CITY OF HAMILTON
PUBLIC WORKS DEPARTMENT
Hamilton Water Division

TO:	Chair and Members Public Works Committee
COMMITTEE DATE:	November 16, 2015
SUBJECT/REPORT NO:	Corrosion Control Program for the Woodward Drinking Water System (DWS) (PW15079) - (City Wide)
WARD(S) AFFECTED:	City Wide
PREPARED BY:	Dan McKinnon (905) 546-2424, Extension 5941 Andrea Bazzard (905) 546-2424, Extension 5605
SUBMITTED BY: **SIGNATURE:**	Gerry Davis, CPA, CMA General Manager Public Works Department

RECOMMENDATION

(a) That the General Manager of Public Works be authorized and directed to implement corrosion control within the Woodward Drinking Water System (DWS) using a phosphate-based treatment approach with orthophosphate as the method for corrosion control (phosphoric acid as the treatment additive);

(b) That Capital Project ID 5141666110 in the amount of $4.95 Million be approved for the design and construction of a chemical addition, storage and metering facility at the Woodward Water Treatment Plant, including $2 Million WIP funding from Project 5141166110 (planned process upgrades at the Woodward facility);

(c) That the Water Operating Budget Forecast be increased by $310,000 in 2018 to support the annual ongoing cost of the Corrosion Control Program (substantially for purchase of the chemical);

(d) That the General Manager of Public Works be directed to develop and implement an Outreach Plan for the users of the Woodward DWS respecting the Corrosion Control Program;

(e) That one temporary Full-time Equivalent (FTE) be added to the Hamilton Water complement for a two year period to support the implementation and monitoring associated with the Corrosion Control Program, anticipated to occur between 2016 – 2019;

(f) That a one-time increase of $250,000 be added to the Water Operating Budget Forecast in 2018 to support preparation of the Woodward DWS for chemical addition.

EXECUTIVE SUMMARY

The purpose of this report is to obtain approval to implement the Corrosion Control Program (CCP) for the City of Hamilton which is required under Ontario Regulation 170/03 (O. Reg. 170/03), made under the Safe Drinking Water Act, 2002. These requirements are intended to improve the quality of water received by the end user specifically reducing lead concentrations at the tap to below the allowable limit of 10 µg/L as defined in the ODWQS. The regulation prescribes that if more than 10 percent of collected samples for two or more consecutive sampling programs as part of the Legislated Community Lead Sampling Program exceed the Ontario Drinking Water Quality Standard (ODWQS) for lead of 10 ppb (parts per billion), or 10 µg/L, a Corrosion Control Plan is required to be submitted to the Ontario Ministry of Environment and Climate Change (MOECC). The City's Corrosion Control Plan, approved by the MOECC in 2010, involves the implementation of a phosphate-based treatment approach for corrosion control where orthophosphate will be introduced into the DWS in small doses in the form of food-grade phosphoric acid.

The City of Hamilton conducted its Legislated Community Lead Sampling Program for the Woodward DWS and the communal well systems between 2008 and 2009. The results of the sampling program for the Woodward DWS identified that greater than 10 percent of tap water samples collected from residential and non-residential plumbing systems ("at the tap") exceeded 10 micrograms per litre (µg/L) in all four sampling rounds and as such the MOECC required the City of Hamilton to prepare and submit a Corrosion Control Plan for the Woodward DWS. The sampling program for the communal well systems revealed samples results below the threshold and therefore no Corrosion Control Plan was required for these systems.

A comprehensive analysis of lead reduction strategies and treatment alternatives was undertaken as a component of the City's Corrosion Control Plan which included a thorough review of the occurrence of lead measured at the tap, the number of lead services remaining in the system, the cost associated with lead service line (LSL) replacement and the experience of other municipalities with similar water quality conditions. Based on the results of the review a phosphate-based treatment approach was identified as the most optimal solution for corrosion control in the Woodward DWS.

