



Pelham Water Distribution System
ANNUAL SUMMARY REPORT

January 1, 2015 to December 31, 2015

Preamble

This report was prepared by the Director of Public Works and Manager of Public Works for the Owner of the Pelham Water Distribution System, the Corporation of the Town of Pelham, to be presented to Council.

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1. GLOSSARY

DWQMS	Drinking Water Quality Management Standard
MOECC	Ontario Ministry of the Environment and Climate Change
OIC	Operator-in-Charge, as per Ontario Regulation 128/04
OIT	Operator-in-Training, as per Ontario Regulation 128/04
ORO	Overall Responsible Operator, as per Ontario Regulation 128/04
QMS	Quality Management System
WTP	Water Treatment Plant

2. PURPOSE

Two annual water reports are required by the Ministry of the Environment and Climate Change (MOECC) to be prepared – the 'MOECC Annual Report' (O. Reg. 170/03 section 11), and the municipal 'Summary Report' (O. Reg. 170/03 schedule 22).

The MOECC Annual Reports for 2015 have already been prepared and approved by Council, and have been made available to the public.

As legislated, Council is responsible as Owner of the water system for ensuring these reports are prepared and available to the public (before February 28, 2016 for the MOECC Annual Report and before March 31, 2016 for the Summary Report).

To enhance the communication and understanding of both of these reports, this Annual Drinking Water Summary Report contains additional non-legislated information on the drinking water system operations and water quality.

3. SYSTEM OVERVIEW

The provision of drinking water for residents in the Niagara Region is a responsibility shared between two tiers of municipal government. The Niagara Region is responsible for treatment and supply of the water to the Town of Pelham via transmission mains. The Town of Pelham is responsible for distributing water to local consumers via its own network of distribution pipes.

The Pelham Distribution System is a Class 2 water distribution subsystem. The system consists of approximately 77.8 km of watermains varying in size from 50mm to 400mm diameter providing water to approximately 12,000 residents within the general urban area.

The service area has an approximate area of 14 square km and includes the Villages of Fonthill, Ridgeville and Fenwick. The system receives treated drinking water from the Welland Water Treatment Plant located on Cross Street in the City of Welland. The treatment plant is owned and operated by the Regional Municipality of Niagara. The plant receives its raw water from the Welland Recreational Canal. Treated water is transmitted to the Town by way of a 750mm diameter watermain to the Shoalts Drive Reservoir. The reservoir, which includes chlorination, is also Regionally-owned and operated. Water enters the Pelham Distribution System at the reservoir outlet.

The Town of Pelham owns and operates a water filling station with side-fill and a backflow prevention device to serve consumers outside of the urban boundary who do not have direct access to the distribution system. Water haulers must obtain approval from the Niagara Region before being permitted to use the station.

The Town of Pelham owns a small pressure booster pump station which is located on the Niagara Region's Elevated Tank Property. This pump is used to improve water pressure in the Chestnut Ridge development area. The normal operating pressure in the area is low due to its geographic location in relation to the elevated tank that supplies distribution supply and pressure by way of gravity.

4. LEGISLATIVE COMPLIANCE

Water Quality Testing

Ontario Regulation 170/03 prescribes water quality testing requirements for municipal drinking water systems.

The requirements prescribed by the MOECC include: test parameters, number of test samples, frequency of testing, location of testing, reporting of test results, and reporting and corrective action of adverse test results, amongst other items. Operational guidelines are parameters used to monitor the general quality of water and the performance of the system.

The Town carried out testing in 2015 as prescribed by legislation.

The Town was granted relief under Schedule 15.1 of Ontario Regulation 170/03. The Town is no longer required to take samples from residential or non-residential plumbing for the community lead testing program; however, reduced sampling must still take place in four locations within the distribution system on a three year cycle. As such, the Town has continued with its lead testing program in the distribution system under the relief regime as required, with no concerns.

In addition to the prescribed sampling, the Town tested for water quality in response to complaints from consumers. Complaints generally refer to colour, odour, pressure, particulate, supply and/or taste.

The Town responded to **36** water quality/supply complaints in 2015. All were resolved promptly, 23 related to frozen water services, 9 related to both high and low pressure concerns and 4 to colour/odour.

