating a significant financial benefit to our rate payers. As a result of such efforts, 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 of 2014, Guelph City Council endorsed the Water Supply Master Plan Update. Through this update, servicing capacity reclaimed through Water Conservation and Efficiency continued to be a top priority in achieving a sustainable and cost effective community water supply, with a new reduction target of 9,147 m<sup>3</sup> in average daily production set through this plan to guide the City’s Water Conservation Programming for the planning period of 2015 to 2038.

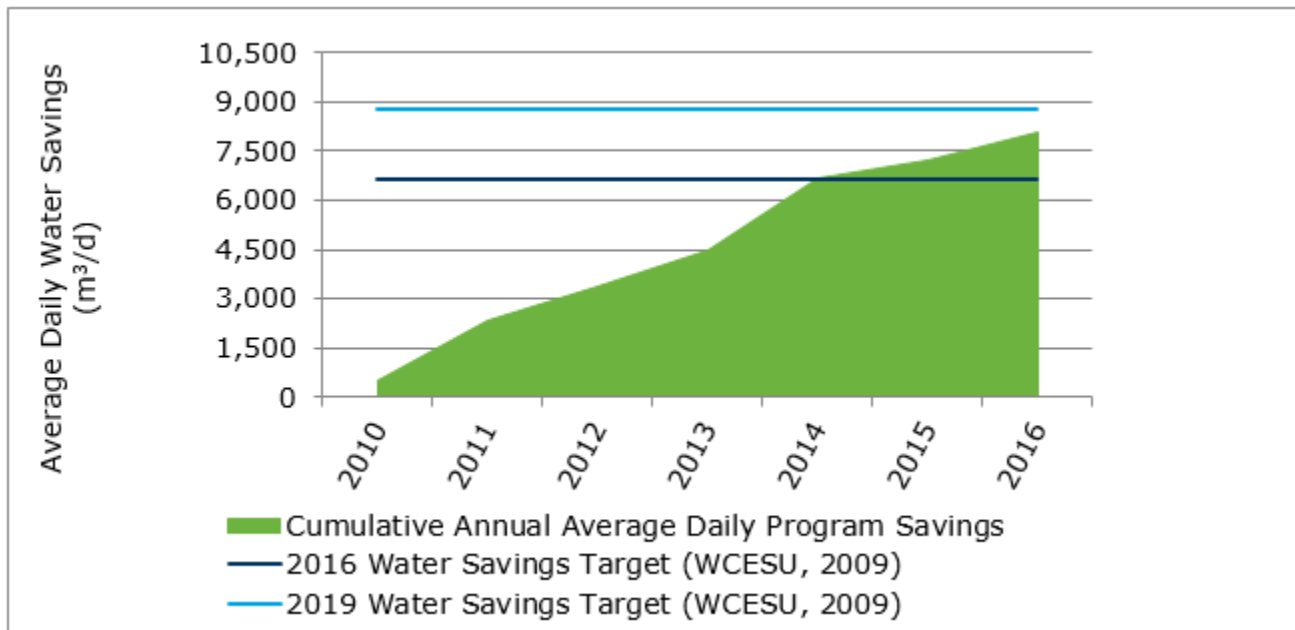
In April 2015, an update to the 2009 Water Conservation and Efficiency Strategy commenced. After multiple opportunities for public engagement, including the utilization of the long-standing Water Conservation and Efficiency Public Advisory Committee, feedback on the proposed measures to help to achieve the water reduction goal, as outlined in the 2014 Water Supply Master Plan, was used to inform the program and service improvements. Thus, the 2016 Water Efficiency Strategy update defines the programs, policies and resources that will help Guelph meet its reduction targets while ensuring the City continues to offer effective programs that provide value for the community. In September of 2016, Guelph City Council unanimously approved the Water Efficiency Strategy and its aggressive projected savings, with programs commencing in 2017. The Water Efficiency Strategy Update can be viewed online at [guelph.ca/wesu](http://guelph.ca/wesu).

The following sections provide an update of the water conservation and efficiency program activities and successes from January 1 to December 31, 2016. For more information on the City's Water Conservation Program and individual program resources please visit: [guelph.ca/ourstoconserve](http://guelph.ca/ourstoconserve).