Hamilton Water retained the services of WSP Group Inc. to conduct a Corrosion Control Pilot Study, which was subsequently peer reviewed by CH2M Hill to ensure that the most appropriate phosphate-based additive was chosen to address the corrosion issue in Hamilton. The results of this work recommended that the City proceed to full-scale implementation with orthophosphate for corrosion control, using phosphoric acid as the source additive.

Orthophosphate is an effective corrosion inhibitor as it forms a thin protective coating on lead surfaces. This coating helps reduce corrosion and the leaching of lead from surfaces in contact with drinking water. The additional phosphate that will be introduced into the DWS as part of the CCP will represent only a small fraction of phosphate in the Canadian diet where phosphate is found in many foods, including dairy and meat products. To put this into perspective, an average person would need to drink more than 330 glasses of tap water to get the same amount of phosphate that is present in one glass of milk[1].

There is currently substantial evidence that exposure to even small amounts of lead can be harmful to human health, especially in infants, young children and pregnant women (impacts to fetus). There is no recommended level of lead ingestion that is considered safe. While there are multiple potential exposures to lead in the community, the implementation of the CCP will decrease the risk of exposure through corrosion of drinking water pipes and is a system-wide approach that will benefit all Hamilton residences.

As outlined in the Corrosion Control Plan and approved by the MOECC, Hamilton Water recommends that in compliance with Schedule 15.1 of O. Reg 170/03 City Council approve the recommendations in this report.

Alternatives for Consideration - See Page 12

FINANCIAL - STAFFING - LEGAL IMPLICATIONS

Financial: The capital budget for the full-scale corrosion control chemical addition, storage and metering facility at the Woodward WTP, Project ID 5141666110, is estimated to be $4.95M. This includes $2M WIP funding from previously approved Project 5141166110 (planned process upgrades at the Woodward facility);

The pre-implementation costs are expected to occur between 2016-2018 and are estimated as follows:

- $97,000 annually for 1 temporary FTE (for a period of 2 year) in Compliance and Regulations (salary, benefits and other costs) for the purposes of baseline testing and ongoing monitoring associated with the implementation of the Corrosion Control Program;
- $10,000 annually for laboratory analysis associated with the baseline testing, implementation and ongoing monitoring;

The post-implementation annual costs for operation and sustainability of the program, commencing in 2018, are estimated as follows:

- $10,000 annually for laboratory analysis associated with implementation and ongoing monitoring;
- $300,000 annually for chemical addition;
- One time increase of $250,000 will be required in the 2018 Operating Budget to support flushing the distribution system.

These annual costs will remain within the Annual Water Rate supported budget.

Staffing: Hamilton Water will require the addition of 1 temporary FTE for a duration of 2 years for baseline testing and ongoing monitoring associated with the implementation of the Corrosion Control Program which is anticipated to occur between 2016-2018

Potential increases in staffing needs in the Hamilton Water Customer Contact Centre will be addressed on an as-needed basis and are not expected to require an increase in complement.

Legal: The recommendations of this report are in response to the legal requirements set forth by the MOECC in Schedule 15.1 of O. Reg. 170/03 made under Safe Drinking Water Act, 2002. This regulation, and specifically this Schedule, seeks to improve the safety of drinking water as it relates to the presence of lead in drinking water. O. Reg. 170/03 makes it mandatory for the City to have a Corrosion Control Plan which meets the requirements of Schedule 15.1. All owners of the municipal drinking water systems and every person who on behalf of the municipality oversees the operating authority of the system, including members of Council, or exercise decision-making authority over the system have a legal obligation to meet the standard of care requirements under the Safe Drinking Water Act, 2002. The recommendations in this report fulfil the legal obligations as outlined above.

HISTORICAL BACKGROUND

In 2007, the MOECC amended O. Reg. 170/03, made under the Safe Drinking Water Act, 2002, which required municipalities to conduct a community sampling and testing program for lead. The intent of this program was to determine if lead was present in the drinking water, at the tap, at levels that may pose a health concern to the community.

Elevated lead may be present in tap water within older buildings, primarily as a result of the corrosion or deterioration of materials containing lead that may be found in water service lines and internal plumbing. The most common sources of lead are lead water services (generally used to service homes built before 1955), lead-based solder used to join copper pipe within the house plumbing (a common practice until the late 1980s), and fixtures/faucets made of brass and chrome-plated brass with a higher lead concentration than current standards.

