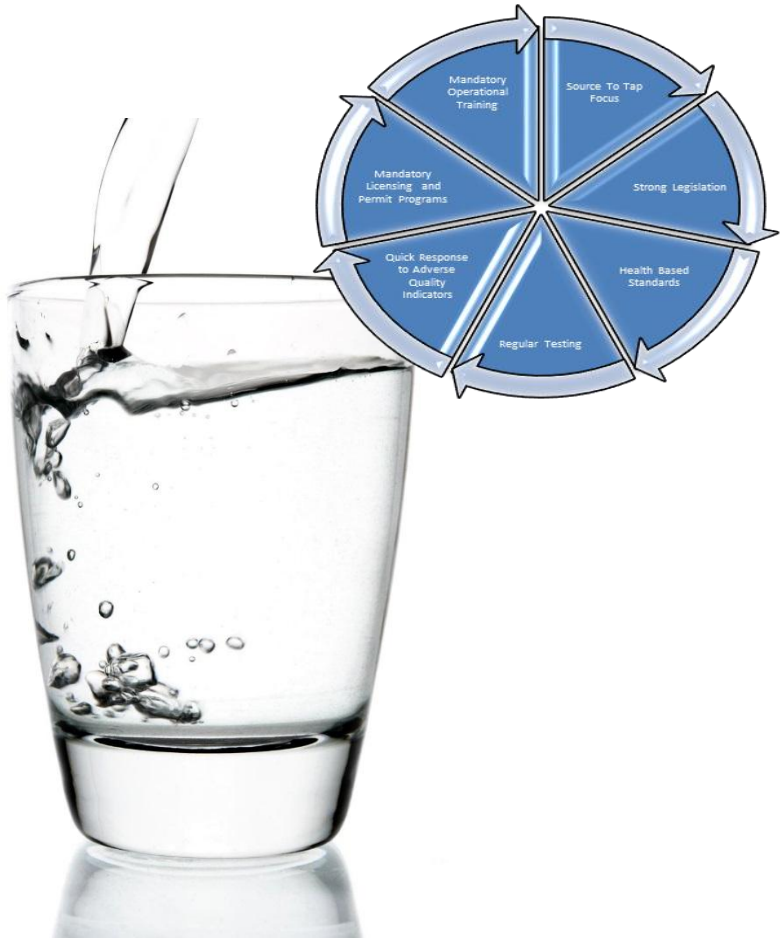
Drinking Water Quality Management System

DWQMS Multi-System Operational Plan 2.0



The Township of North Glengarry Water Works Department
www.northglengarry.ca

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1. Quality Management System

In response the system wide contamination and public health impacts that occurred in Walkerton Ontario in 2000, a public inquiry was performed to examine how and why these events took place, who was responsible and how to prevent similar events from re-occurring in the future. As a part of the Walkerton Inquiry one of the many recommendations was to implement a quality management approach to the production of drinking water. By implementing this approach, drinking water systems will achieve consistent and good management strategies/practices, protect public health, utilize multi-barrier treatment tactics and preform preventative risk management rather than reactive risk management.

A such the Township of North Glengarry has developed this Operational Plan in response to the requirements of the Ministry of the Environment Municipal Drinking Water Licensing Program and the Drinking Water Quality Management Standard.

This manual, along with the procedures and other documents to which it refers, forms the basis of North Glengarry's Drinking Water Quality Management System. Where appropriate, this Operational Plan and its associated procedures make explicitly clear those areas where facility-specific information is being provided.

The scope of the operations covered by this Plan includes the following operational subsystems:

1. **The Alexandria Drinking Water System**
    - **Alexandria Water Treatment Plant**
    - **Alexandria Distribution System and Water Tower**
    - **The Alexandria-Maxville Transmission Main and Booster System**
    - **Maxville Water Tower and Distribution System**
2. **The Glen Robertson Drinking Water System**
    - **Glen Robertson Water Treatment Plant**
    - **Glen Robertson Distribution System**

Even though the facilities listed above are distinct operational subsystems as defined by the DWQMS, the Township of North Glengarry has included these facilities in a single Plan because they share common:

- Chief Administrative Officer
- Operations Management
- Operations Staff
- Ownership

Throughout this plan various acronyms will be used to identify various elements or groups, listed below are these acronyms and the associated definitions.

CAP: contingency action plan

Distribution: network of piping, fittings, valves and hydrants used to distribute potable drinking water from the treatment plants to residences or to flushing water from the system for quality purposes or for sale.

DWQMS: Drinking Water Quality Management System

DWWP: Drinking Water Works Permit

MDWL: Municipal Drinking Water License

MDWP: Municipal Drinking Water Permit

MECP: previously Ministry of the Environment and Climate Control, now referred to as the Ministry of the Environment, Conservation and Parks.

OIC: Operator in Charge

QMS: Quality Management System

SDWA: Safe Drinking Water Act

SOP: Standard Operating Procedure

The Standard: Drinking Water Quality Management Standard

WTP: Water Treatment Plant

2. QMS System Policy

The following policy was created was implemented in October 2009 and is recognized by the Township of North Glengarry as being an important foundational element of its Quality Management System (QMS) . It will be communicated to the Owner (represented by the Mayor and Council of North Glengarry), operating authority personnel, goods and services providers and the public according to the QMS Communications Procedure (QMS SYS-P9) found in the Appendices of this document.

The managers and staff who are directly involved in the production and distribution of drinking water must be committed to and share in the responsibility for implementing, maintain and contribution to the continual improvement of the QMS in order to ensure its currency.

Drinking Water Quality Management System Policy

The Township of North Glengarry is committed to:

- Providing a safe and reliable supply of drinking water to all consumers,
- Meeting and striving to exceed regulatory requirements during the production and distribution of drinking water,
- Acting quickly to mitigate and resolve water quality issues as they arise from time to time,
- Maintaining and striving to continually improve the QMS as a whole
- Ensuring open communications through various levels from the consumer to the owner concerning matters of drinking water quality.

3. Commitment and Endorsement

The Township of North Glengarry, as the system owner, supports the development, the implementation, and the on-going maintenance of the Drinking Water Quality Management System (DWQMS) through all municipally operated water treatment and distribution systems within the township boundaries, as documented within this plan.

Endorsement of this plan acknowledges the roles and responsibilities of each individual and or group within the system, as described in section 9. As a part of these responsibilities Top Management will appoint a designated Quality Management System Representative for administrative purposes.

Endorsement also ensures a commitment by the owner, top management and the operating authority to ensure communication as per procedures and the provision of sufficient resources to maintain and continually improve the DWQMS and the associated works going forward.

Endorsement of this document is to be obtained through council resolution. Re-endorsement will be required periodically in the future and this will be performed as per the QMS Commitment and Endorsement Procedure (QMS SYS-P13).
Please refer to Appendix G1 for the Endorsement and By-law.

4. QMS Representative

QMS Representative must be appointed by the Top Management within the Township of North Glengarry. This position must adhere to the duties and responsibilities listed in the endorsement and under section 9 of the operational plan, the representative must acknowledge that this role also requires:

- Familiarity with the drinking-water system of the Township of North Glengarry,
- Having knowledge of best practices for drinking-water systems,
- Having a thorough understanding of the DWQMS,
- Demonstrate understanding of the importance of management commitment,
- Familiarity with audit principles and the ability to demonstrate to an auditor that the DWQMS requirements have been met,
- Familiarity with applicable legislative and regulatory requirements, and
- Understanding the importance of developing and maintaining good, open communication with Top Management.

Top Management, as defined within the Township of North Glengarry, has currently appointed and authorized the Waterworks Foreperson, Angela Cullen, as the QMS Representative. It is noted that these two positions are independent of each other and in the event of staff change or organizational restructuring, the Top Management must re-evaluate the appropriate staff to determine the personnel best suited for this position and re-appoint as required.

5. Document and Records Control

The Township of North Glengarry recognizes effective document and records control as being a key element in the successful implementation and maintenance of its drinking water quality management system. With this in mind, comprehensive procedures for control of both documents (QMS SYS-P1) and records (QMS SYS-P2) have been developed and are included in the Appendix A of this document.

The acknowledged benefits of the implementation of these procedures include:

- ✓ The integrity of the information contained in the Operational Plan is ensured.
- ✓ Training of new personnel is facilitated.
- ✓ Procedures are consistent in content, format, and currency, and are more likely to be correctly followed.
- ✓ The most up-to-date versions of documents are easily retrievable by the people who need them.
- ✓ Conformance audits and compliance inspections are facilitated.
- ✓ Due diligence is demonstrated.
- ✓ Owner and consumer confidence are promoted.
- ✓ Internal and external communications are facilitated.
- ✓ Decision making is made more focused and consistent.

Over time, the QMS Operational Plan and its associated procedures will change. Recognizing this, the QMS Representative will ensure that training of existing personnel and new hires includes these fundamental instructions to staff with respect to document control:

- *Documents can be changed by following the appropriate process, but records cannot*
- *Always check that the version of the document you are using is the most current*
- *Always communicate changes that affect your drinking water system to the QMS Representative to ensure QMS currency and affect documentation can be changed in a timely fashion as required.*

Document: includes a sound recording, video tape, film, photograph, chart, graph, map, plan, survey, book of account, and information recorded or stored by means of any device.

Record: a document stating results achieved or providing proof of activities performed.

6. Drinking Water System

As introduced earlier in this Operational Plan, the portfolio of drinking water assets owned and operated by the Township of North Glengarry and applicable under the Municipal Drinking Water Licensing Program includes four distinct operational subsystems:

- **The Alexandria Drinking Water System**
  - *The Alexandria Distribution System and Water Tower*
  - *The Alexandria-Maxville Transmission Main and Booster Station*
  - *The Maxville Water Tower and Distribution*
- **The Glen Robertson Drinking Water System**
  - *Glen Robertson Water Treatment Plant*
  - *Glen Robertson Distribution System*

6.1 The Alexandria Drinking Water System Overview

Drinking Water System Number	220001030
Drinking Water System Category	Large Municipal Residential
Drinking Water System Owner	The Corporation of the Township of North Glengarry
Drinking Water System Operating Authority	North Glengarry Water Works Department
Raw water source:	Mill Pond
Facility description:	Surface Water Supply/Conventional Treatment
Service area:	Alexandria, ON
Service population:	3500
In-service date:	1952
Permit to Take Water	0512-8VVPRD Issued: 06-Jul-12 Expiry: 08-Jul-22
Drinking Water Works Permit	181-201-3 Issued: 22-Mar-16
Municipal Drinking Water License	181-101-2 Issued: 22-Mar-16 Expiry: 21-Mar-21

The Alexandria Drinking Water System is comprised of a Class 3 Water Treatment Facility and a Class 2 Distribution System. The current rated capacity of the water treatment facility is 8,014m3/day, however the PTTW only allows for a maximum daily flow of 5,616m3/day.

The source water is drawn from the Mill Pond, a manmade lake where the original source is ground water from Loch Garry. Water flows through dam systems, other small lake systems and rivers up-stream prior to entering the pond. The surrounding land masses are primarily

residential, agricultural or wetland/forest areas. The raw water source is a poor source, with high organic loading, varying turbidity levels, high colour and fluctuating temperatures. Bacteriological sampling has indicated low to moderate total coliform and e. coli counts throughout the year with observed spikes during the summer and fall, attributed to increased water temperatures and increase biological activity.

Processes used to treat the organic loading and potential pathogenic organisms are

- coagulation,
- flocculation,
- sedimentation,
- filtration,
- post-filter chlorination (primary disinfection), and
- chloramination (secondary disinfection)

This multi-step treatment process helps to ensure a multi-barrier approach is applied to water production and each step helps to ensures regulatory compliance and promotes public health protection.

6.1.1 Description of Raw Water Source

The plant draws water from the Alexandria Mill Pond, which is supplied by the Garry River System. The Mill Pond is a relatively shallow water body, less than 3 m in depth, whose water levels can fluctuate up to 0.6 m. The water levels are mainly controlled by a dam located on the north east outlet, operated by the Raisin River Conservation Authority. The source water is a combination of runoff and groundwater discharge (spring), in which the raw water temperatures will fluctuate from near freezing in winter to near 30^{o}C in summer months. Turbidity, colour and bacteria counts in the raw water will also vary greatly depending on time of year and seasonal conditions. Typically, during the winter months after ice cover has developed, manganese levels begin to rise and have become problematic.

