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|  | Ballantrae/Musselman's Lake and Stouffville Water Distribution Systems | Date Performed: 02-06-2018 & 02-14-2018 Date(s) Reviewed: 01-15-2019 01-24-2020 Revision: 5 |
| | Operational Plan Quality Management System | |
| | QMS-APP-08-01 - Risk Assessment Outcomes | |

February 6, 2018 Attendees: Rob Flindall (Director, Public Works), Peter Wyllie (QMS Representative), Laura Smit (Water/Wastewater Supervisor), Mandy Paglia (Acting Manager, Capital Projects), Matt Sullivan (Licensed Lead Hand), Peter Pound (Licensed Operator), Russ Corby (Operations Technologist), Jessica Deng (Capital Projects Co-op Student)

February 14, 2018 Attendees: Brian Kavanagh (Acting Director, Public Works), Peter Wyllie (QMS Representative), Laura Smit (Water/Wastewater Supervisor), Russ Corby (Operations Technologist)

March 19, 2018: Review of Draft by Tavares Group Consulting completed

January 15, 2019 Attendees: Brian Kavanagh (Director, Public Works), Peter Wyllie (QMS Representative), Matt Sullivan (Water/Wastewater Supervisor), Russ Corby (Operations Technologist)

January 24, 2020 Attendees: Brian Kavanagh (Director Public Works), Peter Wyllie (QMS Representative), Matt Sullivan (Water/Wastewater Supervisor), Russ Corby (Operations Technologist), Peter Pound (Licensed Operator), Chris Leney (Licensed Lead Hand)

| Activity or Process Step | Description of Hazardous Event | Description of Hazard | Control Measures | Monitoring Procedures | Response Procedures | Controllable (Yes/No) | Likelihood | Severity | Detectability | Total (CPP Threshold >= 7) | Critical Control Point (Yes/No) | Critical Control Limits |
|--|--|--|---|---|--|-----------------------------|------------|----------|---------------|----------------------------|---------------------------------|-------------------------|
| | | | | | | | | | | | | |
| Drinking Water Supply | | | | | | | | | | | | |
| Supply of Water (Quantity) From York Region <i>* Highway 48 system part of Stouffville WDS with no redundancy. Due to uniqueness of</i> | York Region owns and maintains the wells, pumps, and reservoirs required for the supply of the Town's potable water. York Region is an accredited Operating Authority and must comply with the DWQMS, including performing a risk assessment. | Microbiological: • E. Coli • Total Coliform • HPC Physical: • Colour • Turbidity • Low pressure | No control measures by the Town. York Region has communication protocols in place in the event of a failure. | York Region SCADA system Resident complaints | Water restriction by-law Isolation of distribution system Emergency response escalation procedures | Ballantrae/Musselman's Lake | | | | | | |
| | | | | | | No | 1 | 4 | 1 | 6 | No | None |
| | | | | | | Stouffville | | | | | | |
| | | | | | | No | 1 | 4 | 1 | 6 | No | None |
| *Stouffville (Highway 48) | | | | | | | | | | | | |
| No | 3 | 3 | 1 | 7 | No | None | | | | | | |

| Activity or Process Step | Description of Hazardous Event | Description of Hazard | Control Measures | Monitoring Procedures | Response Procedures | Controllable (Yes /No) | Likelihood | Severity | Detectability | Total Threshold >= 7) | Critical Control Point (Yes/No) | Critical Control Limits |
|---|--|-----------------------|------------------|-----------------------|---|------------------------|------------|----------|---------------|--------------------------|------------------------------------|-------------------------|
| <p><i>situation, this zone has been assessed separately</i></p> | <p>Failure of any of these components can create long-term adverse effects to the source, requiring York Region to stop supply on a temporary or permanent basis. Short and long-term adverse effects to the quantity of supply include, but are not limited to:</p> <ul style="list-style-type: none"> • power failures • equipment failure • well levels • scheduled & unscheduled maintenance • long-term impacts to climate change (10 years or greater) • shortfall in water supply • extreme weather events • sustained extreme temperatures • Chemical spills impacting source water • terrorist & vandalism actions • sustained pressure loss | | | | <p>Emergency supply of bulk water (bottled, trucks, etc.)</p> | | | | | | | |