Health Canada has established a maximum acceptable concentration (MAC) of lead in drinking water of 10 ppb (parts per billion), also referred to as 10 µg/L, in a free flowing sample of water. This is also the limit prescribed for lead under O. Reg. 169/03, made under the Safe Drinking Water Act, 2002, (Ontario Drinking Water Quality Standards).

The City conducted sampling and testing for lead in drinking water as part of its Legislated Community Lead Sampling Program which consisted of four sampling events

between 2008 and 2009 where a total of 448 residential and non-residential samples were collected from the tap and 91 samples from the distribution system.

The results of the sampling program identified that no samples from the distribution system exceeded the ODWQS of 10 µg/L. However, results of the four sampling rounds showed that 16%, 33%, 11% and 34%, respectively, of samples taken from residential and non-residential plumbing systems ("at the tap") within the Woodward DWS exceeded 10 µg/L. As such, the City was required under O. Reg 170/03 to prepare and submit a Corrosion Control Plan for the Woodward DWS to the MOECC.

Hamilton Water retained the services of CH2M Hill to investigate the occurrence of corrosion in the City's Drinking Water System and to prepare a Corrosion Control Plan for submission to the MOECC in compliance with O. Reg 170/03. CH2M Hill is a global, full service consulting firm that provides design, construction and operations services globally for the water industry and is very experienced with corrosion control programs in a variety of forms. Following the completion and submission of the Corrosion Control Plan in 2010, Hamilton Water then retained WSP Group Inc. to fulfil the recommendations of the Corrosion Control Plan and conduct a Corrosion Control Pilot Study to evaluate alternatives for corrosion control and develop design conditions. Subsequently CH2M Hill was retained to peer review the pilot study results and prepare a series of technical memorandums in support of the recommendations from and implementation of the Corrosion Control Plan.

The work completed to date, in support of the Corrosion Control Plan, ensured regulatory compliance of the DWS by way of a thorough assessment of the DWS concerns, review and comparison of potential corrosion control alternatives and ensured that the most appropriate recommendation was being made for corrosion control within the City of Hamilton.

POLICY IMPLICATIONS AND LEGISLATED REQUIREMENTS

The recommendations of this report are consistent with the Corporate Budget Policy - Budgeted Complement Control Policy for the increase of one temporary FTE, Laboratory Technician.

The recommendations in this report are as a result of work completed as required under the Safe Drinking Water Act (2002) and O. Reg. 170/03. The results of the Legislated Community Lead Sampling Program for the Woodward DWS exceeded the legislated requirements (greater than 10% of tap water samples exceeding 10 µg/L in two or more consecutive sampling rounds), and as such the MOECC required the City of Hamilton to prepare, submit and implement a Corrosion Control Plan for the Woodward DWS.

The MOECC requirements are intended to improve the quality of water received by the end user specifically reducing lead concentrations at the tap to below the allowable limit of 10 µg/L as defined in the ODWQS.

RELEVANT CONSULTATION

The following City Departments have reviewed this report and are supportive of the pertinent content:

Public Health Services Department: Health Protection Division

Corporate Services Department: Finance, Administration & Revenue Generation

City Manager's Office: Legal Services

ANALYSIS AND RATIONALE FOR RECOMMENDATION

Health Related Concerns of Lead

There is currently growing evidence that exposure to even small amounts of lead can be harmful to human health, especially in infants, young children and pregnant women (impacts to fetus). Lead primarily impacts the brain, kidneys and bones. Some of the symptoms of lead exposure include forgetfulness, tiredness, headaches, changes in mood and behaviour, lower IQ, an increased risk of developing kidney disease, anaemia and future risk of osteoporosis in children exposed to lead.[3] Board of Health Report BOH07049 explains the sources and health effects of lead.

There is no recommended level of lead ingestion that is considered safe. While there are multiple potential exposures to lead in the community (e.g., lead paint, old industrial sites, old water pipes) steps can be taken on a community-level to decrease the risk of exposure through corrosion of drinking water pipes. This systems-wide approach will benefit all Hamilton residences.

