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Prepared for:

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Preliminary Design Report (Final)

Chesterville Water Storage Reservoir and Treatment System

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS

Value through service and commitment

Table of Contents

Table of Figures

Table of Tables

List of Appendices

1.0 Introduction

J.L. Richards & Associates Limited (JLR) has been retained by the Township of North Dundas (the Township) to provide engineering services in support of various water and wastewater infrastructure expansions and upgrades. The Chesterville Drinking Water Supply System (DWSS) is one of the key pieces of infrastructure to be upgraded as part of this project.

1.1 Background

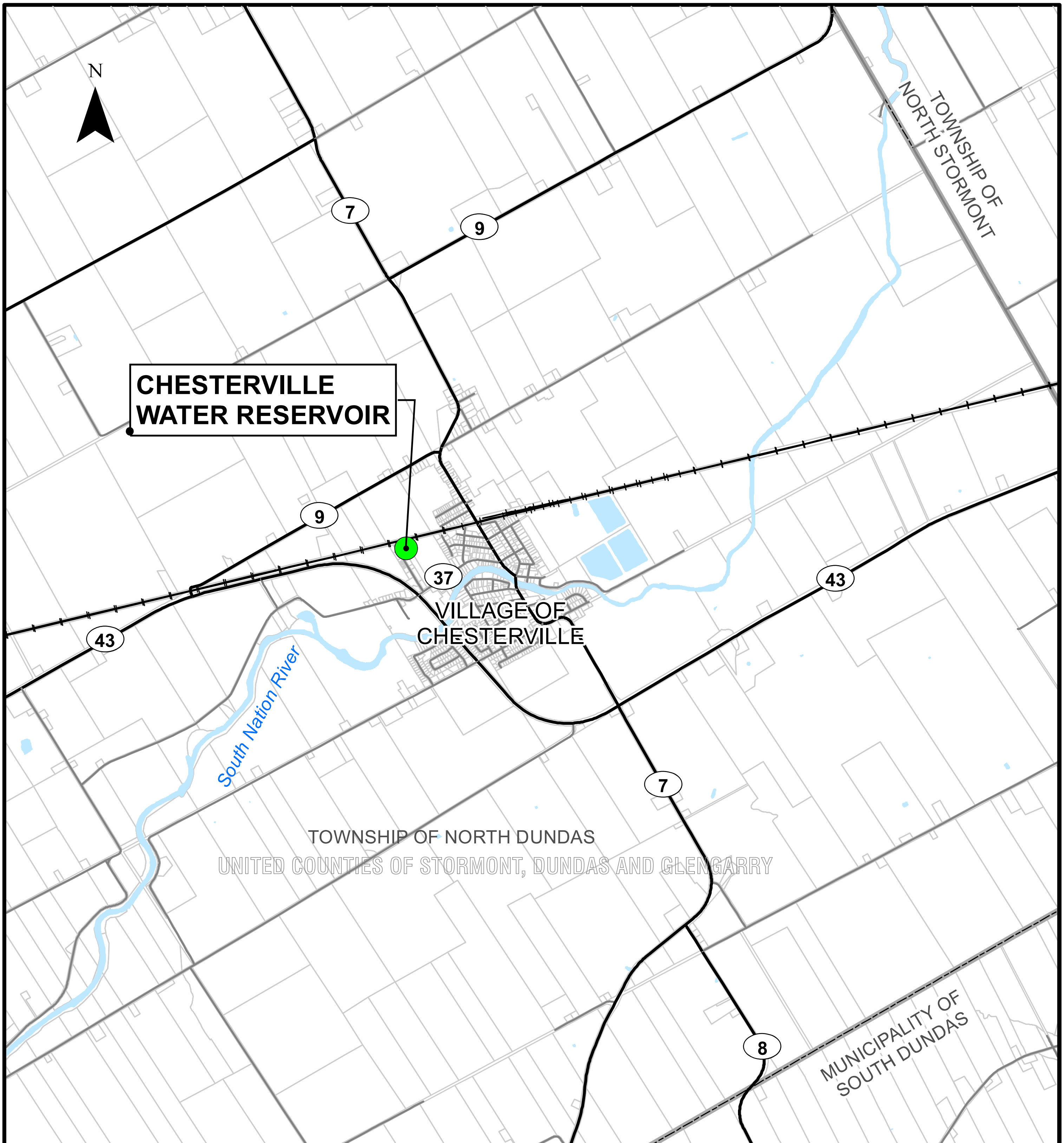
The Township is located approximately 50 km south of downtown Ottawa, midway between Ottawa and Morrisburg. The Township was founded in 1998 with the amalgamation of the former Townships of Winchester and Mountain and the Villages of Chesterville and Winchester. The Village of Chesterville is located north of the intersection between County Road No. 43 and No. 7, with McLean Creek running through its center.