| Activity or Process Step | Description of Hazardous Event | Description of Hazard | Control Measures | Monitoring Procedures | Response Procedures | Controllable (Yes/No) | Likelihood | Severity | Detectability | Total (CPP Threshold >= 7) | Critical Control Point (Yes/No) | Critical Control Limits |
|--|--|--|--|--|---|-----------------------------|------------|----------|---------------|-------------------------------|------------------------------------|-------------------------|
| | | | | | | | | | | | | |
| Supply of Water (Quality) from York Region | <p>The York Region owns and maintains the primary and secondary disinfection equipment required for the Town to meet MECP water quality standards.</p> <p>York Region is an accredited Operating Authority and must comply with the DWQMS, including performing a risk assessment.</p> <p>Failure of any of these components can create adverse effects to water quality. Adverse effects to water quality of the supply include, but are not limited to:</p> <ul style="list-style-type: none"> power failures equipment failure loss of secondary disinfection well levels scheduled & unscheduled maintenance long-term impacts to climate change (10 years or greater) extreme weather events sustained extreme temperatures Chemical spills impacting source water terrorist & vandalism actions sustained pressure loss | <p>Microbiological:</p> <ul style="list-style-type: none"> E. Coli Total Coliform HPC <p>Physical:</p> <ul style="list-style-type: none"> Colour Turbidity <p>Chemical:</p> <ul style="list-style-type: none"> List contained in O. Reg 169/03 | <p>No control measures by the Town.</p> <p>York Region has communication protocols in place in the event of a failure.</p> <p>York Region has source water protection plan in place to assess long- term supply requirements</p> | <p>Region SCADA system</p> <p>Routine water quality sampling. Not all parameters sampled on a regular basis</p> <p>Resident complaints</p> | <p>Isolation of distribution system</p> <p>Emergency response escalation procedures</p> <p>DWA or BWA as determined by the Medical Officer of Health</p> <p>Emergency supply of bulk water (bottled, trucks, etc)</p> <p>Temporary suspend lake-based supply (Stouffville WDS only)</p> | Ballantrae/Musselman's Lake | | | | | | |
| | | | | | | No | 1 | 4 | 1 | 6 | No | None |
| | | | | | | Stouffville | | | | | | |
| | | | | | | No | 1 | 5 | 1 | 7 | No | None |

| Activity or Process Step | Description of Hazardous Event | Description of Hazard | Control Measures | Monitoring Procedures | Response Procedures | Controllable (Yes /No) | Likelihood | Severity | Detectability | Total (CPP Threshold >= 7) | Critical Control Point (Yes/No) | Critical Control Limits |
|---|--|---|------------------|---|---|-----------------------------|------------|----------|---------------|-------------------------------|------------------------------------|-------------------------|
| Distribution System Infrastructure | | | | | | | | | | | | |
| Distribution Piping, Valves and Appurtenances – Mechanical Failure | Mechanical failure of distribution system appurtenances can create adverse effects to water quantity and quality. Adverse effects include, but are not limited to: <ul style="list-style-type: none"> • scheduled & unscheduled maintenance • extreme weather events • sustained extreme temperatures • terrorist & vandalism actions • sustained pressure loss | Routine and Unplanned repairs always pose a risk of: Microbiological: <ul style="list-style-type: none"> • E. Coli • Total Coliform • HPC Physical: <ul style="list-style-type: none"> • Colour • Turbidity Chemical: <ul style="list-style-type: none"> • List contained in O. Reg 169/03 | None | Routine inspection Resident complaints Redundancy (localized issue) Preventative Maintenance program Lifecycle replacement | Adverse Water Quality Standard Operating Procedure MECP Disinfection Procedure | Ballantrae/Musselman’s Lake | | | | | | |
| | | | | | | No | 1 | 2 | 2 | 5 | No | None |
| | | | | | | Stouffville | | | | | | |
| | | | | | | No | 3 | 2 | 2 | 7 | No | None |
| Distribution Piping, Valves and Appurtenances – Tuberculation and sedimentation | Tuberculation and sedimentation can create adverse effects to water quantity and quality. Adverse effects include, but are not limited to: <ul style="list-style-type: none"> • scheduled & unscheduled maintenance | Microbiological: <ul style="list-style-type: none"> • Biofilm • Iron eating bacteria • Total Coliform Physical: <ul style="list-style-type: none"> • Turbidity • Colour • Solids (suspended or dissolved) | None | Routine water quality sampling | Pipe cleaning (i.e. flushing) Asset management (i.e. replacement or rehabilitation of iron pipe) | Ballantrae/Musselman’s Lake | | | | | | |
| | | | | | | No | 3 | 2 | 3 | 8 | No | None |
| | | | | | | Stouffville | | | | | | |
| | | | | | | No | 3 | 2 | 3 | 8 | No | None |