Legislated Community Lead Sampling Program

The City conducted its Legislated Community Lead Sampling Program which consisted of four sampling events between 2008 and 2009 where a total of 448 residential and non-residential samples were collected from the tap and 91 samples from the distribution system.

The results of the sampling program confirmed that all samples taken from the distribution system did not exceed 10 µg/L, which illustrates that the City's drinking water supply consistently meets the ODWQS for lead. However, the residential and non-residential samples taken at the tap within the Woodward DWS revealed that 16%, 33%, 11% and 34% of the samples from the four sampling events, respectively, exceeded the ODWQS for lead. These results indicate that the presence of lead at the tap is not due to concentrations in the source water, treated water or the distribution system, but are present due to corrosion occurring between the distribution system and the premise plumbing (pipes that go from the distribution system into the home).

Since greater than 10% of samples taken from residential and non-residential plumbing systems within the Woodward DWS exceeded 10 µg/L in all four sampling rounds the MOECC required the City of Hamilton to prepare and submit a Corrosion Control Plan for the Woodward DWS.

Corrosion Control Plan

The *Corrosion Control Plan for the Woodward Sub-System within the City of Hamilton's Drinking Water System* (CH2M Hill, 2010) was submitted for review and approval to the MOECC in 2010 for compliance with Schedule 15.1 of O. Reg 170/03 in 2010. The Corrosion Control Plan investigated the occurrence of corrosion in the City of Hamilton's (City's) Drinking Water System and addressed the following requirements of Schedule 15.1:

i. Assessment of Corrosion in the City's Water System
ii. Development of Alternative Corrosion Control Measures and Their Evaluation
iii. Identify the Preferred Measure for Corrosion Control
iv. Implementation Plan and Post-Implementation Monitoring

Analysis of Lead Reduction Strategies

Lead Source Reduction

Although it is difficult to determine with complete certainty, staff believe there to be approximately 20,000 lead service lines (LSLs) in the Woodward DWS. Currently the City replaces lead services as part of a Lead Service Line Replacement Program or through capital renewal at a rate of approximately 500-800 LSLs per year. At the City's current replacement rate it will take anywhere from 25 to 40 years to complete LSL replacements. Although the City may replace the public side of these LSLs the homeowners are not obligated to replace the private portion of the LSL which is located on private property. While the City currently has a loan program to assist homeowners who wish to replace the private portion of the LSL, historical participation in the loan program suggests that the program itself may not be an effective incentive therefore it must assume that in some instances the LSLs will only be partially replaced. Additionally, the replacement of the water service does not reduce the influence of lead containing appurtenances within a buildings plumbing and therefore LSL replacement is not the most effective method for lead reduction.

The Corrosion Control Plan (CH2M Hill, 2010) identified that, based on the experience in other jurisdictions with similar water quality; the effect of partial LSL replacement on lead levels at the tap is variable. The data varied widely but confirmed that i) the degree of lead reduction achieved following either a partial or full LSL replacement is variable, and that ii) better lead reduction is achieved following a full LSL replacement than a partial LSL replacement.

For the purpose of estimating the benefits of full and partial LSL replacement, it is assumed that partial LSL replacement is not expected to reduce tap water lead concentrations to below the ODWQS at all sites. Some benefit will be realized by partial LSL replacement, however, the benefit is not expected to be consistent and it is therefore unlikely that partial LSL replacements will reduce lead to levels low enough for compliance of the system as a whole. With LSLs only partially replaced on some occasions, a lead source reduction strategy alone is not anticipated to bring the City into compliance with O. Reg. 170/03, Schedule 15.1.