The Township's DWSS supplies treated water to residents of the Village of Winchester and the Village of Chesterville, in addition to industrial, commercial and institutional users (notably Lactalis® Canada in Winchester). Villages of Winchester and Chesterville have populations of 2,394 and 1,677 (based on the 2016 Census), respectively. The populations of both villages are projected to increase due to future developments. Refer to Figure 1 for a Location Plan of the Township of North Dundas.

On August 16, 2019, the Township retained JLR in association with Golder Associates Ltd. (Golder) to undertake a Schedule 'C' Municipal Class Environmental Assessment (Class EA) for the Township DWSS to address long-term potable water supply needs and evaluate servicing solutions for the 20-year planning horizon. The Phase 1 Report of the Class EA was issued September 15, 2020 [1].

On December 16, 2020, JLR issued the Water and Wastewater Servicing Study Technical Memo (Servicing Study) [2], which provided an update to relevant planning projections, flows and demand projections, timing of recommended servicing solutions, and opinions of probable costs. The study identified a need for increased water storage in the Village of Chesterville in the near- and long-term scenarios, with one of the recommendations being increased storage capacity at the Chesterville Reservoir and Pumping Station. In addition to the required storage expansion, the Township has reported aesthetic drinking water concerns associated with elevated levels of both iron and manganese.

This Preliminary Design Report (PDR) describes the selected solution to increase potable water storage capacity and reduce the elevated levels of both iron and manganese within the Village of Chesterville.



PROJECT:

CHESTERVILLE WATER RESERVOIR

VILLAGE OF CHESTERVILLE, NORTH DUNDAS, ONTARIO

DRAWING:

LOCATION PLAN

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DESIGN:	OP
DRAWN:	KTK
CHECKED:	SS
JLR #:	31486

DRAWING #:

FIGURE 1

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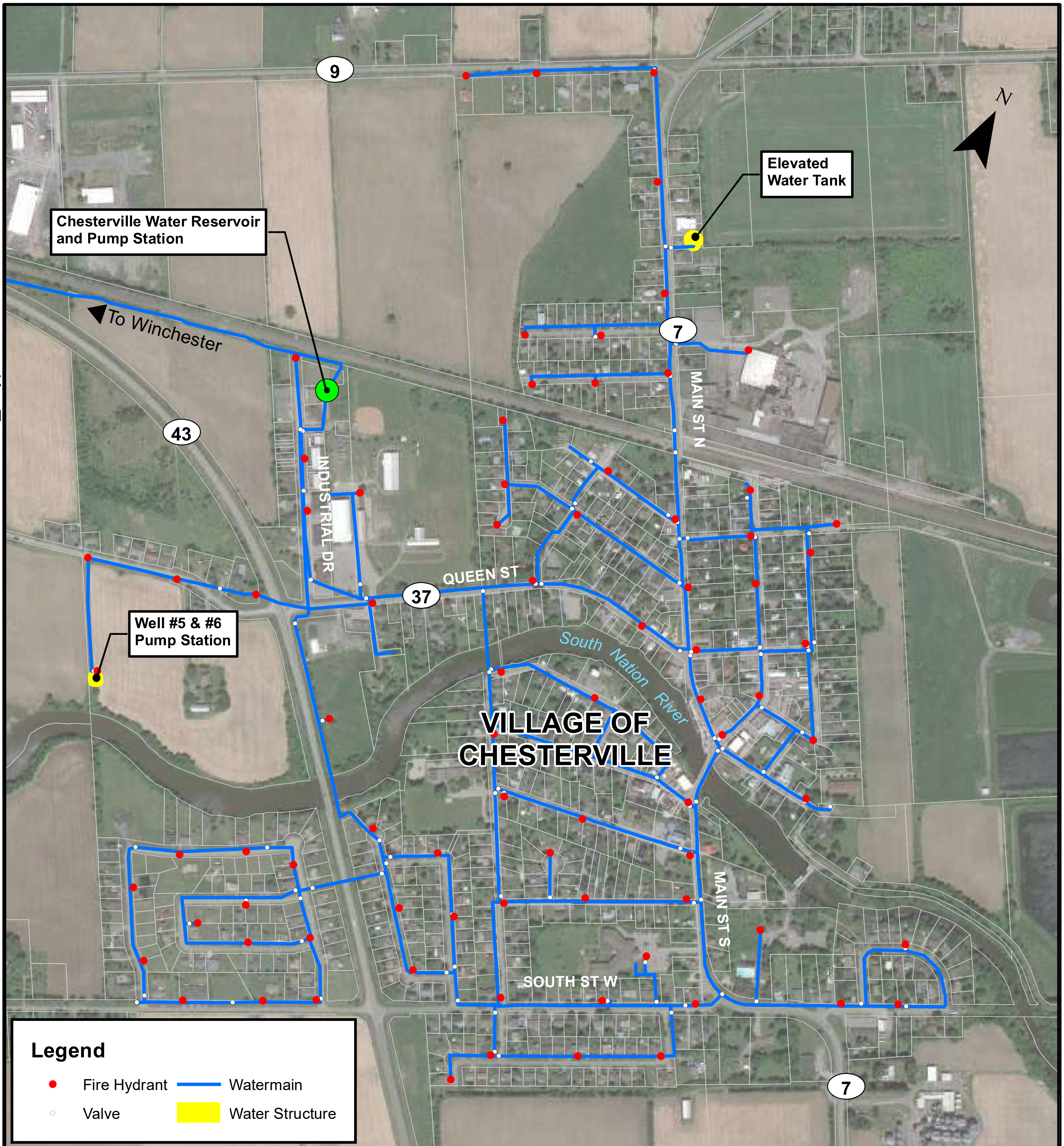

PROJECT:

CHESTERVILLE WATER RESERVOIR

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DRAWING:

KEY PLAN

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CHECKED:	SS
JLR #:	31486

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FIGURE 2

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1.2 Previous Studies and Reports

The following related reports support the new water storage reservoir and water treatment improvements at civic address 1 Brannen Drive:

- Schedule 'C' Municipal Class Environmental Assessment (JLR 2020) in association with Golder Associates Ltd. This addressed long-term potable water supply needs and evaluated servicing solutions for the 20-year planning horizon for the Township drinking water supply system [1].

- Township of North Dundas – Hydraulic Water Model which developed a hydraulic water model in support of the Municipal Environmental Assessment (Class EA) for the North Dundas Drinking Water Supply System Capacity Expansion works [3].

- Township of North Dundas Water and Wastewater Service Study Technical Memorandum (JLR 2020) which assessed the ability of existing infrastructure to support future growth and development. This provided an update to relevant planning projections, flows and demand projections, timing of recommended servicing solutions, and opinions of probable costs [2].

- Chesterville Drinking Water Supply System Iron and Manganese Treatment Options Memorandum (JLR 2022) which analyzed observed iron and manganese levels in the Chesterville distribution system and assessed various treatment options [4].

1.3 Design Report Objectives

The objectives of this Design Report are to:

- Summarize and present the preliminary design scope for the proposed upgrades.
- Provide background information and preliminary design documentation including the design basis that will be used for further design development as the project progresses towards implementation.
- Describe the intended operating strategy and control philosophy.
- Identify any construction phasing challenges, if applicable.
- Provide a summary of approval framework, intended design and implementation schedule and a Class 'C' Opinion of Probable Construction Costs (OPCC).