#### **Water Reduction Target Progress:**

The 2016 water saving target of 6,659 m<sup>3</sup>/d, outlined in the 2009 Water Conservation and Efficiency Strategy has been surpassed through the implementation of the City's innovative water conservation programs. From 2010 to 2016 an estimated total water savings of 8,155 m<sup>3</sup>/day is attributed to community participation in the City's Water Conservation Programs and Leak Detection Program and is shown in Figure 6. The water savings goals outlined in the 2009 Water Conservation and Efficiency Strategy Update support the reduction in production targets outlined in the 2006 Water Supply Master Plan which are shown in Figure 6.

**Figure 6: Water Conservation and Efficiency Strategy Update: Estimated Annual Savings vs. Program Reduction Targets**



### Water Conservation and Efficiency Public Advisory Committee:

As one of the key tasks to the Water Efficiency Strategy implementation, a Water Conservation and Efficiency Public Advisory Committee (WCEPAC) of Council was formed in 2009 to provide a forum for community input and guidance to the City throughout the implementation of the Water Efficiency Strategy. In 2016, the WCEPAC represented the “Public at Large/Residential Rate Payers” as part of the Community Liaison Committee (CLC) formed as part of the community engagement strategy to complete the 2016 Water Efficiency Strategy Update. In 2016 the WCEPAC continues to be an active and engaged Committee, meeting once (1) as a committee and three (3) times as part of the Water Efficiency Strategy Update CLC. Throughout this time, the WCEPAC has offered valued insights on opportunities for continued optimization of current water conservation programming and policy, as well as, the enhancement of education, engagement and outreach resources offered by the City.

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 2016. In 2016 WCEPAC contributions included the following:

- Feedback on the proposed 2017 water efficiency programming with respect to the changes associated with the Royal Flush and Smart Wash Programs. This includes the how

to best implement the selected programming changes as outlined in the Water Efficiency Strategy and ensures the public is aware of these changes.

- Consultation regarding the development, beta testing and roll-out of the water conservation app watr which is anticipated to be rolled out in Q1 2017
- Review and updating of the Committee's Terms of Reference with respect to the Council approved 2016 Water Efficiency Strategy.

A full list of the WCEPAC members, meeting minutes and agendas can be found at <http://guelph.ca/city-hall/council-and-committees/advisory-committees/water-conservation-and-efficiency-public-advisory-committee/>.

The WCEPAC possesses no annual budget. Funding for the City's Water Conservation and Efficiency Program is provided within the approved 2016 Non Tax Supported Water and Wastewater Services Capital and Operating Budgets as well as Development Charges.

In 2017 the WCEPAC will continue to be engaged to solicit input throughout detailed design and implementation of 2016 Water Efficiency Strategy recommendations and associated public and stakeholder engagement campaigns.

#### **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 the time of production and end delivery to customers. Since the onset of this program to year-end 2016, the total volume of water saved equates to 1,168,090 m<sup>3</sup> (please note, this is not a cumulative value).

The 2016 Leak Detection Program was launched in April. This program included sounding and correlation of all 287 kilometers of metallic watermains and 3 kilometres of first generation PVC watermains within City's distribution system, encompassing a total of 290 kilometres of linear infrastructure. In total, 12 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 equates to approximately 365 m<sup>3</sup>/day, with a total volume of 132,740 m<sup>3</sup> in 2016.

The 2016 Leak Detection Program also included the continued detailed design of district metered areas (DMA). In recognition of benefits offered through this proactive water loss management approach, Water Services will be working to implement 20 DMAs over the period of 2016 to 2018 with funding provided through local development charges and local user rates. The goal of the DMA program is to reclaim and sustain 1.5 MLD (approximately 3.3 per cent on 2015 daily system input volume) in water servicing capacity by 2019. To date, 16 DMAs have been installed with an additional 8 scheduled for 2017.

**Residential Water Conservation Rebate Programs:**

During 2016, a total number of 1,736 rebate applications were processed via the City's residential rebate programs. Rebates claimed continue to be largely based in the City's Royal Flush Toilet Rebate and Smart Wash Clothes Washer Rebate Programs, with an average of 200 m<sup>3</sup>/day of reclaimed water savings anticipated as a result of residential rebate program participation in 2016.