Corrosion Control Treatment Options

In addition to lead source reduction, treatment alternatives were identified in the Corrosion Control Plan as a method for corrosion control. A thorough analysis of treatment options was conducted based on lead solubility theory and information available in the literature as well as experience from other municipalities with similar water quality. The alternatives considered were as follows:

i. Upward pH adjustment (lime, sodium hydroxide, potassium hydroxide)
ii. Downward pH adjustment (sulphuric acid, carbon dioxide)
iii. Phosphate-based Inhibitors (phosphoric acid, sodium phosphate, potassium phosphate, polyphosphate blends, orthopolyphosphate blends)

The comprehensive list of alternatives was reduced to a representative short list based on prevalent use elsewhere on the Great Lakes, an appreciation for chemical costs, compatibility with the City's treatment works, and suitability for the City's water quality. For each treatment alternative, the following was identified:

- Treatment objectives (e.g., pH, dissolved inorganic carbon, alkalinity, phosphate residual)
- Water quality conditions suitable for application of the control measure
- Expected performance based on results from other municipal supplies with similar water quality
- Implementation needs
- Capital and operating costs

Following a thorough analysis of treatment-based measures for corrosion control, four alternatives were selected for further evaluation that employs phosphate-based inhibition (using phosphoric acid with and without pH adjustment and using a blended phosphate product with and without pH adjustment). Based on lead control theory and experience from analogous systems, only phosphate-based measures were carried forward to the shortlist of alternatives for more intensive investigation. The alternatives using sodium hydroxide or potassium hydroxide were eliminated from consideration due to potential secondary impacts to the DWS and performance with respect to controlling lead. The results of the desktop analysis identified phosphate-base inhibition (using phosphoric acid or orthopolyphosphate) as the preferred treatment alternative.

Hamilton Water retained the services of WSP Group Inc. to conduct a Corrosion Control Pilot Study, which was subsequently peer reviewed by CH2M Hill to ensure that the most optimal phosphate-based additive was chosen to address the corrosion issue in Hamilton. The results of this work recommended that the City proceed to full-scale implementation with orthophosphate for corrosion control, using phosphoric acid as the source additive.

Preferred Option for Corrosion Control

Chemical-based treatment, with optimization, is expected to bring the Woodward DWS into regulatory compliance by managing lead concentrations at the tap. If all sources of lead are eliminated from the system, then corrosion control by lead source reduction would be feasible. However, based on the number of LSLs in the DWS and typical

rates of participation from homeowners to replace the private portion of the LSL, it is unlikely that using lead source reduction alone will bring the DWS into compliance.

Based on a comprehensive review of the occurrence of lead measured at the tap, the number of lead services remaining in the system, the cost associated with LSL replacement and the experience of other municipalities with similar water quality conditions, a phosphate-based treatment approach by means of orthophosphate, using phosphoric acid as the treatment additive, was recommended for corrosion control for the City of Hamilton.

Human Health Impact and Benefit of Phosphate-Based Corrosion Control Treatment

Phosphorus is an essential mineral primarily used for growth and repair of body cells and tissues. All body cells contain phosphorus. Structurally it is found in bones and teeth, functionally it is required for a variety of biochemical processes including energy production and pH regulation[2.]

Orthophosphate is an effective corrosion inhibitor as it forms a thin protective coating on lead surfaces. This coating helps reduce corrosion and the leaching of lead from surfaces in contact with drinking water. As part of Hamilton's CCP, orthophosphate will be introduced into the DWS in small doses in the form of food-grade phosphoric acid, which is a clear, odourless liquid. By comparison, this represents only a small fraction of phosphate in the Canadian diet where phosphate is found in many foods, including dairy and meat products. To put this into perspective, an average person would need to drink more than 330 glasses of tap water to get the same amount of phosphate that is present in one glass of milk[1.]

A literature summary conducted by Marie McKeary (McMaster Institute for Healthier Environments, 2015) on behalf of Hamilton Public Health Services and referenced in this report identified the following:

> *"No scientific studies were found during the literature review which documented adverse health impacts for humans specifically, from the addition of phosphorous based chemical inhibitors to drinking water in order to achieve corrosion control. The amounts generally added are very small and spread over a large volume of water and the health benefit from lead reduction is much greater in comparison. In terms of the City of Hamilton municipal water supply and according to the water system operators at Hamilton Water, it would appear the amount of chemical inhibitor recommended by their consultants is in line with general industry practice and overall, would be only one source within a multiplicity of phosphate sources consumed by individuals on a daily basis."*

Reducing the opportunity for lead to leach into the drinking water from lead service lines, interior plumbing and lead bearing water fixtures will reduce lead intake amongst the whole population who receive their drinking water from the Woodward DWS.