Taste and odour episodes are often related to a natural phenomenon caused by seasonal biological changes in the source water. These changes may produce odour-causing chemical compounds that can be detected by humans at very low levels. Most municipalities in Ontario which obtain their water supply from surface water sources experience this problem periodically in the summer or early fall. Also, private plumbing fixtures including small water filtration systems and drain traps can also contribute to concerns regarding taste and odour of municipally supplied water. Once identified, most of these can be resolved quickly and easily through regular maintenance completed by the property owner.

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Water Treatment Plants are equipped with various filtration systems designed to reduce the effects of taste and odour, but may not eliminate it entirely.

Table 1 shows the testing requirements and number of deficient samples in 2015.

Table 1 – 2015 Testing Summary

Parameter	# Samples Required	Actual # Samples Taken	Legislated Requirement	Guideline	Actual # Samples Exceeding Limit
Escherichia Coli (bacteriological)	22 per month	~ 46 per month	Not detected - 0 CFU/100mL	--	0
Total Coliform (bacteriological)	22 per month	~ 46 per month	Not detected - 0 CFU/100mL	--	Five (5) (Four events)
HPC (heterotrophic plate count - bacteriological)	6 per month (25% of 26)	~ 46 per month	--	< 500 CFU/100mL (AWWA C651-05)	None
Trihalomethanes	1 per quarter	3 per quarter	100 ug/L (annual running average)	--	None
Free chlorine	7 per week	14 per week	>=0.05 mg/L, <=4.0 mg/L	--	None
pH	4 per semi-annual test period	4 per semi-annual test period	--	6.5 – 8.5 O.G.	None
Alkalinity	4 per semi-annual test period	4 per semi-annual test period	--	30 – 500 mg/L O.G.	None

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Parameter	# Samples Required	Actual # Samples Taken	Legislated Requirement	Guideline	Actual # Samples Exceeding Limit
Lead	4 per applicable semi-annual test period, 8 per applicable year of test cycle	4 per applicable semi-annual test period, 8 per applicable year of test cycle	0.01 mg/L	--	None
Pressure	None	5 per month including 1 sample in each pressure zone	--	>=28psi	None

O.G. – operational guideline

Adverse Water Quality Incidents

An “adverse water quality incident” refers to a water quality test result exceeding the legislated requirements shown in Table 1.

A total of **Four*** incidents of adverse water quality conditions were detected in the system in 2015 covering 5 exceedances of the total coliform standard.

When these adverse incidents occurred, staff went beyond legislated requirements for response and corrective action by thoroughly reviewing all operational, sampling practices, equipment, hygiene and lab processes, and came to the general conclusion that a likely cause of these incidents was sampling error.

Total coliforms were the cause of all of the adverse incidents in 2015. Total coliforms are a group of closely related bacteria that are generally harmless. They are natural and common inhabitants of the soil and surface waters (such as lakes and rivers). They are an indicator - their presence in drinking water **suggests that there may have been a breach, failure, or other change in the integrity of the water system and that pathogens may have entered into the drinking water system.**

All adverse incidents were resolved in consultation with Niagara Region Public Health and the Ministry of the Environment, by planned flushing in the area, repeated re-testing and investigation of potential causes. The Town’s response resulted in no service disruption to consumers, and no known impact to public health.

MOECC Drinking Water System Inspection Report



In October 2015, the Town’s distribution system underwent an unannounced focused annual inspection by a MOECC Drinking Water Inspector. The inspection covered the period September 27, 2014 to September 30, 2015.

No issues of non-compliance with regulatory requirements or recommended best practices were identified by the inspector in either system, and the system received a **100% Inspection Risk Rating.**

Regulatory Updates

Some regulatory changes occurred in 2015, which have a moderate effect on water operations.

Drinking Water Quality Management Standard

The MOECC drafted an updated Drinking Water Quality Management Standard in 2013, and the Director of Public Works participated in a focus group with the MOECC providing comment on this draft. The finalized new standard has still not yet been released. The revisions are administrative in nature and intended to clarify existing requirements and to ensure that consideration is given to the potential impacts of climate change when the risks to a drinking water system are being assessed by the system owner or operating authority. The changes are not anticipated to have a significant effect on the management system in place with the Town.