Through the 2016 Water Efficiency Strategy, Council has approved changes in direction and planning of the Royal Flush and Smart Wash rebate programs. These proposed changes were due primarily to behavioural changes in the marketplace and improvements in technology. As a result, effective January 2017, the Smart Wash program will no longer be offered. Residents will however have until March 31, 2017 to submit their rebates pending that they purchased a washing machine on or before December 31, 2016. Changes to the building code have driven the Royal Flush rebate program change. The Royal Flush rebate is now \$50 instead of \$75 effective January 1, 2017. Replacement of 6L toilets instead of only 13L toilets is permitted under the new Royal Flush rebate program. As with the Smart Wash program, residents will have until March 31, 2017 to submit their applications for the \$75 Royal Flush rebate pending that they purchased the toilet on or before December 31, 2017.

Further to routine promotion of the City's water conservation retrofit programs, Water Services also continued to implement customized engagement within local business sectors in 2016 to increase awareness of program resources and potential water use efficiencies specific to the sector. This included a multi residential marketing campaign for building owners comparing individual building unit water consumption to multi-residential sector averages, as well as, anticipated utility savings and return on investment for buildings pursuing mass retrofit of inefficient toilets. As an outcome of these efforts, the City worked with the County of Wellington and other local non-profit housing providers to evaluate opportunities for water savings within their respective operations. To that end, a pilot study was completed with Wellington County Social Housing in 2016 which has defined a potential water savings of up to \$70,000 per year in respective housing facilities. Staff will continue discussions with the County and other non-profit housing stakeholders in hopes of assisting these parties to implement water efficiencies in 2017.

Staff plan to further build upon these engagement campaigns in 2017, as well as seek other ways to customize engagement to defined sectors possessing water saving opportunities. For more information on the City's Water Conservation Rebate Programs please visit [guelph.ca/rebates](http://guelph.ca/rebates).

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**Blue Built Home Water Efficiency Standards and Rebate Program:**

The Blue Built Home Water Efficiency Standards and Rebate Program is a voluntary construction standard designed to outperform the plumbing and water-using fixture requirements of the Ontario Building Code. This certification program for new homes uses an approved set of high quality home fixtures and appliances designed and third-party tested to save water and reduce water and wastewater utility bills by 15 to 62 per cent. Blue Built Homes are certified according to three water efficiency standards—Bronze, Silver or Gold—and provide home buyers with a one-time rebate on their investment.

From launch in 2010 until year end 2016, a total of 47 local new homes have been certified (41 Bronze, 4 Silver and 2 Gold). 2016 was a successful year for this program with 26 homes built by leading local home builders, 18 of which were certified. This includes construction of an additional 22 Blue Built Homes as part of the Riverview townhouse development by Terra View Homes Ltd., of which 15 were certified in 2016. Reid's Heritage Homes constructed 4 Blue Built Homes as part of their Westminster Woods community, of which 3 were certified in 2016. Reid's Heritage Homes' Blue Built Homes are part of the National Net Zero Building Program, which aims to have each home produce as much energy as it consumes on an annual basis through the use of leading edge technology that is readily available to the average builder. The City is a partner to this project supporting research on plumbing configuration alternatives to reduce hot water energy losses as well as monitoring detailed water demands to assess performance of these homes for a 2 year period. Water use monitoring commenced at the beginning of October 2016, and sufficient monitoring information is not available at this time.

For more information on the Blue Built Home program please visit [bluebuilthome.ca](http://bluebuilthome.ca).

**Institutional, Commercial and Industrial (ICI) Water Capacity Buyback Program:**

Since introduction of the ICI Water Capacity Buyback Program in 2007, the City has reclaimed an annual average daily savings of 1,590 m<sup>3</sup> per day in water/wastewater servicing capacity, while assisting local business reduce their environmental footprint and ongoing operational utility costs. This program offers financial assistance to local business for the completion of detailed water efficiency process audits and incentives towards capital retrofits which reduce water demand.