Implementation Plan

Outreach Plan

In consultation with Public Health Services, Hamilton Water will inform various stakeholders of the details of the CCP, the health risks of lead exposure and the benefits of corrosion control. The stakeholders will include residential, commercial, industrial and institutional customers as well as other water systems supplied by Hamilton Water (Haldimand County and Halton Region).

The following outreach plan will be implemented by Hamilton Water prior to full-scale implementation:

Outreach Activity	Timeline
Web Page	November 2015
Question and Answer Document	November 2015
Staff Briefing	
Hamilton Water	3*
Customer Contact Centre	3*
Direct Letter:	
Residential	3*
Commercial/Industrial	6 & 12*
Institutional	6 & 12*

**months prior to implementation*

Capital Program

The corrosion control chemical addition system at the Woodward WTP will consist of tanks for chemical storage and chemical metering pumps that will add phosphoric acid (as the source of orthophosphate) to treated water prior to entering the distribution system. Phosphoric acid will initially be added at a concentration of 3 mg/L as PO_4 (phosphate), with the opportunity to vary the amount between 1 to 5 mg/L as PO_4 (phosphate) during the optimization process. The maintenance chemical dose will be determined following full-scale implementation, however, may be as low as 1 to 2 mg/L as PO_4 (phosphate). The optimal dose will be determined by monitoring the water quality in the system to ensure that sufficient residual phosphate is present to maintain the protective coating on the lead surfaces and also ensuring that the water quality of the system continues to meet the ODWQS. The results from post-implementation monitoring will be used to adjust the dose to optimize corrosion control within the distribution system with the ultimate goal of reducing lead concentrations to below the MAC.

The estimated capital cost for a full-scale corrosion control chemical addition, storage and metering facility at the Woodward WTP is estimated to be $4.95M. Preliminary design of the Capital Works program will begin in 2016 and construction is estimated to be completed by 2018.

Monitoring Plan

A monitoring program will be developed to support the full-scale implementation of the corrosion control chemical addition to the City's DWS. The monitoring strategy will assess water quality in the DWS and the impacts of performance of corrosion control with respect to facility operations at the Woodward Treatment Plant. The purpose of monitoring is to assess orthophosphate use and its performance in the system for lead control and potential secondary impacts. The monitoring plan will include sampling parameters, locations, frequency, and methods for treated water (entry point), the distribution system and lead sampling.

Hamilton Water will routinely analyze results to determine when dose adjustments can be made, to allow a transition from an initial dose strategy to a maintenance dose strategy. An enhanced monitoring plan will remain in effect until lead levels at the tap meet ODWQS and then be transitioned down to a routine monitoring plan.

Hamilton Water intends to begin baseline monitoring in Q4 2016 and will require a 2 year temporary FTE to assist with the monitoring and sampling program during full-scale implementation. Baseline monitoring will require additional sampling throughout the distribution system that will provide an understanding of and the ability to manage the changes to the system that will occur during the implementation phase. Monitoring of lead concentrations at the tap will be incorporated into the monitoring plan once the system has stabilized. The details of the monitoring program are to be determined upon approval of the CCP.

Distribution Plan

Staff have determined that upon activation of a treatment system that adds a corrosion control chemical to City drinking water, a robust flushing program may be undertaken to uniformly distribute the treated water throughout the distribution system. As part of this flushing program, some localized water quality issues can be expected, such as the development of cloudy or rusty water as well as possible taste and odour complaints. These water quality issues are a normal part of the corrosion control process and they can be controlled by flushing the affected areas. During this phase of the program Hamilton Water will ensure additional staff are available to respond to these events should they occur and homeowner response to these issues will be provided through the Outreach Plan.