Disinfection of Water Mains

All 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 a condition of Drinking Water Works Permits. In 2014, the MOECC continued working with the Ontario Water Works Association and municipal stakeholders to clarify the requirements of C651, and to develop alternative procedures to be used during emergency repairs. The new Watermain Disinfection Procedure was published by the MOECC in November 2015.

Competency

Operator training is required by law to maintain water licenses and ensure competency. In 2015, training records were reviewed for all licensed operators in an ongoing effort to ensure that staff remain competent, and participate in training opportunities that are engaging and relevant to Town operations.

Operators and key water staff participated in a number of diverse course offerings aimed at broadening their knowledge. This included training in water metering installation, trenching, pipe and cable locating, QMS awareness, safe watermain repair and many other topics.

Licensing and Training

The Town of Pelham owns and operates a Class 2 Water Distribution System and a Class 2 Wastewater Collection System. Town of Pelham Water Distribution and Wastewater Collection System Operators are working towards obtaining or maintaining Class 2 Licenses in both water and wastewater disciplines. All water/wastewater staff are endeavoring to upgrade to Class 2 licenses by 2018.

The Town water group currently has a complement of a Manager of Public Works, Lead Hand of Water and Wastewater, and three Water Operators. Of these staff, there are three operators with a Class 2 license (compared to two in 2013), one with a Class 1 license, and one Operator-in-Training. The Operators have established a plan to each achieve a Class 2 license over the next few years.

Training to be offered in 2016 for upgrading licenses or maintaining existing will include:

- Water Loss Management and Leak Detection Techniques
- Commissioning of New Water Mains including new Chlorination Regulations
- Hydrant Maintenance and Fire Flow Testing
- Proper Installation of repair clamps, couplers and fittings

5. FLOW DATA

Flow Data

Water consumed by the Town of Pelham is measured by the Niagara Region, and provided monthly to the Town. In 2015, a total of 1,364,450 cubic meters (m³) of water flowed to the Town of Pelham in total. (1 cubic meter of water = 1,000 litres). This quantity has decreased since 2007, and appears to be on a slightly decreasing overall trend, as shown in **Table 2**.

Table 2 – Annual Totals

Year	Supply (m³)
2006	1,559,490
2007	1,752,470
2008	1,488,891
2009	1,499,700
2010	1,497,110
2011	1,469,470
2012	1,491,850
2013	1,420,220
2014	1,374,130
2015	1,364,450

It is anticipated that the decreasing general demand may be generally attributed to decreasing customer demand.

All water demands were met in the system, thus the Town was not required to implement the additional use restrictions under section 4 (p) of the Water Supply By-law No. 3198-2011.

The Town’s Drinking Water License does not limit demand or flows to the Town, so a comparison to license limits is not required. The 2015 average daily consumptions are shown in **Table 3**, along with the maximum daily flows for each month.

Table 3 –2015 Daily Water Usage

Month	Average Daily Quantity (m ³)	Peak Flow in One Day (m ³)
January	3238	3990
February	3416	3940
March	3521	4160
April	3346	4160
May	4908	7340
June	4245	5790
July	4688	6780
August	4379	5510
September	2840	5530
October	3116	3940
November	3030	3860
December	3015	3790

The 2015 highest demand day occurred in May, but may have been associated with a pumping issue at the booster station. Without this one high volume day, the highest demand days occurred consistently in June and July, which aligns with the typical high monthly demands in the summer months.

The Master Servicing Plan (MSP - September 2011) lists 2016 peak day demand projections (at the combined two zones of the BPS) at 10,970 m³/day, which is higher than the actual 7,340 m³/day peak usage.