Raw Water Characteristics						
Year	2016		2017		2018	
Parameter	Average	Range	Average	Range	Average	Range
Temperature (^{o}C)	13.0	1.3 - 28.3	12.6	1.4 - 25.7	12.4	1.4 - 28.0
pH	7.39	6.05 - 8.61	7.21	6.66 - 7.69	7.43	6.69 - 8.52
Colour (FTU)	74.5	6 - 153	77.6	0 - 222	64.2	18 - 163
Turbidity (NTU)	1.54	0.63 - 7.68	1.40	0.31 - 8.63	1.61	0.35 - 11.30
Manganese (mg/L)	0.04	0.01 - 0.12	0.05	0.01 - 0.26	0.05	0.01 - 0.16
Total Coliform (cfu/100mL)	47.8	7 - 340	59.4	4 - 940	49.2	8 - 160
E. Coli (cfu/100mL)	9.8	0 - 31	14.7	0 - 89	13.8	0 - 73

6.1.2 Treatment Process Description

Intake

The raw water intake works consists of the intake structure located in the Alexandria Mill Pond approximately 425 m southwest of the water treatment plant, positioned just after river confluence area. The intake crib is screened with hemlock boards to create an effective screen opening and the intake pipe transports the raw water from the mill pond to the raw well.

Low Lift Chamber (Raw Well)

The raw water is conveyed by gravity through the intake pipe into the raw well/low lift chamber, due to this fact, the level in the raw well fluctuates with the level in the Mill Pond. The water level is monitored with an ultrasonic level transmitter, that is wired into the SCADA system and alarms are in place in the event that the levels drop significantly.

The chamber is separated into two sections by coarse screens, the raw well and the low lift chamber. Operational staff monitors debris build up on the screens and in the well, and clean as required. The raw well houses a mud pump which is used to remove sludge or debris build up from the bottom of the well. The low lift chambers houses low lift two pumps that move the water up to the flocculation tanks.

Manganese Control

Potassium permanganate is periodically dosed in the raw well during winter months to treat increased raw manganese levels. The chemical is transferred from the holding tank to the injection system via pumps, which are connected to the SCADA system for alarm and operational purposes. The dosage rate is based on the treated manganese levels and adjusted by operational staff as required. The pumps run as lead and lag, with a monthly maintenance rotation but do have automated switch over capability in the event of a pump failure.

Taste and Odour Control

Historically the taste and odour issues were treated by powder activated carbon. In 2020 the filters were upgraded to contain granular activated carbon, which is now used to remove the taste and odour issues.

Coagulation

The coagulant is stored in 2 tanks which can hold up to a maximum of 32m³, tank 1 holding capacity of 23m³, tank 2 holding capacity 9m³. It is transferred by pump from the tanks to the injection point just prior to an in-line static mixer. The pumps are connected into the SCADA system and are run based on pace to flow. Dosing rates for these pumps change dependant on time of year, water temperature, colour, pH, and plant performance / observations. The pumps run as lead and lag, with a monthly maintenance rotation but do have automated switch over capability in the event of a pump failure. An alarm will be initiated through the SCADA system.

After the mixer water is then directed through a Magmeter and past an automated flow control valve and into the flocculation tanks. The valve is a 12” electronic butterfly valve that will modulate open or closed dependant on the water demand, which is based off the flocculation tank levels. As the water level in the flocculation tank drops the raw water valve will modulate open to supply more water. The modulation of this valve is controlled through the SCADA system and alarms are in place in the event of a malfunction. Manual operation of the valve can be performed if necessary.

A polymer is also used to help enhance the coagulation process and is injected into the piping as the water enters the first flocculation chamber. It is batched on-site in a 500L tank as needed. The prepared chemical is then transferred into a 3000L holding tank. Once the chemical is mixed it will begin to deteriorate after approximately 48-72 hrs, so over batching chemical is not recommended. The polymer is transferred by pump from the holding tanks to the injection system. The pumps are connected to the SCADA system and are run based on pace to flow. Dosing rates for these pumps change dependant on time of year, water temperature, and plant

performance / observations. The pumps run as lead and lag, with a monthly maintenance rotation but do have automated switch over capability in the event of a pump failure. An alarm will be initiated through the SCADA system.

Flocculation

The coagulated water is pumped into the flocculation tanks and from this point the water utilizes gravity to flow to the following processes. In 2019-2020 the flocculation process was expanded from 2 tanks to 4 tanks to inhibit process short circuiting under higher flow demands created through the expansion for the Maxville water project. The flocculation process takes place in four concrete chambers, which operate in series. The tanks are separated by valves or concrete walls and utilized piping or precast openings to allow water to flow from one tank to the next. Isolation of tanks is provided through valves and redundancy piping. Each tank contains a variable speed agitator, that can be adjusted as required in order to obtain optimum flocculation.

The water level in the flocculation tanks is monitored at the end of the second tank by an ultrasonic level transmitter. The unit is connected to the SCADA system and alarms are in place to prevent adverse conditions. The normal operational level in the flocculation is between 4.75mm – 4.65mm but can fluctuate slightly outside of this range prior to any alarm.

Sedimentation

The flocculated water then travels by gravity from the second flocculation tank into a common conduit. All 4 basins operate in parallel; each basin contains a baffle wall made of cedar, conventional tube settlers, and a sludge removal system. Each basin is 2.7m deep and the baffle wall is located 4.7m from the inlet. The walls at the base of the basins are sloped at a 60° in order to direct sludge collection system. The water flows through the basins and is then directed into a common header that feeds the filtration process. The normal retention time in the basins can range from 2 hours to 4 hours dependant on water flows.

In the bottom of each basins a sludge removal system is in place which utilizes head pressure to remove sludge from the bottom of the basin, sending it to the sludge tank. The sludge removal system works based on the SCADA program setup, once the setpoint is reached, sludge valve will open, and the suction carriage will travel along the track on bottom of the basin removing sludge. Basins are also manually drained, as required, to completing maintenance checks and inspections. It should be noted the sludge level should not be allowed to reach the bottom of the baffle wall, as this will severely impact the sedimentation process.

Filtration

Water flows from the common header conduit at the end of sedimentation to the filters by gravitation force. Filtration is provided by four filters which all run in parallel. In 2019-2020 all filters were upgraded, with each filter containing a layer of granular activated carbon and sand. The under-drain system in each filter was also replaced at this time with low profile underdrain. Each filter is capable of filtering 2003m³ per day. The water flows through in influent valve into the channels falling over onto the media below. The water flows down through the media by gravity and is then enters into the under-drain system; which brings the filtered water into a common header pipe. The flow at which the water exits the filters is determined by the filter effluent valve setting. The SCADA system has an adjustable set filter rate, the effluent valves will modulate until the desired flow rate is achieved. All filters are equipped with automatic and

manual backwash system, including a surface wash system, which was upgraded in 2019-2020 to include VFD for better flow control and operations.

The set points in the SCADA system are all normal operating targets; however, they can be changed as needed. If limits are exceeded an alarm will be displayed in the SCADA system, an audible alarm will sound on-site, and the on-call operator will be advised through contact from the security system.

Plant Start Up and Shut Down

The high lift pumps will be directed to run or not run based on adjustable set points within the SCADA System. These set points are based on the water level in the elevated storage and through various operational programs. All program set points are adjustable or the plant can be run manually as needed.

***Note**: high water level is 134.1 m and the low water level is 123.1m AMSL, as per design.*

Plant start up

The duty high lift pumps will start once the set point has been achieved and run at an output flow rate of 0 to 93 litres per second. The lag high lift pump will start if the demand is beyond the capabilities of a single pump (approximately 75 LPS). Each month the pumps are alternated, as part of the regular maintenance practices. As the clear well level drops the water treatment processes will be triggered to commence and replenish the treated water levels.

Plant Shut Down

The duty high lift pump will stop, when the elevated storage tank level has achieved the set level in the SCADA; which the operators can adjust as required. The clearwell level will continue increase until the set point has been achieved. At which point the raw water flow valve (V-240) will shut ceasing the water flow through the flocculation, sedimentation and filtration processes. This cessation will also shut down the associated chemical feed systems, as these processes pace to flow dosing.

Filter Backwash

The filtration system is equipped with an automatic filter backwash system; however manual backwashes can also be initiated if needed. The automated system consists of two backwash pumps, a surface wash system and a wastewater drainage system. The filters are set to automatically backwash if the loss of head exceeds the limit set point; if the filtration hours exceed the limit set point; or if the turbidity increases over the limit set point.

When a filter is backwashed the filter, influent valve is shut. The remaining water is then filtered to the clear well until the water level is below the overflow trough. At this point, the effluent valve closes, and the surface wash begins and directs pressurized treated water to scour the top portion of the filter media. After a timed surface wash, one of the backwash pumps will start - forcing treated water up through the filter media into the overflow trough and finally into the drain.

The wastewater leaves the filter through the drain and is directed through piping to the sludge holding tank. The sludge holding tank is equipped with a supernatant overflow pipe which drains into the sanitary sewer. Sludge levels are monitored and if a build up is noted, operators will schedule a shut down for cleaning.

The auto sequence can be adjusted as required to elongate or minimize each step. Alarms are also in place throughout the sequence and water level sensor is located in each filter to help prevent overflows.

Monitoring Filter Effluent

There are four on-line turbidity meters that continuously monitor the filter effluent from each filter. The turbidity is then recorded electronically on the SCADA system. These meters are also connected to the alarm system and if the turbidity reading is above 0.700 NTU, for more than 15 mins, an alarm will be sent to the on-call operator. If the turbidity increases to 0.900 NTU or greater the filter will shut down causing a water quality alarm to sound in the water treatment plant and the on-call operator is notified by the alarm central.

Disinfection

The disinfection system uses chlorine gas which is injected into the header pipe prior to entering the clear well. See process flow chart in this section for exact locations. Chlorine gas is supplied in 68 kg cylinders, which are stored in the chlorine room. Two sets of two cylinders each are hooked to the regulators and are deemed as either in service or in stand-by mode. Automatic switchover from in service cylinders to the stand-by cylinders happens when tanks are empty.

The chlorination system has three duty chlorinators equipped with two vacuum regulators and injectors to draw chlorine into solution. The regulator is fail-safe and releases chlorine under vacuum only to the supply line. In the event of vacuum loss an alarm will sound.

Chlorine residuals are monitored by on-line analyzers at various point during the disinfection process and samples can be tested and/or verified at the individual analyzer or in the lab area at the specific sample taps provided. Analyzer locations include after chlorine injection, after clear well disinfection and after chloramination. All analyzers are tied into the SCADA System for monitoring, recording and alarm conditions. If alarm set points are exceeded an alarm will be displayed in the SCADA system, an audible alarm will sound on-site, and the on-call operator will be advised through contact from the security system.

Clear Wells and High Lift Pumping

The clearwell is divided into 4 separate wells, well 1- 145.68 m^2, well 2- 28.12 m^2, well 3- 28.88 m^2, well 4- 37.24 m^2 for a total area of 239.92 m^2. The wells are interconnected using pipes and valves. Isolation of the wells for cleaning or inspection is possible by operation of specific valves. Access hatches are located only in wells #1 and #4.

As the water leaves the filters it is directed into a header pipe which transports the water past injection points for chlorine and phosphate. After injection the water will be directed to clearwell #4, where it travels through all four clearwells and then towards two high lift pumps, located in clearwell #1. The treated water is pumped into piping, which is equipped with a Magmeter, ammonia injection points and sample line leading back to two chlorine analyzers. This water is directed to the distribution system and towards the water tower. The distribution pressure is based in the water level elevation in the water tower or the pressure from the distribution pumps while in service.

Another high lift pump is located in clearwell #4; however, this pump can only to be run in emergency situations after contact with Ministry of Health and Long-Term Care or after a 75min

retention time has been met. It cannot automatically start, operators must manual transfer the controls over to this pump prior to use. A 150mm re-circulation line was installed in 2019-2020 for maintenance purposes.

Chloramination

After the disinfection process has been completed, and prior to the water leaving the discharge pipe into the distribution, ammonia sulphate is added to create chloramines. The optimum dosage is 5:1 chlorine to ammonia, however operators may adjust the ratio dependant on monochloramine or free ammonia levels present in treated water, in order to try to optimize process.