In 2016 Hamilton Water will initiate a Corrosion Control Best Practices Study. This study will engage other municipalities that have implemented a treatment solution for corrosion control and have them provide information about the scope of their flushing programs, the resources that were required to manage the program and deal with any abnormal water quality, and any specific lessons learned that will help the implementation in Hamilton go as smoothly as possible. It is anticipated that this study will be completed by the end of 2016.

ALTERNATIVES FOR CONSIDERATION

Lead Source Reduction Program for Full LSL Replacement

Although it is difficult to determine with certainty, staff believe there to be approximately 20,000 lead service lines (LSLs) in the City's DWS. After analysis of internal corrosion problems and sources of contamination in the City of Hamilton it is anticipated that partial LSL replacement may not bring all sites into compliance with O. Reg. 170/03, Schedule 15.1. So it is assumed that full, not partial, LSL replacement is required in order to realize the full benefits of LSL replacement and to reduce lead levels below the regulated standard.

As shown in Table 1, if complete replacement of LSLs was conducted over a 15 year timeframe, with a generous grant program for residents to promote the replacement of LSLs on the private side, Hamilton Water would incur an annual cost of $9.38 million, with an overall cost of $134 million over 15 years.

Table 1: Cost Analysis for Full LSL Replacement

Estimated number of LSLs	20,000
Replacement Rate *7% per year, US EPA Benchmark* *Complete replacement within 15 years*	1400 LSL/year
Replacement Cost per LSL: Municipal Portion Private Portion *(estimate)*	 $5,000 Up to $1,700
Annual LSL Replacement Cost: Municipal Portion Private Portion	**$9,380,000** $7,000,000 $2,380,000
Total LSL Replacement Cost (over 15 years): Municipal Portion Private Portion	**$134,000,000** $100,000,000 $34,000,000

This solution is not recommended by staff as it does not provide the ultimate level of protection to residents from lead in drinking water (exposure from lead in plumbing fixtures and solder will remain), and it will not eliminate lead exposure from drinking water in a timely fashion. Additionally, this approach would create a prohibitive budget pressure that would require deferral of a significant portion of the current Water State of Good Repair renewal program or require higher than currently forecast annual rate budget increases. This alternative will also require the City to resubmit the Corrosion Control Plan for review and approval by the MOECC.

ALIGNMENT TO THE 2012 - 2015 STRATEGIC PLAN

Strategic Priority #1

A Prosperous & Healthy Community

WE enhance our image, economy and well-being by demonstrating that Hamilton is a great place to live, work, play and learn.

Strategic Objective

1.5 Support the development and implementation of neighbourhood and City wide strategies that will improve the health and well-being of residents.

1.6 Enhance Overall Sustainability (financial, economic, social and environmental).

Strategic Priority #2

Valued & Sustainable Services

WE deliver high quality services that meet citizen needs and expectations, in a cost effective and responsible manner.

Strategic Objective

2.1 Implement processes to improve services, leverage technology and validate cost effectiveness and efficiencies across the Corporation.

2.4 Ensure high quality water services are received by the community.

Strategic Priority #3

Leadership & Governance

WE work together to ensure we are a government that is respectful towards each other and that the community has confidence and trust in.

Strategic Objective

3.5 Work together with government agencies to provide a service that is of the highest standard and in the best interest of City of Hamilton and its residents.

APPENDICES AND SCHEDULES ATTACHED

None

REFERENCE

[1] McKeary, Marie (2015). *A Proposed Lead Corrosion Control Plan: A Review of Potential Health Impacts from the addition of phosphates as Chemical Inhibitors in the Drinking Water Treatment Process,* (Internal Report) Research Consultant, McMaster Institute for Healthier Environments (MIHE), McMaster University under agreement to Hamilton Public Health Services, Health Protection Branch, Hamilton, Ontario.

[2] Phosphorus Backgrounder. City of Hamilton, Public Health Services, 2015.

[3] Health Canada (2009). Lead Information Package: Some Commonly Asked Questions about Lead and Human Health. Retrieved from: http://www.hc-sc.gc.ca/ewh-semt/contaminants/lead-plomb/asked_questions-questions_posees-eng.php