Following review and acceptance of this PDR by the Township, it will form the basis of the detailed design and eventually the Tender documents for construction. Changes to the information and design parameters in the final PDR during the course of detailed design could impact project schedule and level of effort in preparing final Tender documents.

1.4 Project Team

The project team and a description of the roles and responsibilities of each team member are described below:

- The Township of North Dundas (Municipality/Owner): Owner of the Main Street West SPS.
- The Ontario Clean Water Agency (OCWA): Operator of the Main Street West SPS.
- J.L. Richards & Associates Limited (JLR): Prime consultant responsible for the design of the upgrades to the Chesterville DWSS.

1.5 Report Format

This PDR contains text and tables summarizing the design concepts associated with increased water storage and upgraded treatment system at the Chesterville pumping station.

In addition to the above-referenced information, supplementary drawings have been issued separately and should be read in conjunction with this document. These drawings are working documents that illustrate key design concepts. It should be noted that these drawings will continue to be developed as the design proceeds.

1.6 Filtration Building Design Status

Through the preliminary design of the proposed water storage and treatment systems, it was identified that there is insufficient space within the existing Chesterville pumping station to house the proposed new treatment equipment. As such, the project will include a new filtration building on the site.

Design of a new filtration building was not included within the original scope of the project; however, JLR has submitted a scope change to the Township to add this to the project scope of work. As such, most preliminary design details pertaining to the filtration building are not included within this PDR or in the supplementary drawings.

2.0 Existing Conditions

2.1 Drinking Water Supply System

The Township DWSS supplies treated water to the two communities of Winchester and Chesterville, including the Lactalis® plant (large volume ICI consumer). This water system is comprised of eight active wells, five pump houses with chlorine disinfection, two storage reservoirs (Chesterville underground reservoir and Winchester at-grade reservoir), two elevated tanks and approximately 41.5 km of distribution system piping. The water treatment and distribution system are owned by the Township and operated by OCWA. The DWSS operates in accordance with various Permits to Take Water (PTTW), Municipal Drinking Water License No. 180-101, Issue No. 3, dated March 22, 2016, and Drinking Water Works Permit No. 180-201, Issue No. 4, dated July 31, 2018.

The Chesterville infrastructure is comprised of two active wells (Well 5 & 6), one pump house with sodium hypochlorite disinfection, one underground storage reservoir and pump station, one elevated storage tank, and several kilometers of distribution system piping. Based on existing 2018-2021 Chesterville demand data, the Chesterville reservoir is primarily fed by Well 5, but the system includes flexibility to switch to Well 6 when required. During normal operations, Well 6 supplies the Village of Winchester.

2.2 Site Layout

The existing Chesterville reservoir and pumping station was originally constructed in 1989 and is located at civic address 1 Brannen Drive. The site occupies approx. 2,100 m^2, with a width of approx. 35.5 m and a length of approx. 61 m. On the surface, the site consists of an extended asphalt driveway leading to a gate and a fenced area containing a parking lot, building, fire hydrant, a 200 mm overflow on the west side of the building and fielded area which includes a ditch leading from the building to a catch basin near the municipal ROW. Buried infrastructure includes:

- 200 mm dia. watermain feeding raw water from Chesterville Wells No. 5 and 6.
- 250 mm dia. watermain feeding treated water to the Chesterville elevated storage tank.
- 150 mm dia. sanitary service leading to a sanitary maintenance hole on Brennan Drive.
- A gas main.
- Buried electrical feeds servicing the building.

2.3 Pump Station Building and Equipment

On the surface, the building occupies a footprint of approx. 103 m^2, with dimensions of 9.2 m x 11.2 m. Below grade, the building contains two underground reservoir cells and a suction well, with the foundation extending the 9.2 m width to 14.51 m, with the full foundation occupying a footprint of approx. 163 m^2. The reservoir cells are each about 10.71 m x 4.86 m (52 m^2) and the suction well is approx. 2.5 m x 10.11 m (25 m^2).