| Activity or Process Step | Description of Hazardous Event | Description of Hazard | Control Measures | Monitoring Procedures | Response Procedures | Controllable (Yes/No) | Likelihood | Severity | Detectability | Total (CPP Threshold >= 7) | Critical Control Point (Yes/No) | Critical Control Limits |
|---|---|--|--|---|--|-----------------------------|------------|----------|---------------|-------------------------------|------------------------------------|-------------------------|
| | | | | | | | | | | | | |
| Distribution Piping, Valves and Appurtenances - Nitrification | Nitrification can create adverse effects to water quality. Adverse effects include, but are not limited to: <ul style="list-style-type: none"> • scheduled & unscheduled maintenance • sustained extreme temperatures | Chemical: <ul style="list-style-type: none"> • Nitrogen containing compounds | High dosage of chlorine from Region of York Monitoring of residuals | Monitor and maintain system, nitrification should not form. | Free chlorine disinfection Swabbing Flushing Maximum acceptable concentration (MAC) outlined in O. Reg 169/03. Town initiates response at half the maximum acceptable concentration | Ballantrae/Musselman's Lake | | | | | | |
| | | | | | | Yes | 1 | 3 | 3 | 7 | Yes | 5 mg/l |
| | | | | | | Stouffville | | | | | | |
| | | | | | | Yes | 1 | 3 | 3 | 7 | Yes | 5 mg/l |
| Pressure Reducing Valve | Pressure reducing valves are required between Stouffville Zones 2 & 3 to ensure high pressure does not cause damage to the water distribution system or private plumbing. <ul style="list-style-type: none"> • scheduled & unscheduled maintenance • terrorist & vandalism actions • sustained pressure loss | Physical: <ul style="list-style-type: none"> • Turbidity • Colour • Property damage (high pressure) | Preventative maintenance Lifecycle replacement | Monthly inspection of Zone 3 | Repair/ replacement of PRV | Ballantrae/Musselman's Lake | | | | | | |
| | | | | | | N/A | | | | | | |
| | | | | | | Stouffville | | | | | | |
| | | | | | | No | 1 | 2 | 3 | 6 | Yes | 100psi |

