

CITY OF ST. CATHARINES

WATER DISTRIBUTION SYSTEM 2016 ANNUAL SUMMARY REPORT



February 2017

Waterworks #260003279

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DEFINITIONS

Background Count – the bacterial content in water which can be used to measure water quality deterioration in distribution systems.

Disinfection – effective destruction by chemical or physical processes of pathogenic microorganisms capable of causing disease.

Escherichia coli (E. coli) – a sub-group of Coliform bacteria. It is most frequently associated with recent fecal pollution. The presence of E. coli in drinking water may be an indication of sewage contamination.

Free Chlorine Residual - the amount of chlorine available for disinfection.

Heterotrophic Plate Count (HPC) – a microbiological test indicating the overall water quality in drinking water systems. Increases in HPC can indicate a problem with drinking water treatment.

Lead – present as a result of corrosion of lead solder, lead containing brass fittings or lead water service pipes.

MAC – Maximum Acceptable Concentration - this is a health-related standard established for parameters which, when present above a certain concentration, have known or suspected adverse health effects. The length of time the MAC can be exceeded without injury to health will depend on the nature and concentration of the parameter.

Microbiological parameters (i.e. bacteria) – bacteria which may come from wastewater treatment plants, livestock operations, septic systems and wildlife. Microbiological analysis is the most important aspect of drinking water quality due to its association with dangerous water-borne diseases.

Total Coliforms – the group of bacteria most commonly used as an indicator of water quality. Total coliforms are a group of closely related bacteria that are usually free-living in the environment, but are also normally present in water contaminated with human or animal feces. With certain exceptions, they do not cause disease. Coliforms are used as a screen for fecal contamination. The presence of these bacteria in a water sample indicates inadequate filtration and/or disinfection.

Trihalomethanes (THM's) – disinfection by-products which are produced when chlorine reacts with naturally occurring organics left in the water after filtration.

INTRODUCTION

The Safe Drinking Water Act (SDWA), requires Municipal Council members be provided with a summary report for the drinking water system that falls under their municipal responsibility. The report must list any time the City was unable to meet the requirements of the Act, the regulations, the system's approval, drinking water works permit, municipal drinking water licence or any order issued by the Ministry of the Environment and Climate Change (MOE). Each failure must specify the duration and measures taken to correct the failure. The report must also summarize the amount of water supplied by the system.

Waterworks Description

The St. Catharines water distribution system is classified by the MOE as a Class II, large residential system. The City's waterworks consists of:

- Over 610 kilometres of watermains;
- Approximately 3,500 hydrants;
- Over 5,600 valves.

The Region of Niagara's Decew Water Treatment Plant treats and supplies the water;

- The source of water is surface water, from Lake Erie.
- The water is diverted via an intake from the Welland Canal located approximately six kilometers from the treatment plant, near Allanburg.
- The water travels along a 5.4 kilometre, open supply channel which flows by gravity directly to the treatment plant.
- The Decew Water Treatment Plant is a conventional surface water treatment plant which incorporates:
 - Zebra mussel control,
 - Screening,
 - Chemically assisted flocculation,
 - Coagulation,
 - Sedimentation,
 - Filtration,
 - Disinfection using sodium hypochlorite and ultraviolet light.

Municipal Drinking Water Licencing Program

The Municipal Drinking Water Licencing Program was originally recommended by Justice O'Connor in the Walkerton Inquiry, as part of the approvals framework for municipal drinking water systems. This program requires municipalities to obtain a licence to operate their water distribution system and to incorporate the concept of quality management into their operations. There are four components to the licence that are applicable to St. Catharines including the requirement for a Drinking Water Works Permit, a Drinking Water Quality Management System, system accreditation and a financial plan.

On October 30, 2009, the City received its first Drinking Water Works Permit (Permit) and Drinking Water Licence (Licence) from the MOE. The Permit allows for the establishment and alteration of the water distribution system. It replaces the previous Certificate of Approval process and results in a single permit for the entire system. The Permit does not expire, while the Licence expires and must be renewed every five years.

