4. Safeguards and Best Practices to Mitigate Risk to the Drinking Water System

The City has many safeguards in place to protect drinking water assets, both pressurized and non-pressurized. Throughout this report we will discuss the following processes, procedures and best practices that are utilized to mitigate risk to the drinking water system:

a) Managing and Maintaining Pressure in the Water Distribution System

The City has approximately 2127 kilometres of watermains that supply fresh and safe drinking water though pressurized pipes. The internal pressure is managed and maintained through a combination of gravity fed assets, pumping stations, pressure tanks, various types of valves and the Supervisory Control and Data Acquisition System (SCADA). As the contents of the pressurized assets are under a pressure that is greater than that of the outside atmosphere, pressurized assets like watermains are less vulnerable to contamination.

b) Pressure Transient Mitigation and Monitoring

A pressure transient in a drinking water pipeline is caused by an abrupt change in the velocity of water. Pressure transients commonly occur in every water system and can be caused by watermain breaks, sudden changes in demand, uncontrolled pumping, and opening or closing of fire hydrants as a few examples. Negative pressure transients create the opportunity for back siphonage or backpressure of non-potable water and other contaminants.

There is potential for intrusion of contaminants into the distribution system from pressure transients, such as low or negative pressures. The public health significance of contaminant intrusion from a pressure transient depends on the number of and/or size of the leak(s), the type of contaminant external to the distribution system and the frequency/duration/magnitude of the event. Any contaminant, chemical or microbial, exterior to the distribution system has the potential enter potable water supplies during a negative pressure event.

The City has many standard operating procedures and industry best practices in place to reduce or counteract the adverse effects of pressure transients. To assist with documenting the frequency and magnitude of pressure transient events, the City completes pressure monitoring utilizing pressure data loggers. The generation of this high-quality pressure data helps to determine the effect of routine operational practices on the distribution system, such as impact of hydrant operations, pump start-up/shut down and valve closing speed, among others. This information is considered (applied) when developing standard operating procedures to minimize low pressure events.

c) Backflow Prevention Bylaw

Contaminants may be drawn back into the City’s water distribution system during a type of backflow occurrence called back siphonage, which can be caused from a pressure drop in the City’s water distribution system, such as a watermain break. The Prevention of Backflow into the Water Distribution System of the City of Hamilton (By-Law No. 10-103) ensures that through the installation of a backflow prevention device, the drinking water quality and distribution system is protected from contaminants from industrial, commercial, institutional and multi-residential properties should backflow conditions occur.

d) Proactive Leak Detection

The phenomenon of negative transient pressures caused by water main breaks and leaks in the distribution system calls for the need to promptly identify leaks so that appropriate response actions are initiated quickly. Efforts to reduce distribution system leakage are beneficial not only from a water conservation standpoint, but to mitigate the potential for contaminant intrusion into the potable water supply.

Since the implementation of the City’s Proactive Leak Detection Program in 2019, the program has had great success in locating underground leaks and repairing them before further risk to the system occurred. To date the City has successfully proactively detected approximately 300 public and private leaks.

e) Drinking Water Quality Management System (DWQMS)

The City adheres to a number of procedures and policies that make up our Drinking Water Quality Management System (DWQMS). Drinking water contamination mitigation and intervention measures are well documented and exercised through the DWQMS. The DWQMS is a core training requirement and developmental competency for all Hamilton Water staff or staff that have a direct input on water quality (including essential suppliers and service providers).

There are two key meetings that take place annually to ensure adherence to the DWQMS: Infrastructure Review and Risk Assessment. Updates from both meetings are reviewed at the annual Top Management Review and reported to Council once a year.

A procedure named DWQMS Risk Assessment (PW-WW-P-031-001) outlines the process in which the City examines all drinking water treatment and distribution processes. Through this process, the City is able to identify relevant critical control points which are essential points in the system where there is an ability to exercise control to prevent or eliminate a drinking water hazard or reduce it to an acceptable level.

The DWQMS Risk Assessment Team examines the City’s drinking water systems to identify potential hazards that could compromise the delivery of safe drinking water. The Risk Assessment Team considers potential hazardous events and associated hazards as identified in the MECP document “Potential Hazardous Events for Municipal Residential Drinking Water Systems”, which includes sustained pressure loss. The DWQMS Risk Assessment Team runs each risk through a risk matrix which determines a risk factor. This assists in assessing the risks associated with the occurrence of hazardous events. Additionally, the Infrastructure Renewal group in Engineering Services rates the pipes across the City and identifies the areas with high risk. These high-risk areas are then prioritized for lining or replacement. Operational controls are implemented to manage risks.

f) Water Quality Sampling and Analysis

In accordance with the Safe Drinking Water Act and as outlined in the DWQMS Sampling, Testing and Monitoring procedure (PW-WW-P-013-004), to ensure the production and distribution of safe drinking water, the City completes grab sampling (collection of discrete samples representing water characteristics at a particular time), and continuous sampling. Samples are collected from approximately 111 locations in the water distribution system every month, and more than 55,000 laboratory tests are completed annually.