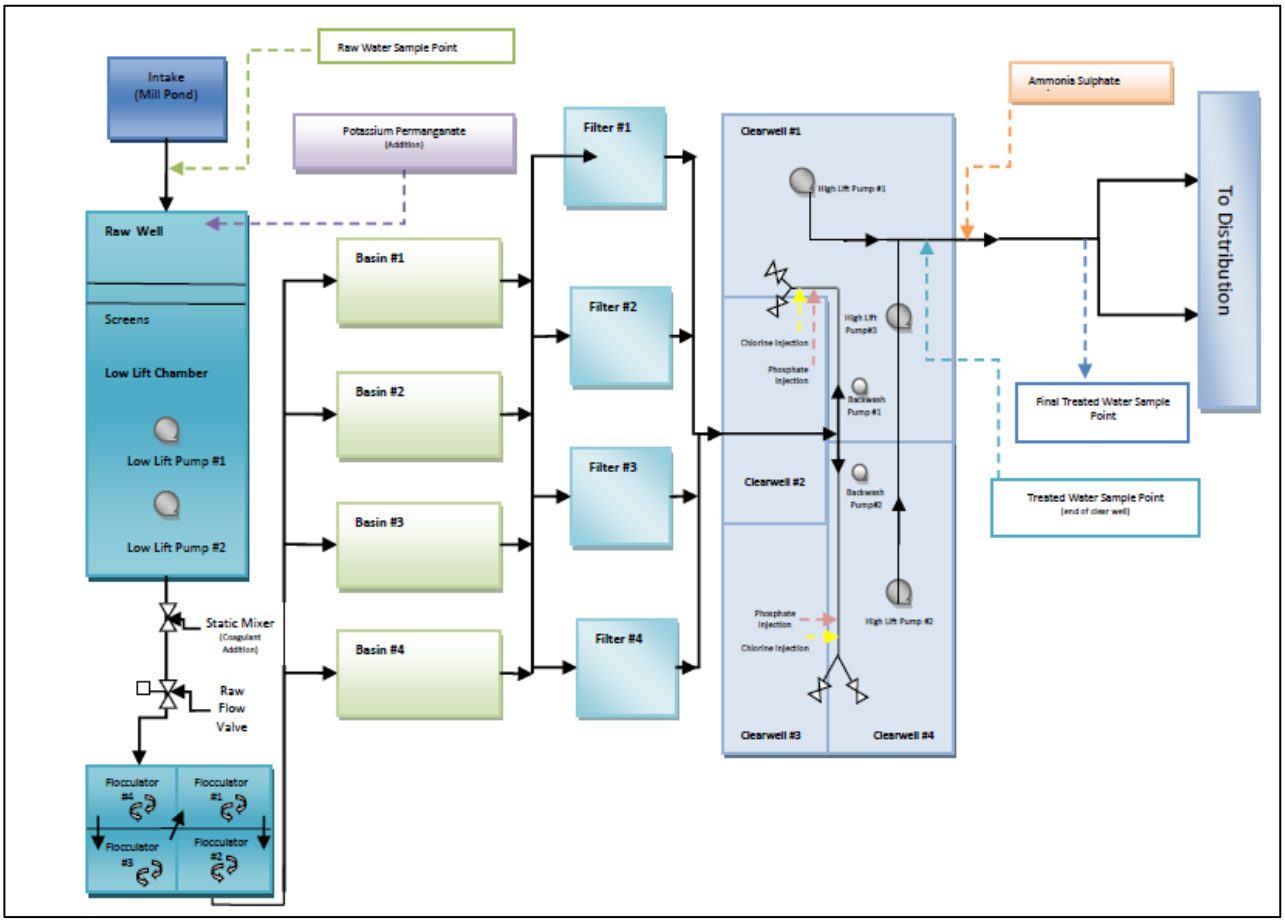
Corrosion Control

Corrosion control in the distribution is achieved by adding a zinc phosphate solution. The phosphate is shipped in 1000L tote bins which is then transferred to 200L tanks. The phosphate is fed and regulated to the clear well via a pump.

Emergency Power

Emergency power is supplied by a 175 kW genset with automatic transfer switchover in case of a power failure.

6.1.3 Process Flow Chart



6.1.4 Distribution System Key Elements

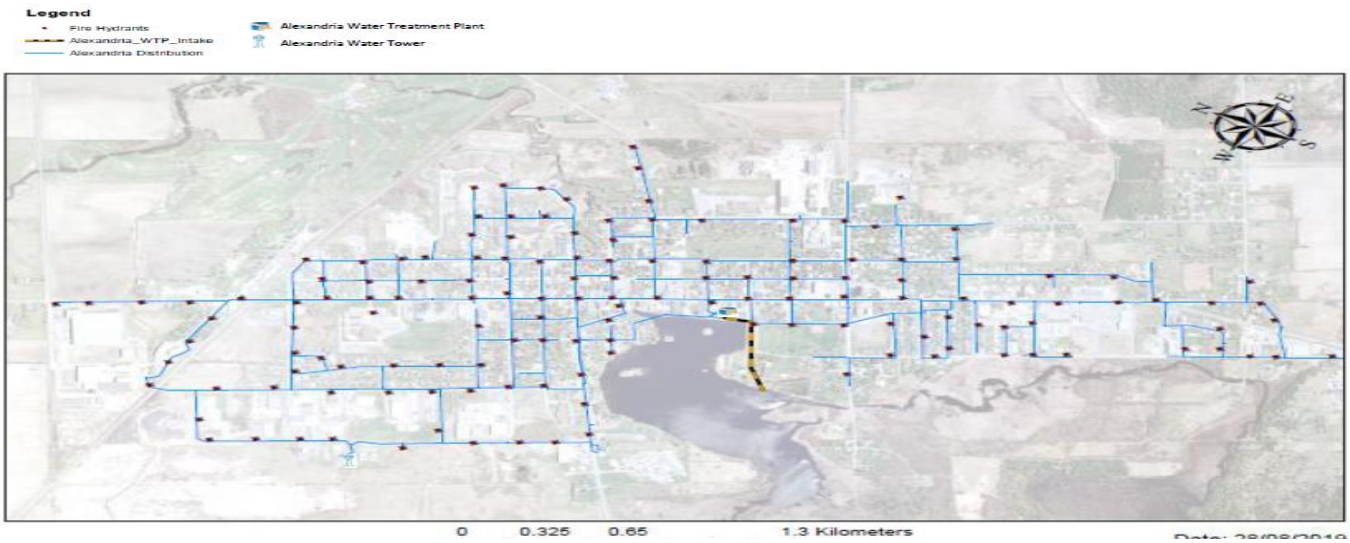
The distribution network consists of three major components the Alexandria distribution system, the Maxville Transmission Main/Booster Station and The Maxville Distribution System. All components are owned by the Township of North Glengarry and operated by the Water Works Department. The Alexandria distribution system piping was initially installed in 1950's and expanded throughout the years until current day. The elevated storage tower within the Alexandria distribution system was constructed by Landmark and commissioned in 2011. The Maxville transmission main and booster station was engineered through EVB engineering and constructed from 2018 to 2019 by Malyon Excavation Ltd on behalf of the Township of North Glengarry under the Maxville Water Project. This system was placed into service in late 2019. The Maxville elevated tower and distribution system was constructed in 2017-2018 by Clarence MacDonald Excavation Ltd, also under the Maxville Water Project and was placed into service in late 2019.

6.1.4.1 Alexandria Distribution System and Water Tower

The distribution system is found wholly within the town limits of Alexandria and is composed of 28.2kms of water mains of varying sizes, from 19mm to 250mm in diameter, and is a mix of various materials including cast iron, ductile iron, asbestos cement, carbon steel and polyvinyl chloride. There are approximately 315 valves and 145 fire hydrants located within the distribution system. The valves are exercised, and the hydrants are flushed annually as a part of a planned spring flushing program.

The elevated storage tank is located approximately 1,200 m northwest of the water treatment plant, is 12.2 meters in diameter and 33.5 meters high and has a capacity of 3,916 m^3. It is continuously monitored through the water treatment plant SCADA system and used to control pressure, store water, and supply the distribution system as required. The tower is also equipped with monitoring equipment for free and total chlorine.

6.1.4.2 Alexandria Distribution System Schematic

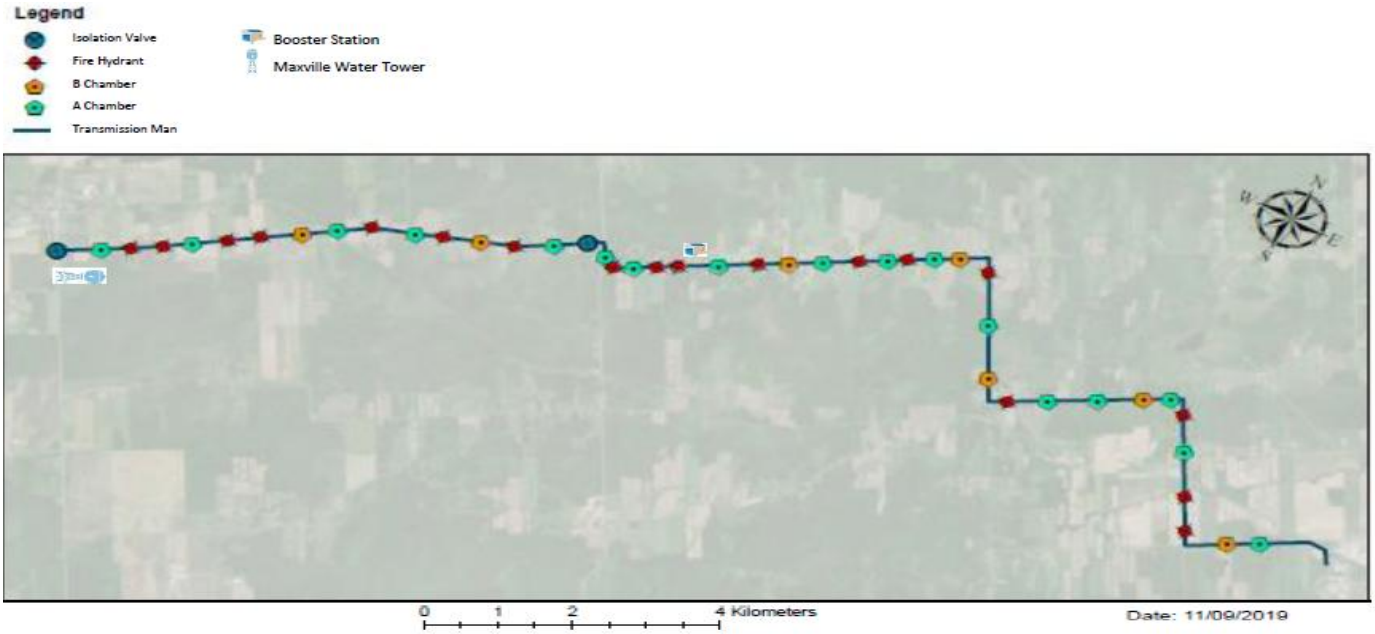


6.1.4.3 Alexandria-Maxville Transmission Main and Booster Station

The transmission main consists of 20.43kms of 300mm polyvinyl chloride pipe that connects the Alexandria Drinking Water System from Industrial Blvd to the Maxville Water Booster Station, and from the Maxville Water Booster Station to the Village of Maxville, following the path of these roads: Unopened Road Right-of-Way, Auld McMillian Road, Concession Road 5, Dornie Road, Concession Road 6, County Road 30, County Road 22, and County Road 20. Installed throughout the transmission line there are 12 isolation valves; 32 air relief valves, and 17 fire hydrants, installed at the highest elevation points or low-pressure points as required. All hydrants will be flushed, and all isolation valves are to be operated annually as part of a Spring Flushing program to ensure operations.

The Booster station houses monitoring equipment (including SCADA), various pumps, VFDs and chemical storage for re-chloramination. The station is rated for 60L/sec, with each pump capable of supplying 30L/sec. As the piping enters the building, a sample line is directed to a mono-chloramine analyzer; this residual is used as the controlling factor for the ammonia and sodium hypochlorite dosing. After chemical dosing and a second sample line is directed to a free chlorine and total chorine analyzer for monitoring purposes. The water is then directed through 2 pumps, which will provide the pumping pressure required for the water to be pumped from the station and into the tower located in Maxville. These pumps run on demand and fill the tower based on set points in the SCADA system. After the pumps the water is directed through a Magmeter and prior to the building exit, and another sample line is installed for verification of free and total chlorine. A generator is also on-site for back up power in the event of a power outage.