From 2007 through 2010, several of the City's top water users had participated in this program, but participation amongst business possessing a smaller water use footprint had been limited due to investment required to undertake process audits and uncertainties of financial efficiencies to be realized as result of participation. In recognition of these challenges, Water Services' ICI Water Efficiency Specialist continued work in 2016 to engage and support all members of the Guelph business, commercial and institutional community. This resource offers the local business

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community engineering services in conducting detailed preliminary water use audits with the intent of realizing potential efficiencies and limiting financial risk to business due to program participation.

Through this program, five detailed facility audits were completed in 2016. Furthermore, 2016 also saw the benefit of relationships built through the tenure of the program with local businesses returning to the program to seek support to implement further site-based efficiencies and inform process decisions. This assistance included professional advice for water saving opportunities, support for sub metering of process water use, overall operational flow monitoring, etc. For reference, these core works included the following within 2016:

- Implementation of automated flow control system at Cargill Meat Solutions accounted for an initial savings of 7,327 m<sup>3</sup> per year (30.53 m<sup>3</sup> per average operating day) in observed water use.
- Implementation of reverse osmosis system upgrade at Transgear accounted for an initial savings of 1,553 m<sup>3</sup> per year (4.25 m<sup>3</sup> per average day) in observed water use.
- A replacement of the pasteurizer at Sleeman Brewery resulted in a total initial reduction of 84,020 m<sup>3</sup> per year (336 m<sup>3</sup> per average operating day) in water use.
- Financial assistance and technical support towards completion of a leak detection survey of the University of Guelph's private water distribution system accounted for an initial reduction of 36,500 m<sup>3</sup> per year (100 m<sup>3</sup> per average day) in water loss.
- Replacement of water cooled air compressors with air cooled air compressors at Clerk Roller and Rubber resulted in a reduction of 8,868 m<sup>3</sup> per year (35.76 m<sup>3</sup> per average operating day) in observed water use.
- Two water audits completed at Linamar facilities were completed to identify water efficiencies.

### **Municipal Facility Water Efficiency Upgrades:**

With the objective of leading by example through the City's own operations, work in support of City operational improvements continued throughout 2016. To date, detailed water use audits have been completed at all of the City's highest water-using facilities as well as City seasonal facilities (included splash pads and waiting pools).

In looking to the renewal of City facility assets, Water Services' ICI Water Efficiency Specialist was also involved in design activities for the upcoming major renovation at Victoria Road Recreation Centre to support feasible water efficiency upgrades through re-construction in 2016. Lastly, the Specialist detailed design of a second phase of storage for the rainwater harvesting system at Guelph Transit. Detailed design for phase 2 of the Guelph Transit's Rainwater

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Harvesting System was initiated in April 2015 and construction was completed by July 2016 and put into operation. Through the completion of this phase, 37m<sup>3</sup> of additional rainwater storage capacity was established to complement water needs for Guelph Transit's Automated Bus Wash Process. The total volume of water savings in 2016 equates to 548 m<sup>3</sup> of municipal water which includes savings from both phase 1 and 2 of this project.

### **Youth and Public Education:**

The City's curriculum based, Grade 2, Grade 8, and High school in class water conservation programming continues to be a popular resource for local educators in both the Upper Grand District School Board (UGDSB) and the Wellington Catholic District School Board (WCDSB), encompassing 60 interactive school presentations to 1,442 students conducted in 2016. Overall, since the inception of this water conservation educational initiative five years ago, the City has provided a total of 315 school presentations to over 11,942 students. There have been increased interest and presentation requests from French immersion schools and the French bi-lingual program is being offered in grade 2 and grade 8 classrooms starting January 2017.

In partnership with the Grand River Conservation Authority's Guelph Lake Nature Centre, a total of 733 local Grade 8 and high school students, as well as volunteers, participated in guided educational tours of the City's Water Services facility in 2016.