| Activity or Process Step | Description of Hazardous Event | Description of Hazard | Control Measures | Monitoring Procedures | Response Procedures | Controllable (Yes/No) | Likelihood | Severity | Detectability | Total (CPP Threshold >= 7) | Critical Control Point (Yes/No) | Critical Control Limits |
|--|---|---|------------------|--|---|-----------------------------|------------|----------|---------------|-------------------------------|------------------------------------|-------------------------|
| | | | | | | No | | | | | | |
| Watermain Break | Watermain breaks can create adverse effects to water quality. Adverse effects include, but are not limited to: <ul style="list-style-type: none"> long-term impacts to climate change (10 years or greater) shortfall in water supply sustained extreme temperatures terrorist & vandalism actions sustained pressure loss Backflow | Microbiological: <ul style="list-style-type: none"> E. Coli Total Coliform HPC Physical: <ul style="list-style-type: none"> Colour Turbidity Chemical: <ul style="list-style-type: none"> List contained in O. Reg 169/03 | None | Resident complaints General observation | QMS-SOP-15-01 – Unscheduled Repairs QMS-SOP-16-02 Adverse Water Quality Reporting MECP Disinfection Procedure Asset management (i.e. replacement of iron pipe) | Ballantrae/Musselman's Lake | | | | | | |
| | | | | | | No | 1 | 2 | 3 | 6 | No | None |
| | | | | | | Stouffville | | | | | | |
| | | | | | | No | 3 | 2 | 3 | 8 | No | None |
| Repairs to Water System Valves and Appurtenances | Repairs to water system valves and appurtenances can create adverse effects to water quality. Adverse effects include, but are not limited to: <ul style="list-style-type: none"> terrorist & vandalism actions Backflow | Microbiological: <ul style="list-style-type: none"> E. Coli Total Coliform HPC Chemical: <ul style="list-style-type: none"> List contained in O. Reg 169/03 | None | Preventative Maintenance | Asset Management Public Notification Timing of Repair | Ballantrae/Musselman's Lake | | | | | | |
| | | | | | | No | 2 | 2 | 1 | 5 | No | None |
| | | | | | | Stouffville | | | | | | |
| | | | | | | No | 2 | 2 | 1 | 5 | No | None |

| Activity or Process Step | Description of Hazardous Event | Description of Hazard | Control Measures | Monitoring Procedures | Response Procedures | Controllable (Yes/No) | Likelihood | Severity | Detectability | Total (CPP Threshold >= 7) | Critical Control Point (Yes/No) | Critical Control Limits |
|---|--|---|--|---|---|-----------------------------|------------|----------|---------------|----------------------------|---------------------------------|-------------------------|
| | | | | | | | | | | | | |
| Infrastructure Commissioning (new or replacement) | Watermain commissioning can create adverse effects to water quality. Adverse effects include, but are not limited to: <ul style="list-style-type: none"> terrorist & vandalism actions Backflow | Microbiological: <ul style="list-style-type: none"> E. Coli Total Coliform HPC Chemical: <ul style="list-style-type: none"> List contained in O. Reg 169/03 | MECP Disinfection Procedure New Watermain Commissioning Procedure (Town Standard) | QMS-SOP-16-01 Collection and Handling of Drinking Water Samples Oversight by Town Licensed Operator (OIC) New infrastructure physically separated from system | QMS-SOP-16-02 Adverse Water Quality Reporting | Ballantrae/Musselman's Lake | | | | | | |
| | | | | | | Yes | 1 | 3 | 3 | 7 | Yes | 0 cfu/ml |
| | | | | | | Stouffville | | | | | | |
| | | | | | | Yes | 1 | 3 | 3 | 7 | Yes | 0 cfu/ml |
| Distribution System - Operational Activities | | | | | | | | | | | | |
| Adverse Water Quality | Adverse water quality can be created by one or a combination of the activities outlined in this risk assessment. It can also be caused from failure of control measures and/or monitoring procedures. <ul style="list-style-type: none"> long-term impacts to climate change shortfall in water supply extreme weather events sustained extreme temperatures Chemical spills impacting source water terrorist & vandalism actions sustained pressure loss Backflow | Microbiological: <ul style="list-style-type: none"> E. Coli Total Coliform Chemical: <ul style="list-style-type: none"> List contained in O. Reg 169/03 Loss of Chlorine Residual | Water Quality Sampling and Testing | QMS-SOP-08-01 Deviations from Critical Control Points QMS-SOP-12-01 Inter-Municipal Communication Protocol QMS-SOP-15-01 Unscheduled Repairs QMS-SOP-15-06 Water and Sewer Connections | QMS-SOP-16-02 Adverse Water Quality Reporting Maximum acceptable concentration (MAC) outlined in O. Reg 169/03. Town initiates response at half the maximum acceptable concentration (MAC) | Ballantrae/Musselman's Lake | | | | | | |
| | | | | | | Yes | 2 | 4 | 2 | 8 | Yes | Half the MAC |
| | | | | | | Stouffville | | | | | | |
| | | | | | | Yes | 2 | 4 | 2 | 8 | Yes | Half the MAC |