The Drinking Water Quality Management System (DWQMS) is a Quality Management System for the City's Water Distribution System. The DWQMS implements a systematic "continuous improvement" approach to planning, operations, corrective actions and management review to allow an organization to demonstrate sound system performance. The success of a DWQMS depends on the commitment from all levels and functions of an organization including operational staff and top management. The DWQMS is documented through the Operational Plan. DWQMS awareness training is provided to staff on an annual basis. The Operational Plan is regularly reviewed and continually improves. In addition, internal audits take place and a yearly risk assessment is conducted and/or reviewed.

The preparation of a Financial Plan is a requirement specified in Regulation 453/07 and intended to demonstrate that the municipality had considered all of the financial impacts of the drinking water system. A new Financial Plan must be submitted to Council and the Ministry of Municipal Affairs and Housing (MMAH) prior to each Licence renewal. Council's Resolution confirming approval of the Financial Plan must be included in the Licence renewal documents.

Every three years an external Verification Audit must be conducted. This audit was conducted by NSF – International Strategic Registrations in September 2014. No non-conformances were found and the City's new Municipal Drinking Water License was issued on October 15, 2014. This Licence will expire in October 2019. The City can expect another onsite Verification Audit to be conducted by NSF in August 2017.

The Drinking Water Quality Management System Policy

The City of St. Catharines is committed to:

- **Ensuring a consistent supply of safe, high quality drinking water;**
- **Maintaining and continuously improving its Quality Management System; and**
- **Meeting or surpassing applicable legislation and regulations.**

Actions Taken to Comply with the Safe Drinking Water Act

- To comply with the legislation, the City is required to take a minimum number of samples each month from a representative cross-section of its watermain network and to test these samples for microbiological indications of contamination. Testing for the free chlorine residual content is also a requirement. The chlorine residual must be sampled at the same time and location as the microbiological sample.
- The City's drinking water is sampled every three months at points within the distribution system where there is a likelihood for the potential of elevated formations of Disinfection Byproducts, including trihalomethanes (THMs) and Haloacetic Acids (HAAs).
- The City must undertake a Community Wide Lead Testing Program. The volunteer based sampling program requires samples be taken from 50 residential homes, 5 non-residential buildings and 10 samples taken directly from the distribution system twice each year. Additional lead samples are taken outside of the regulated and defined sampling periods each year.
- Anyone who conducts sampling from within the water distribution system must hold an Ontario Water Wastewater Certification Office (OWWCO) Water Quality Analyst licence or a Water Distribution Operator's licence. These licences must be renewed every three years and require continuing education for renewal.
- All laboratory analysis must be carried out by an accredited laboratory. The City of St. Catharines currently uses a number of accredited laboratories. Accreditation ensures acceptable laboratory protocols and test methods are in place. It also requires the laboratory to provide evidence and assurances of the proficiency of the analysts performing the test methods. Laboratories are audited by the Canadian Association for Laboratories Accreditation (CALA) and accredited by the Standards Council of Canada (SCC).
- All drinking water sample results are available to the public. Annual reports are available at City Hall, the Lake Street Service Centre and on the City's website, www.stcatharines.ca. The daily sample records are available on request for the public to view.
- Notification is given to the MOE, the Regional Public Health Department and Decew Water Treatment Plant of all incidents of regular sampling which exceed the Maximum Allowable Concentration (MAC).
- On an annual basis, the MOE conducts a rigorous and comprehensive inspection of the municipal drinking water system to determine compliance under the SDWA and associated regulations. The City of St. Catharines received a Final Inspection Rating of 100% in the last Inspection.

WATER QUALITY TEST RESULTS

Summary of Results

In 2016, over 10,700 samples were taken throughout the City and analyzed for microbiological parameters, chlorine residual and chemicals analyses as part of the drinking water surveillance program. **Table 1** summarizes each parameter tested and it gives the number of samples required, the number of samples analyzed, and the range of results.

Table 1: Summary of Water Quality Test Results, 2016

Parameter	MAC	Minimum Number of Samples Required	Number of Samples Taken	Results Range	Comments
Microbiological Analysis (Units = CFU/100 mL)					
<i>Escherichia coli</i> (E. coli)	ND	1368	2015	0	Fecal coliform bacteria that indicates the presence of sewage or animal waste contamination.
Total Coliforms	ND	1368	2015	0 - 15	Not generally harmful; but the presence can indicate the possibility of fecal contamination.
Background Count	NA	1368	2015	0 - 92	General bacterial population used to indicate deterioration of water quality.
Heterotrophic Plate Count (HPC)	NA	342	934	0 - >300	HPC levels are used to monitor the general overall water quality. (*units = CFU/1mL)