### **H2Awesome:**

On May 16, 2016, approximately 950 grade 8 students from the Upper Grand District School Board (UGDSB) and the Wellington Catholic District School Board (WCDSB) participated in the third annual H2Awesome event. This day-long learning event held at the University of Guelph was an opportunity to celebrate water, encourage conservation of this precious resource, and provide focus to the importance of water in our daily lives. The event featured 4 key note guest speakers. These speakers include tornado chaser Ricky Forbes from the TV show "Tornado Hunters", water youth activist Robyn Hamlyn, comedian and water activist Derek Forgie, as well as international environmental journalist Steven Leahy. Key to the event was a variety of 26 different curriculum-linked workshops on various themes, including arts, science, and technology, enabling students to pick their own specific learning venue. The successful event was made possible through collaborative partnership with the Wellington Water Watchers, the Upper Grand District School Board, the Wellington Catholic District School Board and the City of Guelph Water Services Department.

### **Planet Protectors:**

In 2016 Guelph Water partnered with the Community Energy and Transportation and Infrastructure Departments to offer a curriculum focussed, interactive and activity based online

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program called Planet Protectors. This program helps students understand the importance of water conservation by helping them make personal commitments and sharing them with their family members such as shortening shower time. During the 2015/16 school-year this program has reached over 1205 students and have been offered in 57 grade 3, 4, 5 and 6 classrooms in the both the Catholic and Upper Grand school boards. Planet Protector is looking to expand the water awareness and education component of the program and have solicited Water Conservation staff's input to improve the program in 2017. This includes new ways to measure success and additional ways to encourage more water conservation savvy behaviour both in the classroom and at home with students and their families.

### **Canada Water Week:**

This week is a celebration of water from coast-to-coast-to-coast, held annually in the third week of March to coincide with United Nations World Water Day on March 22. The following activities were completed:

- The City of Guelph celebrated Canada Water Week with the fourth annual H2O Go Festival, a community celebration of water. Collaborating with community partners, H2O Go welcomed the contributions of local businesses, community organizations, experts, performers and families. This year's event, offered in partnership with the eMERGE Guelph's Ecomarket, attracted over 4,000 participants of all ages to Old Quebec Street Mall for water-themed presentations, live performances, interactive exhibits, games about water, and artistic children's activities.
- Water Services partnered with the Guelph Public Library for the fourth year in a row to host 'Water Wednesdays' throughout the Month of March at five different local library branches. These events offered water-themed educational programming for all ages, including interactive games and activities designed to inform local youth of Guelph's water sources, steps taken to treat our community's drinking water, and the importance of conservation and protection of our precious water resources.
- Water Services also offered a Water Camp Day at the Guelph Civic museum. Over 100 children participating in March break camps participated in live hands-on demonstrations on edible aquifers and vermiculture in addition to water activity stations to learn about the importance of water in our community.
- In concert with Water Wednesday, the West End Recreation Center also hosted an Aqua Lauti art exhibit during Canada Water Week, which gave residents insight into challenges faced by communities around world with regards to water scarcity and clean water access. More information on this interactive exhibit can be found at <http://watercanada.net/2014/video-the-aqua-lauti-project-in-action/>.

### **Waterloo Wellington Children’s Groundwater Festival:**

This long standing festival, held from May 27 to June 2, 2016, celebrated its 21st year in 2016 where Water Services is proud to be an ongoing partner, sponsor, contributor and organizer of the Festival. The Festival annually educates 5,000 grades two through five City of Guelph, Wellington County, and Region of Waterloo students. Since 1996, over 85,000 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 the Upper Grand District and Wellington Catholic School Boards, staff have worked to increase local awareness and participation in this Festival with upwards of 800 students participating from Guelph on an annual basis.

### **Annual Water Services Open House:**

This event was held on May 28, 2016. This popular community event showcased Water Services’ programs and resources and included a plant and rain barrel sale. It is estimated that over 1000 members of the local public attended the annual open house, with a total of 380 rain barrels sold at the event.

### **Spring and summer events:**

The City’s Water Conservation team attended a variety of events to promote efficient use of indoor and outdoor water at home. These included the Guelph Home Show, Emergency Preparedness Day, the Multi- Cultural Festival, Evergreen Senior center outreach with eMERGE Guelph, Canada Day Festivities, and presentations for Linamar staff during staff meetings and lunchtime events, Earth day festivities at the University of Guelph and Village by the Arboretum.