6.1.4.4 Alexandria-Maxville Water Transmission Main and Booster Station Schematic

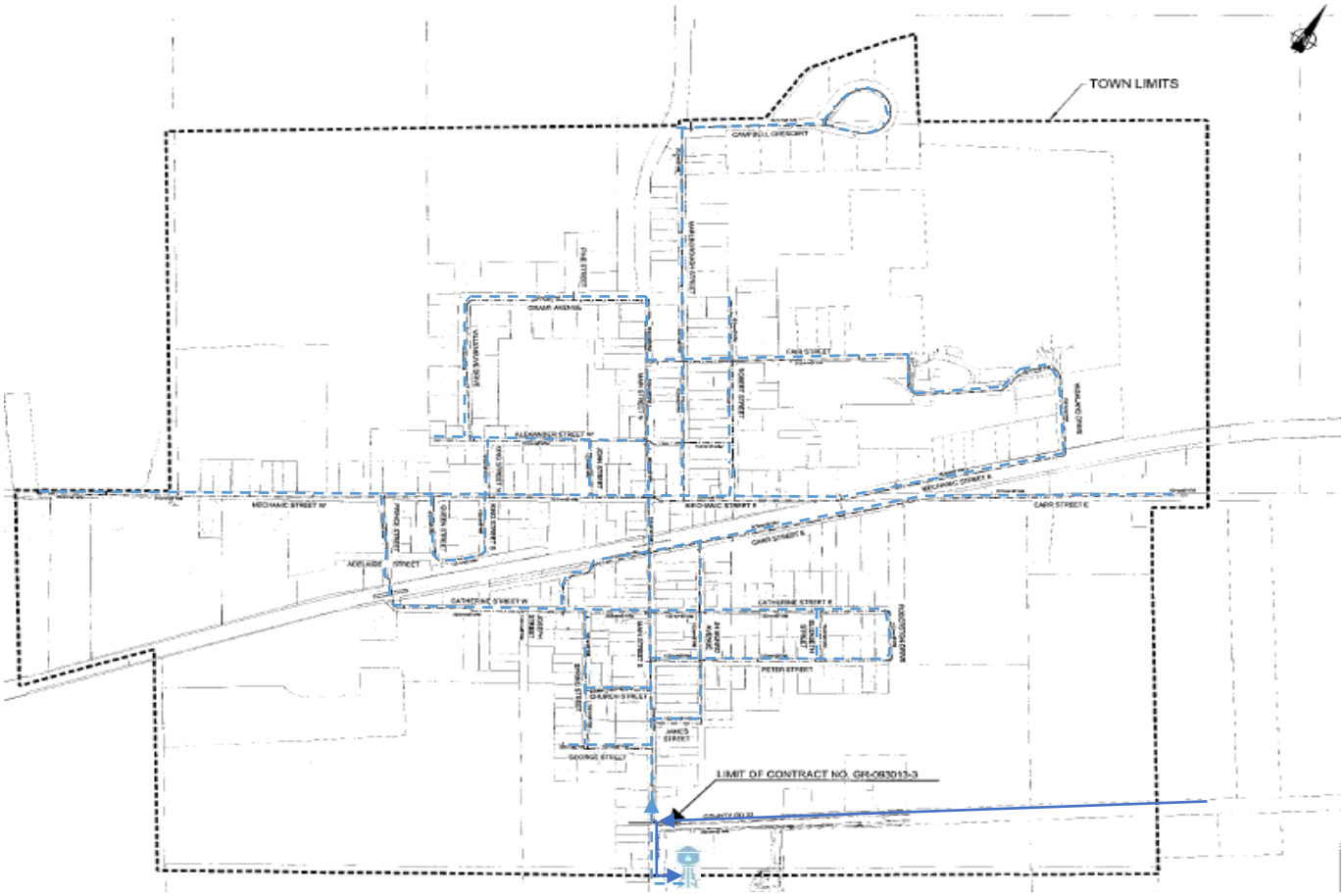


6.1.4.5 Maxville Water Tower and Distribution System

Water is pumped from the booster station directly into the elevated tower, from which water is supplied to the village of Maxville. There is only 1 service connection prior to the tower, all other services are located after the tower. The elevated storage tank is located approximately 8.5kms northwest of the booster station; and has a capacity of 1500m^3. It is continuously monitored through the water treatment plant SCADA system and is used to control pressure, store water, and supply the distribution system as required. The tower is also equipped with monitoring equipment for free and total chlorine.

The distribution system was installed over 2018 and 2019 and is composed of 10.2 kms of PVC pipes,. There are approximately 193 valves and 82 hydrants used for flushing or maintenance, and the system was designed to support fire flows. The system also has 3 hose bibs (another name?) at specific locations for water access by municipal staff, located at the manor pumping station, main pumping station and at the St George park. The valves are exercised, and the hydrants are flushed annually as a part of a planned spring flushing program.

6.1.4.6 Maxville Water Tower and Distribution System Schematic



6.1.5 Critical Upstream or Downstream Processes

The Alexandria Drinking Water system was connected to the Maxville Drinking Water System via the transmission main in 2019 and is the only water source supply for Maxville system. The connection is located at the corner of Industrial Blvd and Leroux St.

6.1.6 Operational Challenges and Potential Threats

The Mill Pond is operated as a part of a dam system and as such the conservation authority control the pond levels, as such during periods of low flows, the lake water can stagnate increasing potential for taste and odour problems. Historically levels have been sufficient for intake purposes, but any changes up stream could take up to 8 hours to see full effects in the Mill Pond. The Township maintains communication with the RRCA in the event of observed irregularities.

Due to an increase in aquatic plant growth and algal blooms, the Township acquired a weed harvester that operates in the mill pond periodically after June 15. Although there has not been observed impacts to date, this has the potential to increase organic loading on the treatment process. Periodic monitoring during summer months for microcystin has also been implemented to identify and prevent possible treatment issues caused by specific algal blooms. Mill Pond has no history of blue-green algae blooms.

Mill Pond has seen an increase in recreational usage since the aquatic plant cutting, creating the potential for accidental contamination. Observed recreational usages are swimming, fishing (summer/winter), and boating. Although the Township has imposed a limit on the boat motor size, no enforcement of this limit has been observed to date.

Currently there is only one raw water intake for the WTP, with limited information on location mapping. Without redundancy any damage, inspection or maintenance will require the treatment system to shut down and relying on storage for system supply.

The raw water intake is located approximately 2m from shore and is located just upstream from the lake's influent river source. As the lake is shallow, when water temperatures increase above 15^0C, the source is susceptible to taste and odour conditions.

When the Mill Pond is under ice cover, the manganese levels will increase to a point that requires treatment. Operational staff will monitor the raw and treated levels and adjust treatment as required.

With increased temperatures, chlorine residual degradation in the water tower has been noted due to the lack of proper internal mixing. As such operators will operate the HLP and Tower to try to optimize filling to tower with increased residuals. Periodic flushing will also be performed as required in lower flow areas to ensure residual and water turn over.

6.2 The Glen Robertson Drinking Water System

Drinking Water System Number	220008408
Drinking Water System Category	Small Municipal Residential
Drinking Water System Owner	The Corporation of the Township of North Glengarry
Drinking Water System Operating Authority	North Glengarry Water Works Department
Raw water source:	Well
Facility description:	GUDI Groundwater
Service area:	Glen Robertson, ON
Service population:	100
In-service date:	1983
Permit to Take Water	3330-9UNQ2Q Issued: 18-Dec-14 Expiry: 16-Mar-25
Drinking Water Works Permit	181-201-2 Issued: 22-Mar-16
Municipal Drinking Water License	181-101-2 Issued: 22-Mar-16 Expiry: 21-Mar-21

The Glen Robertson Drinking Water System is comprised of a Class 1 Distribution and Supply system. The current rated capacity of the water treatment facility is 224m3/day.

The source water is drawn from a groundwater well located within the pump house, at 3342 Irwin St. The surrounding land masses are primarily residential, or agricultural with a railway running adjacent to the property. In 2009 the well source was deemed to be GUDI and as such additional equipment was added to the treatment process. The well provides good quality raw water with observed low turbidity, low colour and consistent temperature. Bacteriological testing has shown little to no total coliform or e. coli contamination.

Processes used to treat the organic loading and potential pathogenic organisms are

- 5-micron filtration,
- 1-micron filtration
- Ultraviolet Light disinfection (primary disinfection), and
- post-treatment chlorination (secondary disinfection)

This multi-step treatment process helps to ensure a multi-barrier approach is applied to water production and each step helps to ensures regulatory compliance and promotes public health protection.

6.2.1 Description of Raw Water Source

The groundwater system draws water from one well, located at 3342 Irwin Street, which serves the Hamlet of Glen Robertson. It is believed to be a shallow aquifer under the influence of surface water. The water is found to contain higher levels of iron, colour and hardness, with the colour most likely being caused by iron oxides.

Both temperature and turbidity are relatively consistent throughout the year, and there are no predictable operational challenges or threats relating to the raw water source.

Raw Water Characteristics						
Year	2016		2017		2018	
Parameter	Average	Range	Average	Range	Average	Range
pH	7.11	6.97 - 7.26	7.07	6.40 - 7.56	7.06	6.93 - 7.06
Turbidity (NTU)	0.43	0.15 - 7.14	0.44	0.11 - 3.62	0.50	0.17 - 5.82
Total Coliform (cfu/100mL)	0.2	0 - 2	1	0 - 4	0.5	0 - 2
E. Coli (cfu/100mL)	0.1	0 - 2	0	0 - 1	0	0 - 0

6.2.2 System Description

Well

The drilled well is 18 metres deep with a 300 mm diameter casing. It is equipped with a submersible well pump, rated at 2.6 l/s with a 50 mm diameter discharge pipe connected to the pump house.

Pumping Station

The pumping station houses pumping, treatment and control equipment including a chlorination system to supply primary disinfection and five pneumatic pressure tanks operating at between 275 to 400 kPa to keep pressure constant.

Chlorine contact disinfection and time is achieved through approximately 52 meters of looped piping located below ground adjacent to the pumping station prior to entering the distribution. A treated water sample line from the end of the contact pipes leads to the pumping station water sample tap and the free chlorine and turbidity analyzer inside the building.

The pumping station is equipped with a 14-kW gas powered emergency generator set, which will automatically transfer in the event of power outage.

Disinfection

The primary source of disinfection is ultra violet treatment. The system being used currently is comprised of three Hewlett 30 UV systems, preceded by two filters for each UV unit. These filters are rated for 5 micron and 1 micron. These units are equipped with an automatic shut down solenoid and are incorporated into the alarm system.

Chlorination is used for both primary and secondary disinfection with a chlorine residual monitoring analyzer at the end of the contact loop. This is achieved using Sodium hypochlorite which is rated at 12%, in order to achieve the required disinfection for distribution, as per O Reg. 170/03. There are two analyzers located just after injection and at the end of the disinfection loop that continuously monitor for chlorine residuals.

Continuous Monitoring of Finished Water

A magnetic flow meter rated at 85 m^3/hr with a chart recorder monitors treated water pumped and activates the chemical metering pumps. This unit is incorporated into the alarm system and an alarm will be initiated if the limits set are exceeded.

A turbidity meter at the pumping station with a chart recorder continuously monitors the finished water turbidity. This unit is incorporated into the alarm system and an alarm will be initiated if the limits set are exceeded.

Two free chlorine residual analysers continuously monitor the water, one after sodium hypochlorite injection and one monitors the treated water prior to distribution. These residuals are recorded on recording charts and are incorporated into the alarm system if the limits set are exceeded.

If any units connected to alarm systems exceed the limits set, an audible alarm will be initiated on-site, and the on-call operator will be notified through the security system.

6.2.3 Distribution System Key Elements

The distribution consists of approximately 800 meters of 150 mm PVC piping. Valves are exercised, and the flushing ports are operated annually during the planned spring flushing program. Flushing of the water mains is achieved through three flushing ports within the system. This system does not support fire flows, and as such, no fire hydrants are located in this system.