Water Loss (Unaccounted Water)

A 2009 Residential and Civil Construction Alliance of Ontario study said leaky pipes cost the province 25 per cent of its drinking water—enough to fill 131,000 Olympic-sized swimming pools. The direct causes of water loss are not known without detailed investigation, auditing, testing and monitoring, but is typically attributed to such causes as:

- meter inaccuracies (after approximately 5years water meters begin to under-read),
- unknown leaks (although leak detection monitoring is performed, not all mains can be tested in their entirety each year, and leak detection itself is complicated

- by traffic noise, normal industrial usage and ground conditions), and
- flushing and main breaks (although estimates of losses are provided from regular maintenance flushing activities, fire department flushing and firefighting use, and from main break events, there is room for significant error in these coarse estimates, which may account for some of the unaccounted loss), and
 - usage through unknown or illegal connections.

Water loss is calculated as a percentage and defined below as:

$$\% \text{ Water Loss} = \text{Unaccounted Consumption} \div \text{Total System Input} \times 100$$

Where:

$$\text{Unaccounted Consumption} = \text{Total System Input} - \text{Accounted Consumption} \\ \text{(purchased from Region)}$$

Accounted Consumption =

Volume of **Billed Authorized Consumption**
(metered water consumption, including Town facilities)

+ Volume of **Unbilled Authorized Consumption**
(metered and estimated operational and construction use, firefighting, main breaks)

Total System Input = Volume of Water Purchased From Niagara Region

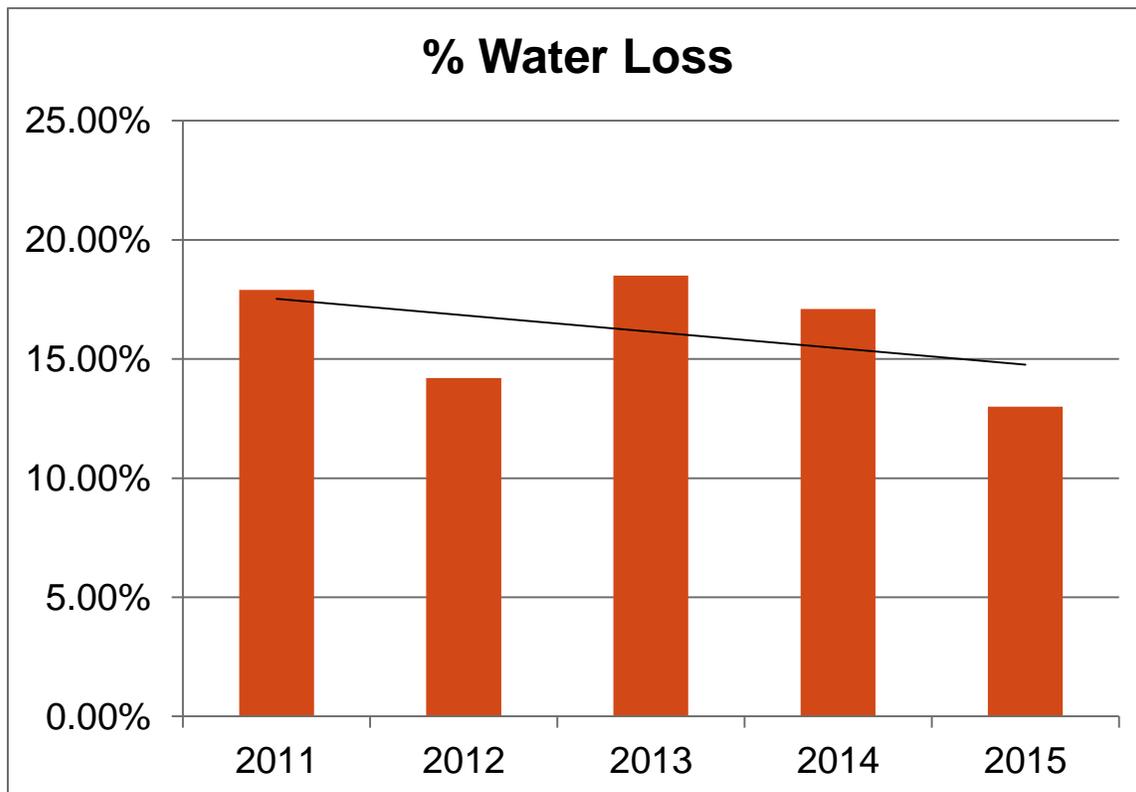
Unbilled authorized water usage is water use that is known, usually from Town uses, but not metered. For example, water through hydrants for some fire training exercises, firefighting, watermain maintenance and main breaks is coarsely estimated and incorporated into this 2015 figure. Estimated loss through a main break is particularly difficult since the loss depends on the system pressures, break size and system conditions, and sometimes can go a significant amount of time undetected.