### **The eMERGE Home Visit and Audit Service Program**

This is an innovative collaboration between the City of Guelph, Guelph Hydro Electric Systems Inc., Union Gas, Transition Guelph, Elora Environment Centre, and other local partners. The eMERGE Guelph Efficient Home Visit service continued with great success in 2016. This service offers a free 1 hour home audit by trained advisors, a complimentary retrofit of common home water use fixtures (such as water efficient showerheads and faucet aerators), and the development of a household-specific action plan, providing information to residents on how to further reduce home resource use and directing homeowners to further resources and tools to assist with the implementation of recommended improvements. This program, recommended through the Council approved 2009 and 2016 Water Conservation and Efficiency Strategy, is available to all residential households in the City of Guelph with utility servicing from Guelph Hydro Electric System Inc., Union Gas and the City. For more information please visit [emergeguelph.ca](http://emergeguelph.ca).

eMERGE home visits have engaged over 274 households as of December 31, 2016. In verifying the household water consumption data for 2015, the City has concluded that, on average, the home owner who receives the visit will reduce their water consumption by approximately 10 percent depending on the retrofit measures taken. To date eMERGE home visits have engaged 955 households with a home audit.

### **Guelph Water Wagon:**

In support of the City's 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 four 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 30 events in 2016 and provided 29,349 litres of water to event attendees. The Water Wagon continues to provide staff an excellent opportunity to engage with the public to discuss the importance of water for the City of Guelph and the need for efficient use of it, discuss common questions or concerns from residents regarding municipal tap water, promote the use of tap water and solicit public involvement and awareness of opportunities to participation in municipal water based public processes and studies.

### **Peak Season Water Demand Management:**

Reduction of peak season water demands continue to be a primary objective of the City's Water Conservation programming. The ability to reduce variations in seasonal water use limits impacts 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. Since 2002, the City's Outside Water Use Program has helped to manage peak season water use via 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 between January 1 and December 31, 2016.

- On June 7, 2016 the City initiated a Level 1 Yellow water restriction under its Outdoor Water Use Program (OWUP) due to ongoing local drought and reduced Eramosa River base flow conditions in advance of the water shed declaration through the Ontario Low Water Response Program.
- On July 6, 2016 the OWUP moved to Level 2 Red due to continuing drought conditions in conjunction with the watershed declaration through the Ontario Low Water Response Program. In August and September the temperature was 3.3 degrees Celsius above average and both months were the 5th hottest in the 100 years of records in the region.

September only saw 28.2 mm of precipitation; this is less than a third of the average of 87.8 mm.

- On November 2, 2016 the OWUP ended the season in Level 1 Yellow due to slight increases in precipitation and river flows starting to see slight increases, and decrease in the need for seasonal outside water use. It is noted, that traditionally the season ends on September 30th, however this year due to the drought conditions it was extended.
- In working to proactively manage peak season demand, the Healthy Landscapes Program offered various public resources throughout 2016. The annual Healthy Landscapes Workshop/Seminar Series featured numerous free talks on time-of-year appropriate 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 Landscape and Seminar series.
- The Healthy Landscapes assessment program continues to be a popular resource with 350 free 1 hour visits completed by a trained landscape staff in 2016. This service offers a complementary site based consultation aiming to educate residents on garden design and maintenance practices to significantly curb outdoor demand at their home.

A rain barrel truckload sale in May of 2016 at the Water Services Open house yielded the sale of over 380 rain barrels sold. 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 service to the City as the barrels are sold at the bulk rate attained through an annual rain barrel tender process.

Water efficiency studies completed in other Ontario communities have shown a net result of 74 litres per day per household during peak season as a result of similar water efficiency-based landscape consultant services. For more information on the Healthy Landscapes Program please visit [guelph.ca/healthylandscapes](http://guelph.ca/healthylandscapes).

#### **Watr - water conservation Mobile app:**

In alignment with the open government objectives of the City's 2012 Strategic Plan, Water Services has initiated work on a mobile-based app to increase customer accessibility to information about household water use. The app will use customer water account information to provide users with tailor-based suggestions for conserving water and reducing bills. Users will also be able to view customized information based on known attributes of their household (e.g. age of home construction, conservation program participation, number of people in household) and will have more immediate access to their household's water use data. The City is working with Focus21, a local technology start-up company specializing in information engagement

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systems, to develop this app. It is anticipated that beta testing of this app will commence in Q1 2017 with initial rollout to be within Q2 2017. For more information on Watr please visit <http://www.watr.io/>.