6.2.4 Critical Upstream or Downstream Processes

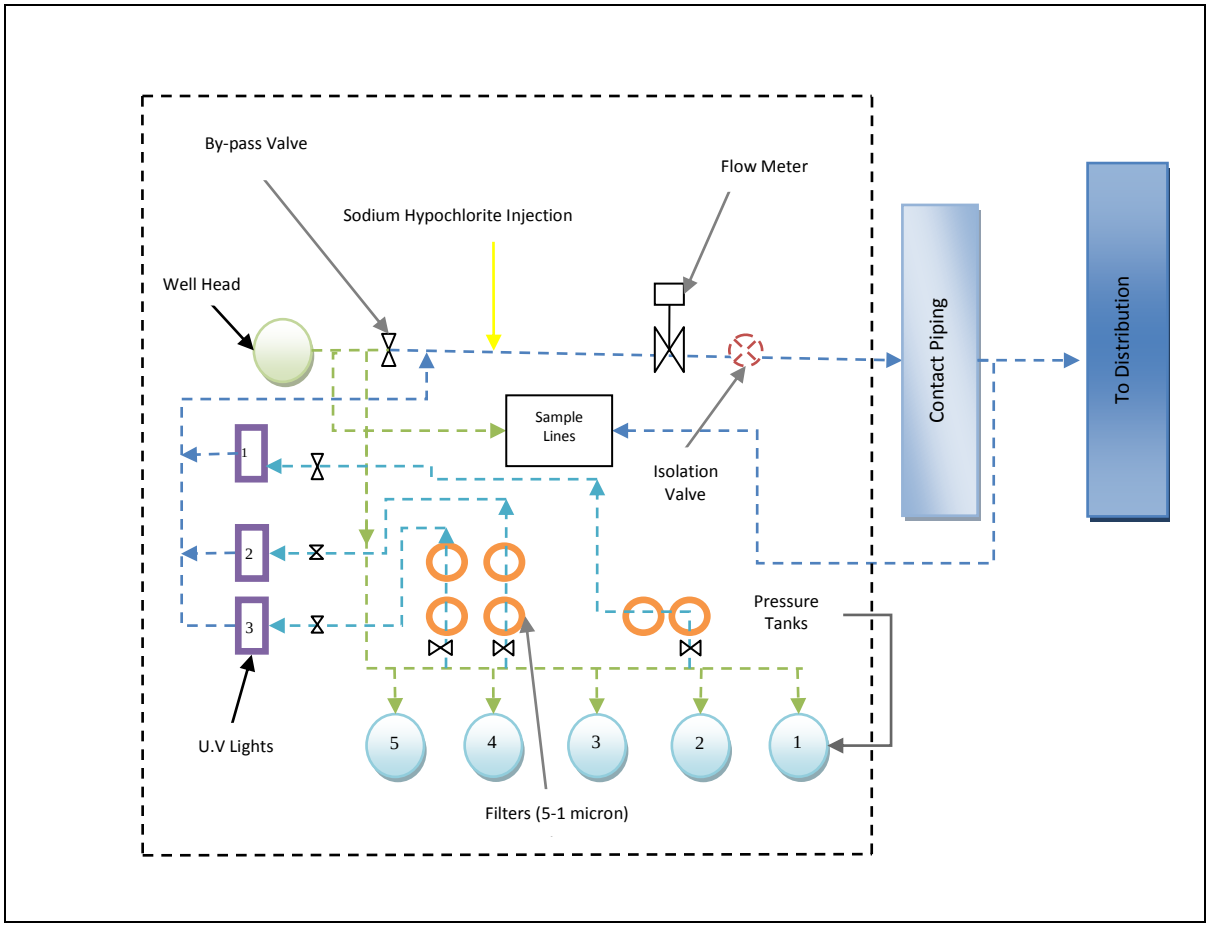
The Glen Robertson Drinking Water system is not connected to any adjoining water systems, and there are no critical upstream or downstream processes.

6.2.5 Operational Challenges or Potential Threats

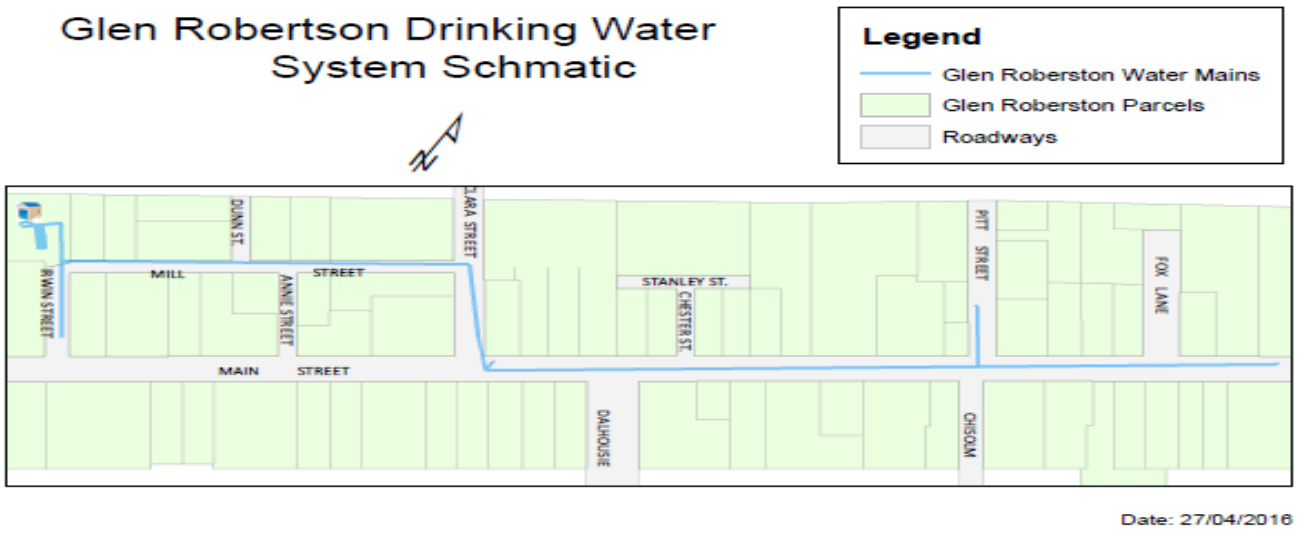
The main operational challenge or potential threat is the lack of redundancy in the source, and the lack of distribution storage. Currently there is only one production well and therefore also only one raw well pump in service. In the event of failure or shut down for maintenance, the WTP would have to be shut down and isolated from the distribution system in order to remove the pump.

Another operational challenge is the fact there is no storage built into this system, so if the well is shut down the system has a very limited run time prior to system wide sustained pressure loss. Contingency plans have been created to supply to distribution with water in the event of planned maintenance or an extended supply issue.

6.2.6 Process Flow Chart



6.2.7 System Schematic



7. Risk Assessment

The Township of North Glengarry recognizes that one of the key purposes of the QMS standard is to encourage system operators to identify, assess, manage and communicate the risks inherent to drinking water systems. In keeping with this purpose and its requirements, the Township of North Glengarry has developed a QMS Risk Assessment Procedure (QMS SYS-P8) and included it in the Appendices of this Operational Plan. The procedure provides a means for consistently assessing risk and presents an opportunity for management to focus its drinking water resources more effectively based on the results of the Risk Assessment process.

The outcomes of the most recent Risk Assessment process are discussed and summarized in Element 8 of this document.

8. Risk Assessment Outcomes

The Drinking Water Quality Management Standard (DWQMS) requires that the following outcomes of the risk assessment be documented:

- Consideration of potential hazardous event and associated hazards identified by the MECP document titled Potential Hazardous Events for Municipal Residential Drinking Water Systems
- Potential hazardous events and associated hazards,
- Assessed risks associated with the occurrence of hazardous events,
- A ranking of the hazardous events that have been identified,
- The identified control measures to address the potential hazards and hazardous events,
- The identified critical control points and their respective critical control limits,
- Procedures and/or processes to monitor the critical control limits,
- Procedures to respond to deviations from the critical control limits, and
- Procedures for reporting and recording deviations from the critical control limits.

Using the QMS Risk Assessment Procedure (QMS SYS-P8), the Township of North Glengarry's drinking water facilities have been evaluated to identify and quantify potential risks to drinking water quality, as described above. As described in the procedure, complete risk assessments have been conducted separately for each individual subsystem:

3. **The Alexandria Drinking Water System,**
    a. **Alexandria Distribution System and Water Tower**
    b. **Alexandria-Maxville Transmission Main and Booster Station**
    c. **Maxville Water Tower and Distribution System**
4. **The Glen Robertson Drinking Water System,**
    a. **Glen Robertson Treatment Plant**
    b. **Glen Robertson Distribution System**

The operational subsystem's comprehensive risk assessment outcomes can be found in the Appendices of this document, as are the relevant procedures relating to critical control points (CCPs) and limits.

8.1 The Alexandria Drinking Water System

8.1.1 Ranked Hazards Table

Can be located In Appendix C of this Document

8.1.2 Critical Control Points (CCPs)

The critical threshold was set at "7". In this case, several hazards identified whose total risk met or exceeded the threshold were contingency situations and offered

little operator opportunity to monitor, control or mitigate the hazard in real time. They are discussed in the following section under "Exclusions".

Points that met or exceeded the risk threshold and offered operators an opportunity to monitor, control or mitigate the hazard are as follows:

- **Coagulant Addition** (improper dosage)
- **Polymer Addition** (improper dosage)
- **Chlorination** (loss of feed)
- **Distribution Residual** (low chlorine residual)
- **Distribution Residual Monitoring** (equipment failure)

The procedures that address how the parameters relating to these points are monitored and controlled are included with the Appendices of this Plan.

8.1.3 Rationale for Inclusion/Exclusion of CCPs

Exclusions

Several hazards/hazardous events exceeded the risk threshold, but the process steps to which they belong were not deemed to be CCPs:

- Contamination (chemical or biological),
- Water Flow Monitoring (raw or treated Magmeter failure),
- Structural Damage,
- Ammonia Addition (loss of feed),
- Chemical Supplies (supplier shortage),
- Equipment or Electrical Failure (Screens, Baffle Wall, Settling Tubes, Pumps, VFD, Generator),
- Major or Minor Water Main Break (Distribution),
- Cross Connection (Distribution),
- Long Term Impacts of Climate Change,

These events were excluded from consideration as critical control points as no effective and timely controls are in place to prevent or mitigate them. As such, they have been classified as *emergency* situations, and included for discussion in the QMS Emergency Management Procedure (QMS SYS-P10).

Inclusions

No hazards below the risk threshold were included for consideration as critical control points.

8.2 The Glen Robertson Drinking Water System

8.2.1 Ranked Hazards Table (presented in declining order of risk)

Can be located In Appendix C of this Document

8.2.2 Critical Control Points (CCPs)

The critical threshold was set at "8". In this case, a number of hazards identified whose total risk met or exceeded the threshold were contingency situations and offered little operator opportunity to monitor, control or mitigate the hazard in real time. They are discussed in the following section under "Exclusions".