However, with best estimates prepared, water loss for 2015 is estimated at 13.0%, compared to 17.1% in 2014 and 18.5% in 2013, summarized in Table 4. Input data becomes more accurate each year, and in previous years, not all of the same input data was always available, skewing the numbers slightly. 2016's 13.0% is considered a conservative estimate of water lost through unaccountable means. **Figure 1** shows the water loss by year.

Table 4 –Water Loss Approximations by Year

Year	% Water Loss
2011	17.9
2012	14.2
2013	18.5
2014	17.1
2015	13.0

Figure 1– Water Loss by Year (%)



The black trend line shows the overall trend of water loss. In general, water loss by percentage has decreased. As this is the first official report to Council from this perspective, the numbers should be interpreted as an indicator, not an absolute, and it is

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the achievements at reducing the loss from a relative comparison that will be even more valuable in each year to come.

The system losses are considered reasonable, but improvement can be made. In 1999, the California Urban Water Conservation Council identified 10% water loss as a reasonable utility benchmark.

6. INFRASTRUCTURE

Capital Projects and Purchases

The Town created its first 20-year capital plan to ensure that it represents the most current water distribution system improvement needs.

The following system-specific capital projects were carried out:

No watermain replacement was completed in 2016. New watermain was constructed in the East Fonhill development, and commissioned successfully. Private watermain was constructed but not yet commissioned at the East Fonhill Commercial Block. This will be commissioned with Town involvement in the spring, due to potential significant public health risk.

Rehabilitation and Repairs

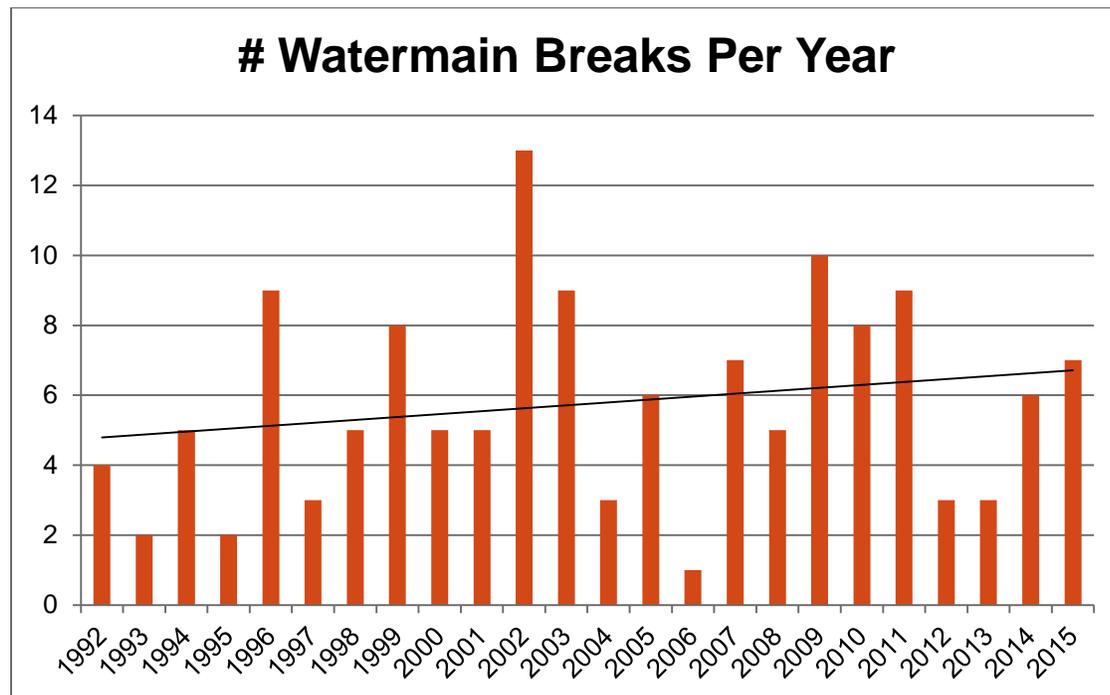
Water Main

A total of seven main breaks occurred in 2015, summarized in Table 5. **Figure 2** shows the overall downward trend for the total number of water main breaks.