| Activity or Process Step | Description of Hazardous Event | Description of Hazard | Control Measures | Monitoring Procedures | Response Procedures | Controllable (Yes/No) | Likelihood | Severity | Detectability | Total (CPP Threshold >= 7) | Critical Control Point (Yes/No) | Critical Control Limits |
|--|---|---|--|--|--|-----------------------------|------------|----------|---------------|-------------------------------|------------------------------------|-------------------------|
| | | | | | | | | | | | | |
| | | | | QMS-SOP-16-01 Collection and Handling of Drinking Water Samples QMS-SOP-16-02 Adverse Water Quality Reporting QMS-SOP-18-01 Contamination of the Drinking Water System QMS-SOP-18-02 Boil Water and Drinking Water Advisory QMS-SOP-18-03 Cross Connections | | | | | | | | |
| Operation of Valves – Valve Position incorrect | Incorrect valve position can create adverse effects to water quality and quantity. <ul style="list-style-type: none"> shortfall in water supply terrorist & vandalism actions | Microbiological: <ul style="list-style-type: none"> E. Coli Total Coliform HPC | QMS-FRM-15-03 - Water Shutdown Notification Information Training | QMS-FRM-15-03 - Water Shutdown Notification Information Training Lockout devices | QMS-SOP-15-01 Unscheduled Repairs QMS-SOP-15-05 Valve Inspections | Ballantrae/Musselman’s Lake | | | | | | |
| | | | | | | Yes | 3 | 2 | 4 | 9 | Yes | Inoperative |
| | | | | | | Stouffville | | | | | | |
| | | | | | | Yes | 3 | 2 | 4 | 9 | Yes | Inoperative |

| Activity or Process Step | Description of Hazardous Event | Description of Hazard | Control Measures | Monitoring Procedures | Response Procedures | Controllable (Yes/No) | Likelihood | Severity | Detectability | Total (CPP Threshold >= 7) | Critical Control Point (Yes/No) | Critical Control Limits |
|---|---|---|---|---|---|-----------------------------|------------|----------|---------------|----------------------------|---------------------------------|-------------------------|
| | | | | | | | | | | | | |
| | | | | Valve turning/maintenance program | | | | | | | | |
| Temporary Connection Between Buildings | Temporary connections between buildings can create adverse effects to water quality and quantity <ul style="list-style-type: none"> long-term impacts to climate change sustained extreme temperatures terrorist & vandalism actions Backflow | Microbiological: <ul style="list-style-type: none"> E. Coli Total Coliform | MECP Watermain Disinfection Procedure, | QMS-SOP-16-01 Collection and Handling of Drinking Water Samples | Site specific requirements | Ballantrae/Musselman's Lake | | | | | | |
| | | | | | | Yes | 1 | 2 | 2 | 5 | No | None |
| | | | | | | Stouffville | | | | | | |
| | | | | | | Yes | 1 | 2 | 2 | 5 | No | None |
| Distribution System – Staff & Equipment | | | | | | | | | | | | |
| Testing and Monitoring Equipment | Failure of equipment can lead to adverse water quality. <ul style="list-style-type: none"> Backflow terrorist & vandalism actions | Microbiological: <ul style="list-style-type: none"> E. Coli Total Coliform Chemical: <ul style="list-style-type: none"> Chlorine Residual (free) | Calibration of units by manufacturer redundancy | Training verification of units by Operators | Operational Plan System Procedure QMS-SYS-17 | Ballantrae/Musselman's Lake | | | | | | |
| | | | | | | Yes | 1 | 2 | 1 | 4 | No | None |
| | | | | | | Stouffville | | | | | | |
| | | | | | | Yes | 1 | 2 | 1 | 4 | No | None |
| Distribution System – Other Unclassified Hazardous Events | | | | | | | | | | | | |
| Unauthorized Connection to system or appurtenances (i.e. Water theft) | Unauthorized connections can create adverse effects to water quality and quantity <ul style="list-style-type: none"> Backflow terrorist & vandalism actions | Microbiological: <ul style="list-style-type: none"> E. Coli Total Coliform | None | Resident complaints | QMS-SOP-15-02 Supply of Bulk Water QMS-SOP-18-03 Cross Connections Water by-law 2018-054 (as amended) | Ballantrae/Musselman's Lake | | | | | | |
| | | | | | | No | 3 | 2 | 4 | 9 | No | None |
| | | | | | | Stouffville | | | | | | |
| | | | | | | No | 3 | 2 | 4 | 9 | No | None |