Points that met or exceeded the risk threshold and offered operators an opportunity to monitor, control or mitigate the hazard are as follows:

- **UV Malfunction (parts/improper dosing)**
- **Sodium Hypochlorite Addition (loss of feed or equipment failure)**
- **Flow Metering Failure (inaccurate or loss of monitoring)**

8.2.3 Rationale for Inclusion/Exclusion of CCPs

Exclusions

Several hazards/hazardous events exceeded the risk threshold, but the process steps to which they belong were not deemed to be CCPs:

- Source Water Contamination
- Lack of Supply/Drought,
- Well Pump Burn Failure,
- Well Screen Damage or Blockage,
- Alarm Panel Malfunction or By-Pass
- Alarm Notification Failure
- Water Break in Contact Chamber or Distribution (Treatment/Distribution)
- Cross Connection

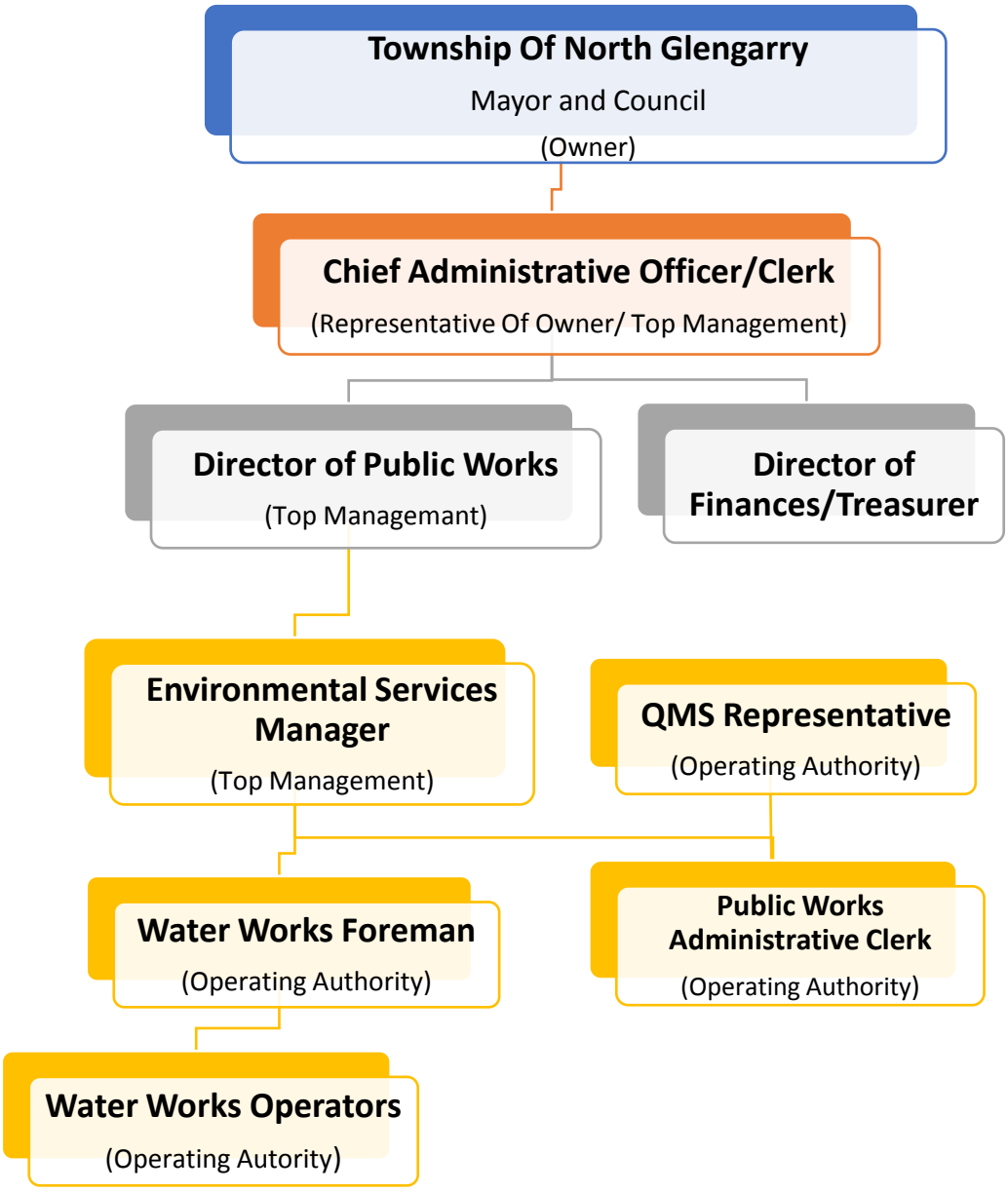
These events were excluded from consideration as critical control points as no effective and/or timely controls were in place to prevent the event form occurring or they did not directly affect the treatment process. As such, they have been classified as *emergency* situations, and included for discussion in the QMS Emergency Management Procedure (QMS SYS-P10).

Inclusions

No hazards below the risk threshold were included for consideration as critical control points at this time.

9. Organizational Structure, Roles, Responsibilities and Authorities

9.1 Organizational Structure



9.2 Roles, Responsibilities and Authorities

9.2.1 The Township of North Glengarry Mayor and Council (Owner)

Responsibilities	Authorities
• Overall responsibility to provide safe and reliable drinking water to the customers of North Glengarry. • Participating in council meetings, committee meetings, and any other bodies as appointed, or as required. • Evaluating the operation and administration of the municipality through the information provided from various key staff or through public input. • Setting policies, procedures and programming throughout various levels in the municipality or approving such actions as required. • Ensure the provision of all necessary resources for the maintenance and operations of the various departments including the waterworks infrastructure and the Quality Management System. • Endorse the QMS Operational Plan. • Ensure that an accredited Operating Authority is in place for each Operational Subsystem within its drinking water systems	• Perform all duties as described under responsibilities • Delegate the management and operations of various departments including the drinking water system to qualified staff. • Hire, evaluate, discipline or terminate staff members or service providers as required. • Overall administrative and financial authority relating to the drinking water system. • Review, revision and approval of proposed by-laws, expenditures, user fees and taxation rates. • Recommend changes to the Operating Authority's QMS Operational Plan.

9.2.2 Chief Administrative Officer (Top Management)

Responsibilities	Authorities
• Oversight of the operation and management of all departments within the Corporation of the Township of North Glengarry • Overall responsible for communications between Council and all department senior staff • Ensure that bylaws, policies and procedures of the Township are communicated and complied with by all departments. • Direct oversight and supervision of all departmental management staff • Endorsement of the QMS Operational Plan and participating in the Management Review of the QMS.	• Act as technical, financial and administrative authority relating to all departments within the Township of North. • Communicate major or unforeseen expenditures or issues to council for approval or informational purposes. • Communicate council policies or operational directions to department heads • Hire, evaluate, discipline or fire management staff or directors, as required.

9.2.1 Chief Administrative Officer (Top Management continued)

Responsibilities	Authorities
• Participate in the annual Infrastructure Review.	• Lead or participate in, conduct, or commission analysis of the Operational Subsystems to enable effective long-term planning and budgeting relating to staffing and infrastructure, maintenance and capital work, and communicate the outcomes of these reviews to the Owner.

9.2.2 Director of Public Works (Top Management)

Responsibilities	Authorities
• Directs the overall co-ordination and business affairs of the Water Works Department, Roads Department, RARE, Landfill Sites and Drainage Department. • Report system conditions and needs, major incidents, or financial needs to Top Management Staff or council, as required. • Determine, obtain or provide the resources needed to maintain and continually improve the systems under the various departments, including the Drinking Water Systems and the Quality Management System. • Overall responsible for communications between Top Management and all department managers • Oversee the financial budget and expenditures in conjunction with the department heads. • Ensure adequate staffing levels of competent operational staff. • Endorsement of the QMS Operational Plan and participating in the Management Review of the QMS. • Participate in the annual Provision of Infrastructure Review and the annual Management Review • Administration of collective bargaining agreement for operational staff.	• Assume or assist in the command of emergency situations in the Operational Subsystems. • Communicate with regulatory bodies on legal and compliance issues relating to drinking water. • Prepare responses to regulatory bodies on legal and compliance issues relating to drinking water. • Hire, train and discipline operators. • Prepare effective long-term planning and budgeting relating to staffing and infrastructure, maintenance and capital works. • Communicate the outcomes of long-term planning and budgeting reviews to the Owner.

9.2.3 Environmental Services Manager (Top Management)

Responsibilities	Authorities
• Directs the overall planning, co-ordination and control of the technical activities of the Water Works Department and Landfill Site. • Ensures adequate staffing levels of competent Operators. • Ensures that the Drinking Water Operational Subsystems are being operated in compliance with current regulations and that a safe and reliable supply of water is being provided to customers of North Glengarry • Reports system conditions or major incidents to Director of Public Works • Oversees the financial budget and expenditures in conjunction with the Director of Public Works. • Ensures a Quality Management System is in place that meets the requirements of the Drinking Water Quality Management Standard. • Ensures that Staff is aware of all applicable legislative and regulatory requirements that pertain to their duties for the operation of the subject systems. • Conduct, at a minimum, periodic assessments of operator competency, as required. • Participate in the annual Infrastructure, Maintenance, Rehabilitation and Renewal Review, the Provision of Infrastructure and the Management Reviews	• Acts as ORO status for the Water Works Department. • Communicate with regulatory bodies on legal and compliance issues relating to drinking water. • Prepare responses to regulatory bodies on legal and compliance issues relating to drinking water. • Assist with hiring, training and disciplining operators. • Review and approve building or system expansion requests. • Select contractors and equipment as required • Ensure that staff is in place to effectively manage the Operational Subsystems and the QMS. • Prepare effective long-term planning and budgeting relating to staffing and infrastructure, maintenance and capital works. • Prepare, review and approve system design specifications or building developments • Select and/or approve contractors and equipment suppliers

9.2.4 Public Works Administrative Clerk

Responsibilities	Authorities
• Provide administrative support to the Public Works Department, including the Water Works Department and the drinking water QMS Representative. • Maintain a working knowledge of the QMS, particularly with respect to Document and Records Control, in order to carry out duties as instructed by the QMS Representative.	• Change QMS documents, as directed by the QMS Representative • File QMS records, as instructed by the QMS Representative.

Responsibilities	Authorities
• Scheduling and documenting operator training	

9.2.5 QMS Representative

Responsibilities	Authorities
• Administer the Quality Management System by ensuring that processes and procedures needed for the Quality Management System are established, effectively communicated and maintained. • Report to Top Management on the performance of the Quality Management System and any need for improvement. • Identify and communicate (to Top Management) resources needed for the continued operation and improvement of the QMS. • Ensure that current versions of documents required by the Quality Management System available to all users as per the QMS Document Control Procedure (QMS SYS-P1). • Lead the annual Infrastructure, Maintenance, Rehabilitation and Renewal Review, the Provision of Infrastructure and the Management Reviews. • Additional responsibilities as specified by QMS procedures. This includes overall responsibility for the Risk Assessment and Internal Audit processes. • Ensure a Quality Management System is in place that meets the requirements of the Drinking Water Quality Management Standard. • Scheduling the internal and external audits as required • Conducting the annual risk assessment and leading comprehensive 36-month risk assessment • Ensure annual essential supplier communications is completed and tracking any supplier issues that may arise.	• Review, change, update and improve the QMS Operational Plan • Create and/or change QMS forms as required. • Prepare and conduct the Infrastructure, Maintenance, Rehabilitation and Renewal Review, the Provision of Infrastructure and the Management Review. • Recommend changes to the QMS Operational Plan. • Make changes to the QMS Operational Plan. • Respond to Corrective Action Requests

9.2.6 Water Works Foreman

Responsibilities	Authorities
• Responsible for day-to-day operations of the Water Works Department. • Maintain required certification for Treatment &	• Maintain awareness of the activities of operational staff as well as day to day operations and maintenance.

Responsibilities	Authorities
Distribution System Operation (as applicable), as per the Ministry of the Environment regulations. • Conduct operational duties in compliance with current regulations. • Ability to operate, monitor and maintain the water works system. • Ensure that the documents (procedures, forms) used in day-to-day operations are the appropriate version as described in the QMS Document Control Procedure (QMS SYS-P1). • Report document errors and omissions to the QMS Representative. • Act upon, record and report incidents of non-compliance with regulations. • Understand the QMS and be able to describe their role within it to auditors and inspectors. • Promote awareness of the Quality Management System throughout the Operating Authority. • To train and regularly assess the competency of operators. • Prepare compliance reports, as required. • Scheduling annual compliance inspection and or annual external maintenance contractors, as required	• In absence will act as ORO. • Assist in the command of emergency situations in the Operational Subsystems. • Collect samples and perform testing within the Operational Subsystems to ensure the provision of safe and reliable drinking water. • Respond to water-related issues raised by customers, as required. • Train operational staff and as required to report any discipline issues to the Environmental Services Manager • Submit approved reports to the applicable ministry or government body. • Communicate with regulatory bodies on compliance issues relating to drinking water. • Prepare responses to regulatory bodies on compliance issues relating to drinking water.

9.2.7 Operators

Responsibilities	Authorities
• Collect samples, perform testing, review trending and adjust treatment processes as required to ensure safe water quality and regulatory compliance is being upheld. • Maintain required certification for Treatment & Distribution System Operation (as applicable), as per the Ministry of the Environment regulations. • Conduct daily operational duties in compliance with current regulations and internal policies and procedures. • Act upon, record and report incidents of non-compliance with regulations as per O. Reg 170/03 and O. Reg 128/04. • Ensure that the documents (procedures, forms)	• Can be OIC as per Water Works Foreman discretion, provided proper licensing is maintained. • Collect samples and perform testing within the Operational Subsystems to ensure the provision of safe and reliable drinking water. • Respond to water-related issues raised by customers as required. • Recommend changes to the QMS Operational Plan.