Table 5 – Water Main Break Summary

Date	Location	Type of Pipe	Suspected Cause	Replacement in 20-year Capital Plan
January	Lorimer	Cast iron	Age/condition	2033
February	Hurricane	Cast iron	Age/condition	2022
February	Welland Road	Cast iron	Age/condition	2019
February	Parkdale	Cast iron	Age/condition	2034
February	Station Street	Cast iron	Age/condition	2016
March	Station Street	Cast iron	Age/condition	2016
November	Hurricane	Cast iron	Age/condition	2022

Figure 2 – Town of Pelham - Water Main Breaks



The number of breaks is generally less than the numbers experienced in the early 2000s. This is due to the replacement and rehabilitation program that has been in place. The trend line suggests the general number of breaks is increasing. The following should be noted:

In the Town of Pelham, the likelihood of breaks increases where:

- The water main pipe material is cast iron
- The diameter of the cast iron pipe is 150mm
- The normal operating pressure of the watermain is 65psi or greater

Approximately 17% of the distribution system is made up of cast iron pipe with an average age of 60 years.

The average system pressure is 71.6psi. The lowest recorded pressure in the system is 42psi and the highest is 95psi.

Table 6 shows the overall downward trend for the total remaining amounts of cast iron still in service in the system.

Table 6 – Remaining Cast Iron in Water Distribution System

Year	Approximate kilometers of Cast Iron Remaining	Approximate % Cast Iron Remaining
2010	21	26%
2011	21	26%
2012	20	25%
2013	19	23%
2014	14	17%
2015	14	17%

Booster Pumping Stations

Regular maintenance and repairs are required at our Chestnut Ridge Booster Pump Station. In 2015 these were completed by the Niagara Region through a Maintenance Agreement. The Town continues to work closely with the Region of Niagara to maintain close communication about pressure or supply interruptions related to this pumping station. Although the Town was considering assuming maintenance of this station, with advice from the Region, the Town is considering simply extending the existing operating agreement, and funding a pump replacement in 2016.

Water Filling Station

The Town of Pelham Water Operations Staff completed an upgrade to the water loading station. The magnetic strip card reader was replaced with a more secure key fob and communication system. Loading station use and account status can now be monitored in real time from Town Hall. During the upgrade the main control valve was also rebuilt by our town staff.

Minor maintenance tasks were also performed at the water loading station including backflow prevention device testing and improvements to site drainage.

7. REGION OF NIAGARA - SUPPLY

Master Servicing Plan

The Region of Niagara's Master Servicing Plan continues to be a regularly referenced document. Input is being provided by staff to the consulting group updating the MSP.

Letters of Understanding

As a result of discussions with several local municipalities and the Region, the Region is proposing that the Letters of Understanding (LOUs) between the Region, as supplier of treated drinking water, and each local municipality, as receiver of the drinking water, be reviewed and updated. The LOU is a critical document that is relied upon in the Drinking Water Quality Management System, as it defines the scope, quality and service requirements for the drinking water received into the Town system.

8. MONITORING AND IMPROVEMENT INITIATIVES

In 2015, staff continued to place an increased emphasis on proactive measures to ensure the Town's continued ability to efficiently deliver safe drinking water.

Town Of Pelham Water Distribution Operators are engaged in new self-directed research and program implementation initiatives including Water Loss Management, Frozen Water Service Procedures, improving the Hydrant Maintenance Program and Water Sampling.

Backflow Prevention

The Ontario Building code requires backflow prevention devices to be installed at each connection to new buildings where a potentially severe health hazard may be caused by backflow. The Town relies on the change in Building Code to ensure that backflow preventers are installed in new buildings.