This sampling and analysis program ensures the quality of the City’s drinking water and identifies any situations that require action or investigation. Any laboratory tests that exceed MECP criteria for drinking water quality are immediately reported to the MECP and the City’s Public Health Services as an Adverse Water Quality Incident (Adverse Water Quality Incidents (AWQIs) and Corrective Actions, PW-WW-P-015-001) and corrective actions are implemented and documented.

g) Ministry of Environment, Conservation and Parks (MECP) Watermain Disinfection Procedure

The MECP Watermain Disinfection Procedure is a tool that outlines a risk management approach to categorize watermain breaks based on the potential for contamination. The procedure sets minimum disinfection requirements to minimize the potential for drinking water health hazards during emergency or unplanned repairs due to watermain and/or appurtenance failure.

The MECP categorizes watermain breaks based on risk of contamination as follows:

- Category 1: A watermain break with no evident or suspected contamination.
- Category 2: A watermain break with evident or suspected contamination and/or watermain repairs involving more than one pipe length (6 metres) of replacement pipe.

Contamination is typically not suspected for circumferential breaks or small leaks where pressure and flow is maintained. For all emergency watermain breaks (Category 1 and 2), the procedure dictates that the operating authority will attempt to maintain flow from the watermain break until an AIR GAP is established. Maintaining sufficient flow can help to minimize the potential for contamination. An air gap is defined as a space at the location of repair between the watermain and excavation surface that is sufficient to prevent water, soil, or any other contaminant in the excavation from contacting the watermain, fittings or appurtenances. It should be noted that Category 2 watermain breaks are rare, with less than a handful occurring per year.

Maintaining an effective disinfectant residual in all parts of the distribution system is emphasized in the procedure. For distribution system negative pressure events, the volume of the intruded water is a fraction of the water within the pipe network, so the opportunity for effective disinfection exists.

h) Procedures for Shutting Down and Recharging Watermains

The City’s internal procedure Isolation and Recharging of Watermains (PW-WW-DC-WD-P-011-006) incorporates the requirements of the MECP Watermain Disinfection Procedure while shutting down and recharging watermains. Prior to the watermain shutdown, the licensed operator performing the processes will ensure that there is an air gap to ensure no back siphonage and minimize potential contamination to the drinking water supply. In situations where maintaining an air gap is not possible or there is possible contamination, the City completes appropriate sampling upon recharging the watermain. Additionally, the City completes a chlorine residual sample each time the watermain is shutdown and recharged.

i) Excess Soils Regulation O. Reg 406/19 On-Site and Excess Soil Management

With the introduction of O. Reg 406/19 On-Site and Excess Soil Management which came into effect Jan 1, 2021, the rules and regulations around managing and re-using excess soils were strengthened to facilitate local beneficial reuse while protecting human health and the environment. Referenced in O. Reg 406/19, the MECP Rules for Soil Management and Excess Soil Standards, Section B: Excess Soil Reuse Planning includes an assessment of past uses, a sampling and analysis plan, a soil characterization report, destination assessment report and requirements of a tracking system. Any fill materials must have appropriate sampling and reporting completed and meet the soils requirements.

j) Geotechnical Investigations

For the construction of new roads and infrastructure within the right-of-way, such as underground utilities, geotechnical investigation is completed to determine the type of

soil and soil conditions. The samples are assessed through laboratory testing, soil classification, estimated permeability and soil chemical analysis. The investigation will indicate whether the soil is suitable reuse on-site or should be treated as an excess soil and include alternate disposal options consistent with O. Reg 406/19.

k) Spills Response

The City has a 24 hours per day, 7 days per week Spills Reporting Line and Spills Response Team who co-ordinate with City staff and qualitied contractors to promptly respond to spills and do everything practicable to prevent and eliminate the negative effects from a spill, including clean up and remediation. The recovery of a spilled pollutant is a top priority because the pollutants can leach into the groundwater, contaminate soil, and pose a risk to the drinking water infrastructure. The City’s specialized spills contractors are responsible for the clean-up, proper disposal of pollutants and remediation. The City’s Environmental Enforcement and Monitoring unit assesses for potential impacts to the City’s drinking water infrastructure and natural water courses. Through this collaboration, the City’s prompt and efficient spills response methodology helps to mitigate risk of soil and drinking water contamination from pollutants from spills.