Responsibilities	Authorities
used in day-to-day operations are the appropriate version as described in the QMS Document Control Procedure (QMS SYS-P1). • Report document errors and omissions to the QMS Representative. • Perform preventative maintenance as scheduled. • Understand the QMS and be able to describe their role within it to auditors and inspectors. • Attend training as required to maintain licenses, obtain records of training and provide these records to the Public Works Administrative Assistant.	

10. Competencies

Competence: the combination of observable and measurable knowledge, skills, and abilities which are required for a person to carry out assigned responsibilities.

10.1 Identifying Required Competencies

The following table identifies the minimum competencies of Water Works Staff whose roles directly impact the provision of safe and reliable drinking water in North Glengarry.

Role	Required Competencies
Top Management	• A theoretical and working knowledge of the Safe Drinking Water Act and applicable regulations. • Thorough knowledge of the DWQMS and QMS Operational Plan. • Ability to effectively communicate QMS and Regulatory issues to staff, Council and external agencies. • Effective budgeting analysis and preparation skills
Environmental Services Manager	• An advanced theoretical and working knowledge of the Safe Drinking Water Act and applicable regulations sufficient to identify, report, and respond to adverse drinking water conditions when they occur. • Ability to effectively communicate QMS and Regulatory issues to staff, Council and external agencies. • High level of technical knowledge of the Township's drinking water systems sufficient to prevent and/or mitigate hazards to drinking water safety. • Effective budgeting analysis and preparation skills • Thorough understanding of the DWQMS and QMS Operational Plan. • Minimum Class 3 Water Treatment Certificate. • Minimum Class 2 Water Distribution Certificate. • Valid driver's license.
QMS Representative	• Thorough understanding of DWQMS and QMS Operational Plan. • QMS and QMS Internal Audit Training. • A working knowledge of the Safe Drinking Water Act and applicable regulations sufficient to interpret, understand and communicate, as required, all QMS references to them. • High level of administrative capabilities, strong written communication abilities and computer skills.
Water Works Foreman	• A working knowledge of the Safe Drinking Water Act and applicable regulations sufficient to identify, report, and respond to adverse drinking water conditions when they occur. • Technical knowledge of the drinking water systems operated by the Township sufficient to prevent and/or mitigate hazards to drinking water safety. • Strong understanding of what is required to operate and maintain the drinking water facilities that the Township operates. Foreman must be able to keep the facilities running and keep them clean. • Ability to follow QMS and Operational procedures.

Role	Required Competencies
Water Works Foreman	• Ability to effectively communicate QMS and Regulatory issues to staff. • Minimum Class 3 Water Treatment Certificate. • Minimum Class 2 Water Distribution Certificate. • Valid driver's license.
Operators	• A working knowledge of the Safe Drinking Water Act and applicable regulations sufficient to identify, report, and respond to adverse drinking water conditions when they occur. • Technical knowledge of the drinking water systems operated by the Township sufficient to prevent and/or mitigate hazards to drinking water safety. • Strong understanding of what is required to operate and maintain the drinking water facilities that the Township operates. Operators must know how to keep the plants running and keep them clean. • Ability to follow QMS and Operational procedures. • Minimum OIT Water Treatment Certificate while working towards the highest level attainable. • Minimum OIT Water Distribution Certificate while working towards the highest level attainable. • Valid driver's license.

10.2 Satisfying Competencies

Competence can be defined as the "demonstrated ability to apply knowledge and skills". In order to assess competence, an organization must consider an employee's education, training, skills and experience.

The Public Works Administrative Clerk maintains an ongoing, electronic record of training hours, including:

- License details and expiry dates for each operator,
- Director approved training required and completed, and
- On-the-job training required and completed.

The Township of North Glengarry provides financial support to staff challenging operator certification examinations, renewing or upgrading certification and for staff to attending training related events or conferences. The methods used by the Township to ensure competence of the personnel directly involved in the production of safe drinking water are summarized in the following table.

Role	Methods for Satisfying Competency
Top Management	• The CAO is briefed on operating conditions by the Director of Public Works. The Director of Public Works notifies the CAO of any relevant changes to drinking water regulations. • Annually, through the Management Review, the top management is provided with information which allows for currency on the functioning of the QMS.

Role	Methods for Satisfying Competency
Environmental Services Manager	• Maintaining of the required licenses and certification. • Internal or external training on various topics such as confined space, occupational health and safety, treatment process operations, regulatory requirements, equipment operations, maintenance, contingency plans and treatment equipment technologies. • System updates are communicated at regularly scheduled meetings. • Candidates for hire must submit proof of education, licensing and other required competencies during the hiring process • Periodically, the Director of Public Works conducts an assessment of the Environmental Services Manager's competency and completed training hours in the current license cycle. The review is kept on site within the Township's filing system.
Water Works Foreman	• Maintaining of the required licenses and certification. • Internal or external training on various topics such as confined space, occupational health and safety, treatment process operations, regulatory requirements, equipment operations, maintenance, contingency plans and treatment equipment technologies. • System updates are communicated at regularly scheduled meetings. • Candidates for hire must submit proof of education, licensing and other required competencies during the hiring process • Periodically, the Environmental Services Manager conducts an assessment of the Water Works Foreperson's competency and completed training hours in the current license cycle. The review is kept on site within the Township's filing system.
QMS Representative	• The QMS Representative receives training relating to the QMS and associated standards and regulations.
Operators	• Maintaining of the required licenses and certification. • Internal or external training on various topics such as confined space, occupational health and safety, treatment process operations, regulatory requirements, equipment operations, maintenance, contingency plans and treatment equipment technologies. • System updates are communicated at regularly scheduled meetings. • Candidates for hire must submit proof of education, licensing and other required competencies during the hiring process • Staff issues are reported to the Environmental Services Manager from the Water Works Foreman or from other concerned staff members. • Periodically, the Environmental Services Manager conducts an assessment of the operational staff competency and completed training hours in the current license cycle. The review is kept on site within the Township's filing system.

11. Personnel Coverage

11.1 General Information

The Environmental Services Manager is currently the Overall Responsible Operator (ORO). In the event that the Manager is unavailable, the Water Works Foreman is deemed to be ORO until return to duty. In order to be designated the position of ORO a person must hold a certificate for that type of subsystem of the same class or higher. In the event that no qualified personnel are available an operator with certification of one class lower than the subsystem may assume the ORO responsibilities for up to 150 days within a calendar year.

The Operator in Charge designation can be applied to any or all operators that hold a class 1 or greater certificate. Currently the on-call operator will assume the OIC designation during all outside of working hours, otherwise all operational staff that meet the OIC requirements can be deemed as OIC in the facilities worked. In the event no qualified personnel are available a professional engineer can be designated at OIC for 180 day in a 24-month period.

The on-call operator is currently determined through staff scheduling. Any operator that maintains a minimum of a class 1 certificate, is familiar with the operational processes and competent enough to respond to adverse scenarios is eligible to be scheduled for on-call operations. The on-call operator is responsible for ensuring that the on-call cell phone is transferred to him/her, as all after-hours calls are received through the on-call operator's cell phone. He/she is to investigate the nature of all the calls received and the actions taken are recorded in the appropriate log book or in the Access E11 app.

Water Works employees are under a collective agreement and work a scheduled 37.5-hours week, 7 a.m. to 3 p.m. Monday through Friday.

11.2 Emergency Scheduling and Response

The Water Works Foreman is responsible for on-call scheduling, which is completed annually, and forwarded to operational staff prior to commencement. Once schedule is posted any changes that are required by operational staff due to scheduling conflicts can be completed and recorded by operational staff. All after-hours emergency calls are handled by on-call personnel according to the rotational schedule. If additional assistance is required after-hours, the on-call operator contacts other operators, in a specified manner as per the collective agreement.

The drinking water systems are monitored constantly through various means. All systems are equipped with a security system with audible alarms, set points and call out capabilities. The security system's call central will receive the alarm and communicate with the on-call operator through cell phone to advise in the event of an active alarm. If for any reason the on-call operator misses the call, the security system is to follow a list of numbers to call until someone can be reached. The Alexandria Water Treatment Plant, Alexandria Water Tower, Booster Station and the Maxville Water Tower are all monitored by the Supervisory Control and Dara

Acquisition (SCADA) system. Once an alarm set point is reached, it will trigger an alarm through the security system to alert the on-call operator. All actions and alarms are to be recorded in the on-site log book, generally located in the SCADA office area.

There are 2 methods in which the public can contact the on-call operator after hours, there is a direct phone number or if they call the main office and they will be directed to the afterhours emergency by selecting the line as required.

11.3 In the Event of a Walk-Out or Strike

As per the collective agreement, all operational staff members covered by the collective agreement are not allowed to strike or walk out as long as the collective agreement is in place. In the rare likelihood of a strike or walkout, management would fill in for operational duties as required, as within their abilities to do so, unless other procedures are put into place.

11.4 Staff Shortage or Events Outside of Normal Operation

In the event of short-term staff shortage, the water works foreman or Environmental Services Manager may schedule staff as required to ensure that operations are always maintained. In the event of a long-term shortage management can hire temporary employees for a limited duration of 6 months, as per the collective agreement.

In the event of extreme incident or special circumstances that last beyond 3 days, the water works foreman or Environmental Services Manager will proceed to schedule staff as required to ensure that operations are always maintained.

Currently there is no mutual aid agreement in place with any other specific municipalities, but the Township of North Glengarry is also a member of On-Warn System.

12. Communications

The Township of North Glengarry acknowledges that if a QMS is not effectively communicated, it is not implemented. The DWQMS standard requires a procedure that describes how relevant aspects of the QMS are communicated between Top Management and:

- The Owner,
- Operating Authority Personnel,
- Suppliers, and
- The Public.

Additionally, the standard calls for a procedure to describe how QMS-related information is fed back to Operating Authority Top Management.

Through the QMS Communications Procedure (QMS SYS-P9), the Township seeks to ensure that all stakeholders of the Drinking Water System are aware of the QMS and its importance. Further, it aims to make certain that all who share responsibility for the production of safe and reliable drinking water understand their roles, the responsibilities and authorities that come with those roles, and the QMS processes and procedures that are relevant to those roles.

The QMS Communications Procedure (QMS SYS-P9) is attached in the Appendices of this document.

13. Essential Supplies and Services

Essential supplies and services are products and services used in the production or operation of a drinking water system, which if absent can introduce risk or loss of production to the system. By documenting the level of quality expected, and by continuing to assess whether supplies and services consistently meet these requirements after they have been selected, an operating authority demonstrates due diligence in minimizing the risk to drinking water quality. Annually a letter is sent to essential suppliers highlighting the DQWMS, the quality standards expected and requires them to return a signed copy with contact and emergency contact information as acknowledgement of the service requirement.

13.1 Procurement Policy

The purchase of goods and services is regulated throughout the Township by the procurement policy by-law, which is controlled and maintained through the treasury department. All forms in association with the procurement policy by-law are not within the DWQMS scope, as they are issued, controlled and archived through the treasury department. This policy includes pricing thresholds that will allow purchasing to be completed directly by Water Works Department from various sources. It also covers emergency purchases that may arise. This policy can be found under Appendix G of this manual.

13.2 Supplies and Services Procedure

The Township of North Glengarry has developed a procedure that will be used by authorized personnel within the water Works department. This procedure describes how it ensures the quality and availability of supplies and services deemed essential to the drinking water systems it operates. The document is called the QMS Essential Supplies and Services Procedure (QMS SYS-P7) and it is included with the Appendices of this Operational Plan.

The Water Works department has created an essential supplier listing, and an emergency contact and services listings, which can be found under Appendix D of this manual.

13.3 Inventory Management

The Water Works department's goal is always to maintain a minimal number of products on-site to ensure continued operations. This is performed by operators monitoring current supplies on-site and placing orders or direct ordering of specific parts as required, when authorized.

Product supply of chlorine gas is on a routine delivery schedule, pre-set annually by supplier. Staff continuously monitors supplies and if required emergency delivery can be arranged if quantity is insufficient prior to next delivery.

The Water Works department has also created a minimum inventory listing, which can be found under Appendix D of this manual. This listing contains essential and non-essential components which should always be kept on-site to ensure continual operations.

14. Review and Provision of Infrastructure

The Township of North Glengarry has developed a procedure for the annual review of the infrastructure necessary to safely and effectively operate and maintain the drinking water systems belonging to and operated by the Township.