### **Water Softener Alternatives Testing:**

With high levels of naturally occurring hardness in the City's groundwater source, the use of residential ion exchange 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 City of Guelph financed ground-breaking research in 2015 to assess the performance of an alternative to ion exchange water softening technology (salt based) 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)); or electromagnetic water treatment (MWT); or chemical conditioning with complexing or chelating agents. Salt and Water free technology employs a combination of processes to effectively 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 2015, after two rounds of testing of the NAC technology in the Region of Waterloo, it was concluded that the NAC is a viable technology for softening water in Waterloo Region and the City of Guelph. It is estimated that the NAC media will remain effective in a local household with three people for over approximately four years based on typical usage.

In 2016, the Region of Waterloo and the City of Guelph co-funded a study to determine the potential environmental impact of residential water softeners to determine the need to pursue strategies to reduce the use of salt based water conditioning units. The study concluded that discharge from water softens is impacting the wastewater quality that could be re-used at the wastewater treatment plant, as well as, is a significant source for potential residential water savings due to the amount of water discharged if these units were removed. Thus, the study recommends that clear and consistent messaging needs to be presented to customers on options for salt reduction; analysis of potential rebates for alternative salt and water-free technologies; consideration of planning or by-law amendments to reduce the use of salt based water softeners; and additional studies and pilot programs with the local water quality companies to develop consistent messaging, alternative products, understanding the markets drive for water softeners and development of expertise in these new technologies. In 2017, the City will continue to work with the Region of Waterloo to reduce the impact of water softeners in both communities.

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Further information about water softeners and research to date can be found at [www.watersoftnerfacts.ca](http://www.watersoftnerfacts.ca).

## Appendix “J” – Glossary

Included below is an index of terms used throughout this report

### Terms and Descriptions

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
<b>Above Detection Limit</b>	Means the result can be detected using the current level of technology.
<b>AMP</b>	Adaptive Management Plan
<b>AO</b>	Aesthetic Objective
<b>AODA</b>	Accessibility for Ontarians with Disabilities Act
<b>A&amp;S</b>	Annual and Summary
<b>AWQI</b>	Adverse Water Quality Incident
<b>Background</b>	Indicator bacteria group used to monitor general water quality (non - regulatory)
<b>BBH</b>	Blue Built Home program
<b>CAO</b>	Chief Administrative Officer
<b>CAPS</b>	Capital Asset Prioritization System



<b>Term</b>	<b>Description</b>
<b>cfu</b>	colony forming unit
<b>CCL</b>	Critical Control Limit
<b>CCP</b>	Critical Control Point
<b>CELP</b>	Community Environmental Leadership Program
<b>Cubic metres</b>	Cubic metres = 1,000 litres water
<b>Distribution Samples</b>	Samples taken within the distribution system, post primary disinfection
<b>DMA</b>	District Metered Area
<b>DWQMS</b>	Drinking Water Quality Management Standard
<b>DWS</b>	Drinking Water System
<b>DWWP</b>	Drinking Water Works Permit
<b>EC</b>	E. coli (Escherichia coli)
<b>E. coli</b>	Escherichia coli, indicator bacteria used to determine the presence of fecal contamination
<b>EDMS</b>	Electronic Document Management System
<b>EHV</b>	Efficient Home Visit
<b>Eng</b>	Engineering Services
<b>EOCG</b>	Emergency Operations Control Group

<b>Term</b>	<b>Description</b>
<b>EPA</b>	Environmental Protection Act
<b>Form 1</b>	Form 1 – Record of Watermains Authorized as a Future Alteration
<b>Form 2</b>	Form 2 – Record of Minor Modification or Replacements to the Drinking Water System
<b>GUDI-WEF</b>	Groundwater Under the Direct Influence of surface water – With Effective Filtration
<b>HPC</b>	Heterotrophic Plate Count, indicator bacteria group used to monitor general water quality (non-regulatory)
<b>ICI</b>	Industrial, Commercial, Institutional
<b>In-situ filtration</b>	Refers to the filtration achieved as river water migrates through the ground and into the Glen Collector System
<b>km</b>	Kilometre
<b>LESP</b>	Lake Erie Source Protection
<b>LRP</b>	Lead Reduction Plan
<b>LSL</b>	Lead Service Lines
<b>L/s</b>	Litres per second
<b>m</b>	Metres
<b>m3</b>	Cubic metres = 1,000 litres water
<b>m3/day</b>	Cubic metres per day = 1,000 litres per day