The main floor of the building contains a natural gas-fired generator, HVAC, chemical feed pumps and tanks, four water distribution pumps and associated piping and appurtenances, electrical control panels, and four hatches providing access to the overflow chamber, the suction well, and both reservoir cells.

Each pump has a suction head approx. 150 mm above the base of the suction well and associated suction piping, while each pump discharges to a main header which then exists the building towards the municipal ROW. The reservoir is split into two clearwells, with sluice gates to isolate the clearwells from each other and the common pump suction well, allowing controlled flow between the clearwells. Current inlet piping enters the building into cell no.1, rises to the main floor, heads through a flow meter, and is then controlled by use of valves to distribute raw water into the two reservoir cells.

2.4 Electrical Power

Power to the existing pumping station is electrically fed from three 347 V pole mounted transformers to a 200A 600V 3 phase service entrance disconnect enclosed within the building's Motor Control Center (MCC). The MCC contains the utility and customer metering as well as the automatic transfer switch. The MCC feeds high lift pumps P-1 through P-4. Pumps P-1 and P-2 were recently upgraded to submersible VFD driven pumps. A 15kVA transformer, located within the MCC services a 20-circuit lighting panel which powers lighting, and other 120V equipment. Emergency power is available to the ATS via an 80-kW indoor natural gas generator.
The pumps duty and standby operations are controlled by differential pressure switches which signal back to the pump motor controllers.

2.1 Communications

The existing station annunciates alarms by utilizing a radio antenna which provides communications from the existing OCWA outpost panel to the Townships SCADA system.

3.0 Design Basis

3.1 Existing Storage Capacity and Water Demand

The reservoir cells bottom elevation is 67.80 m with the maximum liquid level (Max. L.L.) at 73.58 m. The Servicing Study [2] provided a summary of the existing storage available within the Township, seen in Table 1.

Table 1: Existing (2019) Water Storage Capacity

Storage Facility	Existing Capacity (m^3)
Winchester Water Tower	2,300
Winchester Storage Reservoir	400
Winchester Storage Capacity	2,700
Chesterville Water Tower	567.5
Chesterville Storage Reservoir	407
Chesterville Storage Underground Suction Well	122
Chesterville Storage Capacity	**1,096.5**
Total Storage Capacity	3,796.5

The existing water demand was determined in the Water Model [3] and summarized in the Servicing Study [2]. The existing (2019) demand is displayed in Table 2.

Table 2: Existing (2019) Water Demand Summary

Water User	Water Demand Scenario		
	Average Day L/s (m^3/day)	Maximum Day L/s (m^3/day)	Peak Hour L/s (m^3/day)
Lactalis	14.68 (1268.4)	22.02 (1902.5)	22.02 (1902.5)
Winchester District Memorial Hospital	0.70 (60.5)	1.05 (90.7)	1.90 (164.2)
Chesterville	**3.23 (279.07)**	**8.43 (728.35)**	**10.86 (938.30)**
Winchester (Including High water users)	24.67 (2,161.49)	47.37 (4,092.77)	55.22 (4,771.01)
Township of North Dundas (Winchester & Chesterville, including high water users)	27.90 (2410.5)	55.80 (4821.1)	66.08 (5709.3)

3.2 Population Projections

The Servicing Study [2] provided summarized existing and future population projections, water demands and potable water storage requirements for the existing, near-term, mid-term, long-term and build-out timeframes. The high growth scenario (3.5% annual growth) population projection summaries for Chesterville are presented in Table 3. Comparing this with the latest census data, this was a conservative approach and population is not anticipated to exceed these projections.

Table 3: Population Projections in Chesterville

Year	High growth Scenario	
	Annual Projected Growth Rate (%)	Population Projected
2016	-	1,677[1]
2019	3.5	1,853[2]
2039	**3.5**	**3027[2]**

1. Population based on the 2016 Census Information for Chesterville.
2. High growth population increase was based on an assume annual growth rate of 3.5%.

3.3 Water Demand Projections

The design parameters utilized in the Water Model [3] are summarized in Table 4. Parameters are in accordance with the MECP Design Guidelines for Drinking Water Systems [5], except where it does not specify peaking factors for commercial areas, in which case the City of Ottawa Design Guidelines for Water Distribution (July 2010) [6] were used.