ND – None Detected

NA – Not Applicable

CFU – Colony Forming Units

mL - Millilitres

Table 1: Summary of Water Quality Test Results, 2016 (continued)

Parameter	MAC (mg/L)	Minimum Number of Samples Required	Number of Samples Taken	Results Range	Comments	
Chemical Analysis						
Trihalomethanes mg/L	0.10	4	4	0.0388	Disinfection By-product; reaction of chlorine with organic matter. The results are based on a four quarter annual running average.	
Lead mg/L	Residential	0.010	100	117	<0.001 – 0.056	Lead water service connections may be found in homes built prior to 1955. No lead piping was used in the distribution system.
	Non-Residential	0.010	10	10	<0.001	
	Distribution	0.010	20	20	<0.001	
Alkalinity	NA	20	20	62-98	The capacity for neutralizing an acid solution	
pH	NA	130	147	7.2-8.1	Indicates the acidity of the water	
Parameter	MAC (mg/L)	Minimum Number of Samples Required	Number of Samples Taken	Results Range	Comments	
Disinfectant						
Chlorine Residual	Must be between 0.05 mg/L & 4.0 mg/L	1368	3439	0.00 – 1.87	The free chlorine residual in the water distribution system is an indicator of the effectiveness of the disinfection process.	

mg/L – Miligrams per Litre

Summary of Adverse Water Quality Incidents

In 2016, 13 Adverse Water Quality Incidents took place; nine dealing with low free chlorine residual and four had elevated levels of Total Coliforms.

After each adverse water quality incident, a series of actions are required to ensure the safety of the water and compliance with provincial legislation. The City's Standard Operating Procedures provide clear and detailed instruction for follow up actions. This involves flushing hydrants located in the area of the adverse incident, taking additional water samples from the original location and locations around the adverse incident. It also involves notifying the MOE's Niagara office, the Spills Action Centre (SAC) and the Public Health Department both verbally and in writing. **Appendix A** summarizes all adverse water quality incidents throughout the City of St. Catharines in 2016 and the corrective action taken to resolve each incident.

An adverse water quality incident does not mean the drinking water supply is unsafe. An adverse incident simply indicates on that one occasion, a drinking water quality standard was exceeded.

Lead Exceedances

As part of the Community Wide Lead Testing Program, the City is required to take samples from within private properties. The results are not indicative of the quality of the water throughout the distribution system. When sampling for lead, the results simply represent the water sampled from within that residence. Potential lead sources include: older lead water service lines, usually built prior to the 1950's; internal plumbing, used mainly in the early 1900's; and older brass or bronze fittings and fixtures. When a lead exceedance occurs, both the Public Health Department and the MOE are notified. The affected resident is also immediately notified and a package containing the results and informational fact sheets detailing what options are available to the resident are delivered. In 2016, there were six lead exceedances found on private properties.

When a lead water service is found, for example, during a new watermain construction project or when repairing a water service leak the City will replace the portion of the service on public property at the City's expense. The City will replace the public property side of a lead service when a lead exceedance is found and also whenever the property owner first replaces the private portion of the lead service line. Lead lines are replaced with either copper or plastic service lines.

Percentages of Test Results Meeting Ontario Drinking Water Quality Standards

Table 2 shows the percentage of drinking water samples that met the Ministry of Environment’s Drinking Water Quality Standards in the City of St. Catharines distribution system compared with the rest of the Province of Ontario.

Table 2: Percentage of test results meeting MOE Standards, 2016

Parameter	St. Catharines System	Province of Ontario
E. coli	100%	99.98%
Total Coliforms	99.80%	99.72%

OPERATIONAL ACTIVITIES

Watermain Repairs

In 2016, there were 151 watermain breaks. Following a watermain break repair, the City samples from locations both upstream and downstream from where the break occurred. The samples are analyzed for microbiological parameters and chlorine residual.

When a new watermain is installed, the City is required to sample for microbiological parameters and chlorine residual. In 2016, 93 samples were taken to test the new watermains before being put into service. If any bacteria are present, the new watermains are flushed, rechlorinated and sampled again until no bacterial contamination is found before being put into service. All of the watermains must also meet the required standard for chlorine residual.