The procedure ensures a consistent, regular review of the condition and capacity of the drinking water systems that are operated by the Township of North Glengarry. A thoughtful, effective, and reliable review that is effectively communicated to the Owner ensures that infrastructure needs are appropriately communicated to those who can provide them.

The QMS Review and Provision of Infrastructure Procedure (QMS SYS-P3) can be found in Appendix A of this manual.

15. Infrastructure Maintenance, Rehabilitation and Renewal

Effective maintenance programs help to safeguard the reliability and performance of a drinking water system, protect the investment of the Owner, and minimize risks to drinking water supply and quality. Currently the Township quantifies maintenance as planned and unplanned, as described below. The Maintenance Summary Tables for Alexandria (QMS SYS-T10A) and Glen Robertson (QMS SYS-T10G) were created to define and summarizes current practices and can be found in Appendix F of this manual.

The QMS Infrastructure Maintenance, Rehabilitation and Renewal Procedure (QMS SYS-P4) has been created and implemented to evaluate the existing practices and to determine any shortfalls that may arise, and it can be found in Appendix A of this manual.

Maintenance Summaries

The Water Works department maintains a site by site preventative maintenance program, headed by one assigned operator for all sites. He/she must review, maintain and make changes to the scheduling and maintenance forms that are to be completed, as required. Equipment is evaluated and maintenance needs are placed onto existing schedules, which can include but are not limited to weekly, monthly, quarterly, bi-annually and annually requirements. Although these documents are not controlled as other QMS documents, they are controlled by the assigned operator and any major changes to the scheduling are communicated to the QMS representative and all impacted staff members. All forms are identifiable by individual titles, currency is achieved through version codes, and the assigned operator oversees storing and ensuring all records are readily available.

Distribution maintenance programs include periodic hydrant inspections, periodic leak detection, annual spring flushing program, annual valve exercising program, annual fall flushing program and annual hydrant winterization program. These programs are overseen by the Environmental Services Manager and/or the Water Works Foreman, who will assign specific tasks to appropriate staff members or outside contractors as required. Any deficiencies discovered during these programs are documented and kept on file at the Water Works Office. If the deficiency is of high priority, operational staff will schedule repair as soon as reasonable possible. Otherwise operational staff will perform repairs on an on-going basis.

Standard operating procedures are available for some of the maintenance practices, which are available through site specific operational manuals. These manuals are kept on-site for operational reference as needed.

The Township recognizes the importance of keeping these summaries current, communicating the programs and any modifications of them to the Owner, and periodically reviewing the effectiveness of its maintenance programs.

Unplanned Maintenance

Unplanned maintenance is the result of unforeseen equipment malfunction or breakdown. Maintenance is conducted as soon as possible after an issue is discovered, this may be performed by operational staff or external contractors. For each facility, repair and replacement

activity is recorded in the facility's daily log book. For distribution issues operators fill out the required forms to ensure all actions are documented or they report the incident in the Access E11 application.

Frequency and impact of equipment failure is included in the annual discussion of the Township's maintenance programs, as described in QMS SYS-P4.

Rehabilitation and Renewal

Planning for rehabilitation and renewal now takes place annually through the budgeting process. The Director of Public Works in conjunction with the Environmental Services Manager are responsible for identifying rehabilitation and renewal projects through various means. These projects could be selected based on results from the annual infrastructure review, the results from the annual provision for Infrastructure review, system condition assessment reports, vulnerable areas identified through previous deficiencies or breakdowns, equipment replacement selections and/or joint departmental capital works projects.

The North Glengarry Asset Management Plan was created and controlled through the finance department, with departmental equipment/asset information input. It was put into place in 2015. Currently the Township is implementing a computer-generated software to better forecast the expected life cycle of each asset. This plan was put into place to better control asset management, to create a predictive replacement process rather than reactive replacement programs and to help the directors with annual budgeting for critical asset replacements. The public works administrative assistant will have access to the software for cycle analysis and review as required.

Actual rehabilitation and renewal that occurs in each budget cycle is dependent on Council's approval.

16. Sampling, Testing and Monitoring

This element of the QMS Operational Plan addresses how measurements are taken within the drinking water system to monitor what is happening, the Operating Authority's level of control, and the quality of treated drinking water.

The Township of North Glengarry understands the focus of the sampling, testing and monitoring component of the DWQMS as being to ensure:

- The reliability of the sampling, testing and monitoring performed to meet legislated requirements,
- That adequate operational sampling, testing and monitoring are undertaken to maintain the Treatment process and identify potential problems early, and
- That sampling, testing and monitoring activity are planned, consistently performed, documented and communicated.

Regulatory requirements determine what is to be sampled and set minimum requirements for frequency. The DWQMS requires that the following additional information be described by the Operating Authority:

- Details about how sampling, testing and monitoring is performed on the conditions most challenging to the drinking water system,
- Relevant sampling, testing, and monitoring activities that are performed upstream of the subject system (even if they are not carried out by the Operating Authority), and
- How the Owner and Operating Authority share sampling, testing and monitoring results.

The QMS Sampling, Testing and Monitoring Procedure (QMS SYS-P5), which outlines the overall requirements, has been implemented and can be located in Appendix A of this manual. The Sampling and Monitoring Tables for Alexandria (QMS SYS-T4A) and Glen Robertson (QMS SYS-T4G), which indicate the specific system requirements, can be located in Appendix E of this manual.

17. Measurement and Recording Equipment Calibration and Maintenance

If measurement and recording devices are used to inform and guide an operator's actions within a drinking water system, those devices must be appropriately maintained and calibrated.

A procedure has been written and implemented that describes general requirements, time frames and routine check requirements for measurement and recording equipment used by the Township of North Glengarry. The QMS Measurement and Recording Equipment Calibration and Maintenance Procedure (QMS SYS-P6), can be found in Appendix A of this procedure. A comprehensive maintenance summary for each sub-system (QMS SYS-T10A and QMS SYS-T10G) has also been created and can be found in Appendix F of this manual.

As described in element 15, at each site a preventative maintenance program can be found, containing all required maintenance and forms to be completed.

18. Emergency Management

The development, implementation and maintenance of procedures to ensure emergency preparedness are recognized by the Township of North Glengarry as an important facet of the QMS. Emergencies, as defined in the MOE's Implementation Guide and as used in this document, are:

- Potential situations or service interruptions that may result in the loss of the ability to maintain a supply of safe drinking water to customers.

By effectively anticipating and planning for emergency situations, the consequences of emergencies, when they occur, can be mitigated.

The Township of North Glengarry maintains emergency preparedness as described in its QMS Emergency Management Procedure (QMS SYS-P10). This procedure describes how the Operating Authority maintains, communicates, and tests the robustness of its emergency preparedness. Additionally, this document lists the emergency situations that are a natural outcome of the QMS Risk Assessment process (described by QMS SYS-P8), describes how responsibility for response and communication is delineated, refers to applicable operations procedures and provides a general list of emergency contacts.

The QMS Emergency Management Procedure (QMS SYS-P10) is included in the Appendices of this Operational Plan Manual. Specific operations procedures relating to the list of potential emergencies identified by the Township will be included in the QMS as they are developed.

19. Internal Audits

An internal audit of the Township's QMS is conducted annually to ensure that:

- The QMS Operational Plan Manual (QMS SYS-OP PLAN) and its associated procedures meet or exceed the standard of the DWQMS for each element, and
- The Operating Authority is functioning in conformance with its own Operational Plan.

An effective internal audit program, conducted by positive internal auditors and supported by interested and involved management and personnel at various levels, is a useful tool for testing and improving the robustness of a QMS. High quality internal audits lead to continual improvement, a requirement of the DWQMS.

Additionally, internal audits serve a valuable purpose by providing feedback on the effectiveness of the QMS, and by informing and focusing the Management Review Process.

The output of the audit process is an audit report which includes:

- A completed audit checklist,
- Corrective action request (CAR) forms for each issue of non-conformance,
- A brief summary detailing the outcomes of the audit, including areas of strong performance and areas of non-conformance, and
- A list of suggested improvements to the audit process and audit checklist.

The Township of North Glengarry has described the process used to conduct internal audits in its QMS Internal Audit Procedure (QMS SYS-P11). This procedure is included as part of the Appendices of this document.

20. Management Review

The Township of North Glengarry recognizes that support and oversight of the drinking water QMS is an important role fulfilled by Environmental Services Manager. The Management Review process supports a high level of connection and familiarity between Top Management and the QMS through various means of communication and enables focused and effective decision making regarding how to best improve and maintain the quality management system.

The Township has prepared a procedure that describes how QMS Management Reviews are to be conducted. The document is called the QMS Management Review Procedure (QMS SYS-P12) and it is included in the Appendices of this Operational Plan Manual.

In following the Management Review procedure, Director of Public Works ensures that the Owner receives consistent, timely, and focused information about how the QMS is functioning. Additionally, the process affords an opportunity to reinforce with the Owner the resources that are required to continue to maintain and improve the quality management system.

21. Continual Improvement

A QMS cycle is described as plan, do, check and improve. The Township of North Glengarry recognizes that this Operational Plan is simply a first step in implementing and maintaining Quality Management System and strives to ensure engagement at various levels to try to avoid stagnation.

The Township continues to strive towards to continual improvement through various means:

- Annual Reviews Processes
  → an annual review of internal documentation and operations looking for operational or maintenance trends or potential methods for improvement of tracking information. This relies on internal processes and informational output from operational staff.
  → This review includes annual programs, as well as daily logs and maintenance programs. This information will be tracked through the annual infrastructure review.
- Evaluating and Addressing Best Management Practices
  → review and consider all best practice recommendation generated from external auditors, MECP or other governing bodies. These are to be evaluated at the annual infrastructure provisions review and changes are to be implemented through policy or procedure creation, if relevant.
- Preventative Non-Conformance Actions
  → operational staff, QMS Representative or the internal auditor can identify potential non-conformities within the operational system, and these actions if not changed could lead to potential non-conformances to the QMS system. All incidents are to be reported and recorded for evaluation. These are to be evaluated at the annual management review and changes are to be implemented through policy or procedure creation.
  → The Township of North Glengarry has created the QMS Preventative and Corrective Action procedure (QMS SYS-P14) to identify and manage corrective actions and to identify and implement preventative actions in order to mitigate risk.
- Corrective Actions
  → incidents are to be reviewed, root causes are to be determined and corrections are to be applied in the short term or long term as required. The Internal Auditor is to complete follow up to ensure actions have been completed.
  → The Township of North Glengarry has created the QMS Corrective Action Procedure (QMS SYS-P14) to identify and manage corrective actions and to identify and implement preventative actions in order to mitigate risk.
- Adverse Events and Consumer Complaints
  → incidents are to be recorded and reviewed during the weekly staff meeting and/or through the annual infrastructure review with staff. If an incident is a major event, a staff debrief will be completed after the event to determine best actions, operational strengths/weaknesses and if a CAP or SOP will be created to prevent or mitigate the re-occurrence.

The Township expects that the processes it has described, both in this document and its associated procedures, will change and evolve over time as the QMS matures.

Revision History

Version	Date	Reviewer	Approver	Notes/Changes from Previous Version
v1	October 23, 2009	Angela Cullen	Dean McDonald	Initial document version.
v2	October 12, 2012	April Kennedy	Angela Cullen	QMS review, update sections 3, 6, 8, 9, 13, and 15
v3	October 29, 2013	Angela Cullen	Angela Cullen	QMS review update sections 3, 6, 9, 10, 13, and 15. Check all formatting throughout document.
v4	September 8, 2015	Angela Cullen	Angela Cullen	QMS review. Update sections 6, 8, 13 and 15
v5	July 26 2016	Angela Cullen	Angela Cullen	QMS review, removal of redundant information and/or revision of sections 1, 3, 6, 7, 8, 11, 13, 15, 21
v6	October 1, 2019	Angela Cullen	Angela Cullen	QMS review, updated all sections to adhere to Drinking Water Quality Management Standard 2.0; updated to include expansion to Alexandria Drinking Water System.
v7	November 10, 2019	Angela Cullen	Angela Cullen	QMS Review after internal audit, minor changes to ensure 2.0 conformances.

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Appendix A4	QMS Infrastructure Maintenance, Rehabilitation and Renewal Procedure	*QMS SYS-P4*
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Appendix A8	QMS Risk Assessment Procedure	*QMS SYS-P8*
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