In addition, the MOECC has recommended in their annual compliance audit the following:

"The Town is encouraged to provide education and outreach to the owners of all existing industrial/commercial/industrial facilities and agricultural processes served by the drinking water system to educate the owners on the need for backflow prevention devices installation and testing. The Town is also encouraged to create a backflow prevention program for existing facilities as resources become available. "

Staff are considering this recommendation.

Leak Detection

Town staff continues to monitor for leaks when maintaining hydrants and valves. A full Leak Detection Program and Water Audit were last completed in 2013. The system was given an International Leak Index (ILI) score of 1.76 which indicates the Town has been diligent in minimizing water loss.

The 2016 budget includes funding for continuing the leak detection program on remaining cast iron.

Hydraulic Water Mode

Detailed discussions to create a distribution system model for the Town's water system were initiated, with budgetary needs integrated into the 2016 operating budget.

An up-to-date computer model of the Town's water infrastructure can accurately calculate and show how the system operates under all types of conditions. This is likely the most powerful engineering tool available to water staff. The water model can be used to:

- enhance sampling programs,
- study chlorine residual loss,
- evaluate risk and vulnerability
- plan and improve each system's hydraulic performance,
- assist with pipe, pump, and valve placement and sizing,
- perform fire flow analysis, and
- train staff.

9. MUNICIPAL DRINKING WATER LICENSING PROGRAM

The Municipal Drinking Water Licensing Program is a five-stage initiative by the MOECCCC under the Safe Drinking Water Act, 2002. The Town of Pelham maintains its Certificate of Accreditation as an Operating Authority for its water distribution system, and the system license and permit are in place. Table 7 lists the status of the key elements for water licensing.

Table 7 – Municipal Drinking Water Licensing Program Progress

Stage	Status
License	Active and current - Expires July 24, 2019 (originally issued Sept 21 2009)
Permit	Active and current – no expiry (originally issued Sept 17 2009)
Operational Plan	Revision Dec 2013 - to be updated in 2016 (including supporting procedures and forms)
Accreditation	Maintained full accreditation, following an on-site verification audit by NSF in May 2015 - This accreditation certificate expires May 24, 2018
Financial Plan	Updated in 2014, covering 2014 – 2020 inclusive.

10. QUALITY MANAGEMENT SYSTEM

The Quality Management System (QMS) is fully integrated into Water operations, and maturing and improving with time.

Council should remain aware of its commitments in the QMS Policy, which is the framework upon which to set the QMS. It is anticipated that this Policy will be revised in 2016.

It will be the policy of the Town of Pelham to adopt a Quality Management System, that is appropriate for the size and type of the Pelham Distribution System, includes a commitment to the maintenance and continual improvement of the Quality Management System, a commitment to the consumer to provide safe drinking water, a commitment to comply with applicable legislation and regulations and is in a form that provides for ready communication to all Operating Authority personnel, the Owner and the public. In addition, Council must be fully aware of the Operational Plan and its principles. The Operational Plan is the overall guide to the QMS, like a road map to the system that describes how the Water Department performs all the activities described in this summary report. Many of the items covered in this report are managed under QMS processes, and are monitored and improved upon based on initiatives in the QMS.

The current Operational Plan is available through the network or in printed copies at select locations.

Changes that occurred to the plan in 2015/2016 include;

- Emergency procedure and contact updates
- Updates to the risk assessment
- Updates to the trending databases
- Updates to entire procedure and SOP documents

Infrastructure Review

Infrastructure review is a required component of the DWQMS, where infrastructure includes piping and related infrastructure, but also buildings, workspace, process equipment, hardware, software, and supporting services such as transport or communication. The purpose of the review was to assess the adequacy of the infrastructure necessary to operate and maintain the water system.

In 2015, the Director of Public Works and Manager of Public Works completed a basic version of the annual review of infrastructure needs during the budget and capital

planning process, in accordance with the Town's Operational Plan. Recommendations were translated accordingly into the 2016 water operational and capital budgets and 20-year Capital Plan updates.

Management Review

Management review is a required component of the DWQMS. The Management Review for 2015 is overdue, pending major updates to the QMS. The results of the Management Review will be forwarded to Council when complete.

APPENDIX A

Quality Management System
Certificate of Accreditation

APPENDIX B

Quality Management System Policy