<b>Term</b>	<b>Description</b>
<b>MAC</b>	Maximum Allowable Concentration
<b>MCC</b>	Motor Control Centre
<b>MDL</b>	Minimum Detection Limit
<b>MDWL</b>	Municipal Drinking Water Licence
<b>mg/L</b>	Milligrams per litre = 1 part per million
<b>MOECC</b>	Ontario Ministry of the Environment and Climate Change
<b>n/a</b>	Not Applicable
<b>NDOG</b>	Non-Detect Overgrown
<b>NSF 60</b>	NSF/ANSI Standard 60: Drinking Water Treatment Chemicals -- Health Effects
<b>NSF 61</b>	NSF/ANSI Standard 61: Drinking Water System Components -- Health Effects
<b>ntu</b>	nephelometric turbidity unit
<b>O. Reg. 170/03</b>	Ontario Regulation 170/03 Drinking Water Systems
<b>OA</b>	Operating Authority
<b>ODWQS</b>	O. Reg. 169/03 Ontario Drinking Water Quality Standards
<b>ODWSP</b>	Ontario Drinking Water Stewardship Program
<b>OG</b>	Operational Guideline
<b>OIC</b>	Operator-in-Charge

<b>Term</b>	<b>Description</b>
<b>OP</b>	Operational Plan
<b>ORO</b>	Overall Responsible Operator
<b>OTP</b>	Operational Testing Plan
<b>OWRA</b>	Ontario Water Resources Act
<b>OWUP</b>	Outside Water Use Program
<b>OWWCO</b>	Ontario Water Wastewater Certification Office
<b>Pb</b>	Lead
<b>PDDW</b>	Procedure for Disinfection of Drinking Water in Ontario
<b>PLC</b>	Programmable Logic Controller
<b>POE</b>	Point of Entry, the point at or near which treated water enters the distribution system
<b>ppm</b>	Parts per million (mg/L)
<b>ppb</b>	Parts per billion (µg/L)
<b>PTTW</b>	Permit to Take Water
<b>Q1</b>	Quarter One (aka first quarter), Q2 (second quarter), etc.
<b>QMS</b>	Quality Management System
<b>Raw</b>	Refers to samples that have not yet received disinfection
<b>RCAp</b>	Rapid Chemical Analysis Package

<b>Term</b>	<b>Description</b>
<b>RCMP</b>	Reliability-Centered Maintenance Program
<b>SAC</b>	Spills Action Centre
<b>SAN</b>	Storage Area Network
<b>SCADA</b>	Supervisory Control and Data Acquisition
<b>SDS</b>	Subdivision Distribution System (as in Gazer Mooney SDS)
<b>SDWA</b>	Safe Drinking Water Act, 2002
<b>TC</b>	Total Coliform, indicator bacteria group used to determine presence of contamination
<b>TCE</b>	Trichloroethylene
<b>THM</b>	Trihalomethane
<b>TOMRMS</b>	The Ontario Municipal Records Management System
<b>Total Coliform</b>	Indicator bacteria group used to determine presence of contamination
<b>Treated</b>	Refers to samples that have received disinfection
<b>UGDSB</b>	Upper Grand District School Board
<b>UV</b>	Ultraviolet
<b>VOC</b>	volatile organic compound
<b>WCDSB</b>	Wellington Catholic District School Board

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<b>Term</b>	<b>Description</b>
<b>WCES</b>	Water Conservation and Efficiency Strategy
<b>WCWC</b>	Walkerton Clean Water Centre
<b>WDGPH</b>	Wellington-Dufferin-Guelph Public Health
<b>WSMP</b>	Water Supply Master Plan