Maintenance Costs

The total budget for the 2016 Water Improvement Program amounted to \$5.5 million. The total budget allowed for the replacement of approximately 5,500 metres of existing watermain.

Water Flows

Table 3 lists the monthly water flows from the Decew Water Treatment Plant to the City of St. Catharines (source: Regional Municipality of Niagara). More detailed flow data can be found the Decew Water Treatment Plant’s 2016 Summary Report, available at: www.niagararegion.ca.

Table 3: Monthly Water Flows for 2015 and 2016

Month	Quantity (MegaLitres)	
	2015	2016
January	1,111.4	1,043.0
February	958.3	1,004.3
March	1,132.8	1,121.2
April	1,114.5	1,092.2
May	1,354.2	1,311.2
June	1,281.0	1,547.4
July	1,480.2	1,773.4
August	1,471.5	1,505.3
September	1,370.4	1,323.1
October	1,260.2	1,205.7
November	1,137.3	1,108.3
December	1,186.5	1,149.7
Total	14,858.5	15,184.8
Monthly Average	1,238.2	1,265.4
Daily Average	40.7	41.6

Note: 1 MegaLitre (ML) = 1,000,000 Litres

ADDITIONAL INFORMATION

For additional information on the City of St. Catharines drinking water system or the content of this report, please contact:

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 905-688-5600

Summary of Adverse Water Quality Incidents, 2016

Incident Date	Location	Adverse Parameter	Result	Corrective Action	Corrective Action Date
March 1, 2016	Parnell Road	Total Coliform	2 CFU /100 mL	Flushed nearby hydrants. Resampled the surrounding area, including the original location. All of the resamples met the drinking water standard.	March 2/3, 2016
March 22, 2016	Marvin Drive	Free Chlorine Residual	0.04 mg/L	Flushed area hydrants and flushed within the original location. Confirmed the chlorine residual was restored.	March 22, 2016
June 15, 2016	Scott Street	Free Chlorine Residual	0.00 mg/L	Flushed nearby hydrants. Resampled the surrounding area, including the original location. All of the resamples met the drinking water standard.	June 15, 2016
August 12, 2016	Pelham Road @ St. Paul Crescent	Free Chlorine Residual	0.01 mg/L	Flushed area hydrants and flushed within the original location. Confirmed the chlorine residual was restored.	August 12, 2016
August 14, 2016	Lake Street	Free Chlorine Residual	0.00 mg/L	Flushed nearby hydrants. Resampled the surrounding area, including the original location. All of the resamples met the drinking water standard.	August 14, 2016
August 18, 2016	Ellen Circle	Free Chlorine Residual	0.00 mg/L	Flushed nearby hydrants. Resampled the surrounding area, including the original location. All of the resamples met the drinking water standard.	August 18, 2016
September 10, 2016	Densgrove Drive	Total Coliform	4 CFU /100 mL	Flushed nearby hydrants. Resampled the surrounding area, including the original location. All of the resamples met the drinking water standard.	September 10/12, 2016
September 21, 2016	Duncan Drive	Free Chlorine Residual	0.03 mg/L	Flushed area hydrants and flushed within the original location. Confirmed the chlorine residual was restored.	September 21, 2016

Incident Date	Location	Adverse Parameter	Result	Corrective Action	Corrective Action Date
September 21, 2016	Lake Street	Total Coliform	1 CFU /100 mL	Flushed nearby hydrants. Resampled the surrounding area, including the original location. All of the resamples met the drinking water standard.	September 22/23, 2016
September 28, 2016	Duncan Drive	Free Chlorine Residual	0.04 mg/L	Flushed area hydrants and flushed within the original location. Confirmed the chlorine residual was restored.	September 28, 2016
October 17, 2016	Leaside Drive	Free Chlorine Residual	0.01 mg/L	Flushed area hydrants and flushed within the original location. Confirmed the chlorine residual was restored.	October 17, 2016
November 29, 2016	First Street Louth	Total Coliform	15 CFU /100 mL	Flushed nearby hydrants. Resampled the surrounding area, including the original location. All of the resamples met the drinking water standard.	November 30 & December 1, 2016
December 13, 2016	Eastchester Avenue	Free Chlorine Residual	0.04 mg/L	Flushed area hydrants and flushed within the original location. Confirmed the chlorine residual was restored.	December 13, 2016