l) Reservoir Cleaning & Inspection Program

The City of Hamilton maintains a regular schedule and inspection of all drinking water storage facilities, including in-ground reservoirs. Each reservoir has its own cleaning procedure and a master cleaning schedule is created at the beginning of each year as part of an overall asset management assessment workplan. On a 5-10-year rotational schedule the reservoirs are taken offline, drained, and cleaned prior to being inspected. The inspection process is carried out by third-party experts and includes inspecting the floors, walls, ceiling and expansion joints for condition and evidence of any cracks, leaks, or potential for infiltration. The inspections help ensure that any deficiencies requiring repairs are addressed before they become significant enough to adversely impact water quality.

m) Water Quality Trending and Data Review

All drinking water data is reviewed and monitored in a timely manner to ensure compliance with the Safe Drinking Water Act (SDWA) and all pertinent regulations. All data is reviewed and summarized to ensure regulatory obligations are met under the SDWA, including number of samples, and required parameters. Specific data reviews are completed as results are made available from the ISO 17025 accredited laboratory performing the analysis.

Water quality trending allows us to identify any potential decline in water quality or instability in the distribution system. Identifying poor water quality indicators enables us

to request pre-emptive flushing in areas of concern. Part of this process involves creating warning limits that serve as internal water quality indicators that prompt the laboratory to notify the Project Manager – Regulatory Monitoring immediately after analysis so appropriate actions can be taken. These include elevated heterotrophic plate counts and high ortho-phosphate results. In the event of elevated results, due diligence resampling takes place to help identify next steps. All these measures are key steps to safeguard the water quality and mitigate risk in our drinking water systems.

n) Annual MECP Drinking Water System Inspections

The Ministry of Environment, Conservation and Parks (MECP) has a comprehensive annual inspection program to help assure the public that owners and operators of drinking water systems (DWS) and owners of laboratories are fulfilling their legislated obligations. Inspections of water systems focus on source, treatment, and distribution components as well as management practices. Inspections of laboratories focus on chain of custody (the path of a sample from the time it is collected to when it is accepted by the laboratory), reporting, sample handling, subcontracting and management practices.

The DWS inspections occur between April 1st to March 31st of the following year. For Hamilton, that means that each of the five drinking water systems (e.g. Carlisle, Greensville, Freelton, Lynden, Hamilton-Woodward Subsystem and Hamilton-Fifty Road Subsystem) are inspected annually by the local MECP Inspector(s).

During an inspection at a DWS, the inspector evaluates requirements such as proper operation of the treatment system, the availability of up-to-date policy and procedures, sampling and monitoring, and proper operator certification. They also review test results and operational checks during their inspections to confirm all required activities, such as adjusting operational equipment, reporting adverse water quality incidents, and implementing corrective actions, were completed.

In order to measure individual inspection results, the MECP has established an inspection compliance risk framework based on the principles of the Inspection, Investigation & Enforcement (II&E) Secretariat and advice of internal/external risk experts. The Inspection Summary Rating Record (IRR), included as an Appendix of the inspection reports, provides the MECP, the system owner and the local Public Health Units with a summarized quantitative measure of the drinking water system’s annual inspection and regulated water quality testing performance. IRR ratings are published (for the previous inspection year) in the MECP’s Chief Drinking Water Inspectors’ Annual Report.

During an inspection at a licensed laboratory, the inspector evaluates requirements such as the availability of up-to-date policy and procedures, use of approved testing methods, quality control and assurance practices, and reporting and record-keeping practices.

In cases where the inspection identifies a problem, the inspector works with system or laboratory owners to bring them into compliance. For more serious instances of non-compliance, the inspector may issue an order or refer the matter to the MECP’s Environmental Investigations and Enforcement Branch for investigation.

The decision to refer non-compliant behaviour for investigation depends on a number of criteria, including:

- the potential impact of the non-compliance to the health of the users of the system
- the compliance history of the inspected system owner and/or operator
- how cooperative the owner/operator is
- what steps the owner and/or operator has taken or is taking to resolve the issue

The Compliance and Enforcement Regulation (O. Reg. 242/05) also requires the MECP to take mandatory action (e.g. order or referral for investigation) when a violation may compromise the safety of the drinking water.

Operational controls for how the inspections are managed and the results addressed by Hamilton Water staff are found in the following DWQMS documents:

- Legal and Other Requirements (PW-WW-P-004-004)
- BCOS + DWQMS External Regulatory and Other Communications (PW-WW-P-008-002)
- Non-conformance, Corrective & Preventative Action Process (PW-WW-P-015-002)