| Activity or Process Step | Description of Hazardous Event | Description of Hazard | Control Measures | Monitoring Procedures | Response Procedures | Controllable (Yes /No) | Likelihood | Severity | Detectability | Total (CPP Threshold >= 7) | Critical Control Point (Yes/No) | Critical Control Limits |
|--------------------------|--------------------------------|-----------------------|------------------|-----------------------|---|------------------------|------------|----------|---------------|-------------------------------|------------------------------------|-------------------------|
| | | | | | Bulk water station available 24/7 with account setup Hydrant permit system | | | | | | | |

The following potential hazardous events were identified by the MECP as requirements to consider in the DWQMS Risk Assessment. Each activity or process above were reviewed against the potential hazardous events and listed below if the activity or process is impacted by the potential hazardous event.

Long Term Impacts of Climate Change (all systems) – Climate change trends of 10 years or greater.

Water Supply Shortfall (all systems) – York Region required to implement water conservation and restrictions.

Extreme Weather Events (all systems) – 25, 50 and 100-year storm events.

Sustained Extreme Temperatures (all systems) – Temperatures greater than 35 Celsius or below minus 25 Celsius for a period of 14 days or more.

Chemical Spill impacting source water (all systems) – Accidental chemical spills at the water supply as reported by York Region.

Terrorist and Vandalism Actions (all systems) – Intentional sabotage of the drinking water supply and/or distribution systems.

Sustained pressure loss (Distribution Systems) – Pressure in the system drops below 140 kpa (20psi) for longer than 24 hours.

Backflow (Distribution Systems) – Any event that causes a foreign substance to enter the water distribution system as a result of pressure gradient.

Sudden Changes to raw water characteristics (Treatment Systems) – Not applicable for the Ballantrae/Musselman’s Lake or Stouffville Water Distribution Systems.

Failure of equipment or process associated with primary disinfections (Treatment Systems) – Not applicable for the Ballantrae/Musselman’s Lake or Stouffville Water Distribution Systems.

Failure of Equipment or process associated with secondary disinfection (Treatment Systems and Distribution Systems providing secondary disinfection) – Not applicable for the Ballantrae/Musselman’s Lake or Stouffville Water Distribution Systems.

Algal Blooms (Treatment Systems using Surface Water) – Not applicable for the Ballantrae/Musselman’s Lake or Stouffville Water Distribution Systems.

Document Change History

| Revision Number | Date | Change | Revision Made By: |
|-----------------|-------------------|---|-------------------|
| 1 | February 11, 2016 | Updated from annual review | Peter W |
| 2 | December 31, 2016 | Updated to match critical control procedure and remove CCPs for uncontrollable events | Laura S |
| 3 | May 17, 2018 | Full Risk Assessment | Peter W |
| 4 | January 15, 2019 | Risk Assessment Review | Peter W |
| 5 | January 24, 2020 | Risk Assessment Review | Peter W |