Table 4: Future Water Demand Design Parameters

Parameter	Residential	Commercial
Population Density (per Unit)	2.5 person/unit	n/a
Population Density (per hectare)	35 person/ha	n/a
Average Day Flow	350 L/cap/day	28,000 L/ha/day
Maximum Day Flow	2.0 x Average Day	1.5 x Average Day
Peak Hour Flow	1.5 x Maximum Day	1.8 x Maximum Day

For Chesterville, the population growth was assigned the residential average day flow of 350 L/cap/day, and this additional consumption was added to the existing demands. Based on this and the design parameters in Table 4, the existing and projected water demands under near term, mid term, long term and build-out, were calculated during the Servicing Study [2] and are summarized in Table 5.

Table 5: Water Demand Projections for Chesterville

Demand Scenario	Average Day L/s (m³/day)	Maximum Day L/s (m³/day)	Peak Hour L/s (m³/day)
Existing (2019)	3.23 (278.65)	8.43 (728.37)	10.86 (938.56)
Near Term (1-5 year)	4.41 (381.36)	10.81 (933.80)	14.43 (1,246.71)
Mid Term (5-10 year)	5.60 (484.08)	13.19 (1,139.23)	18.00 (1,554.86)
Long Term (10-20 year)	7.98 (689.51)	17.94 (1,550.10)	25.13 (2,171.16)
Build-out (20+ year)	**7.98 (689.51)**	**17.94 (1,550.10)**	**25.13 (2,171.16)**

3.4 Storage Requirement Projections

According to the MECP Design Guidelines [5], treated water storage facilities should be designed to maintain adequate flows and pressures in the distribution system during Peak Hour Demand (PHD), and to meet the critical water demands during fire flow and emergency conditions. To accomplish this, the total treated water storage requirement is calculated via the formula A+B+C, where:

- A = Fire Storage.
- B = Equalization Storage (25% of maximum day demand).
- C = Emergency Storage (25% of A+B).

Table 8-1 of the MECP Design Guidelines [5] stipulates a fire flow of 110 L/s or 125 L/s for a population of 3,000 or 4,000 people, respectively, each with a 2 hour duration. Populations were interpolated between to determine the required fire flow of 110.41 L/s.

Based on required fire flows and projected demands, during the Servicing Study [2], the storage calculation was completed for each of the different scenarios. These calculations were verified with the current growth and that the future projections were adequate. The results are presented in Table 6.

Table 6: Future Potable Water Storage Requirements in Chesterville

Study Period	Existing Storage (m³)	Equivalent Population	Required Storage (m³)				Surplus/ (Deficit) (m³)
			Fire (A)	Equalization (B)	Emergency (C)	Total	
Existing (2019)	1,096.5	1853	650	182	208	1040	56
Near-Term (1-5)	1,096.5	2147	700	233	233	1167	(70)
Mid-Term (5-10)	1,096.5	2440	732	285	254	1270	(174)
Long-Term (10-20)	1,096.5	3027	795	388	296	1478	(382)
Build-Out (20+)	**1,096.5**	**3027**	**795**	**388**	**296**	**1478**	**(382)**
Note: Storage requirements calculated in accordance with MECP Design Guidelines for Sewage Works (2008).							

As displayed, the existing water storage is narrowly exceeding the 2019 requirements based on the A+B+C calculations, while it will be in a deficit in the short term. At the planned build-out population and additional 382 m^3 of storage could be required.

The proposed solution to increasing storage is intended to meet the capacity requirements of the High-growth Full Build-Out scenario. The Servicing Study [2] identified that an additional 450 m^3 of storage would satisfy the build-out storage requirements.

Preliminary discussions with suppliers of a standard potable water tank provided recommendations for a tank with a useable capacity of 472 m^3, which would provide a total storage capacity of approx. 1568.5 m^3 for Chesterville. Figure 3 illustrates the developmental storage requirements as compared to the current reservoir storage capacity and the increased capacity assuming the preliminarily assessed tank size is utilized.

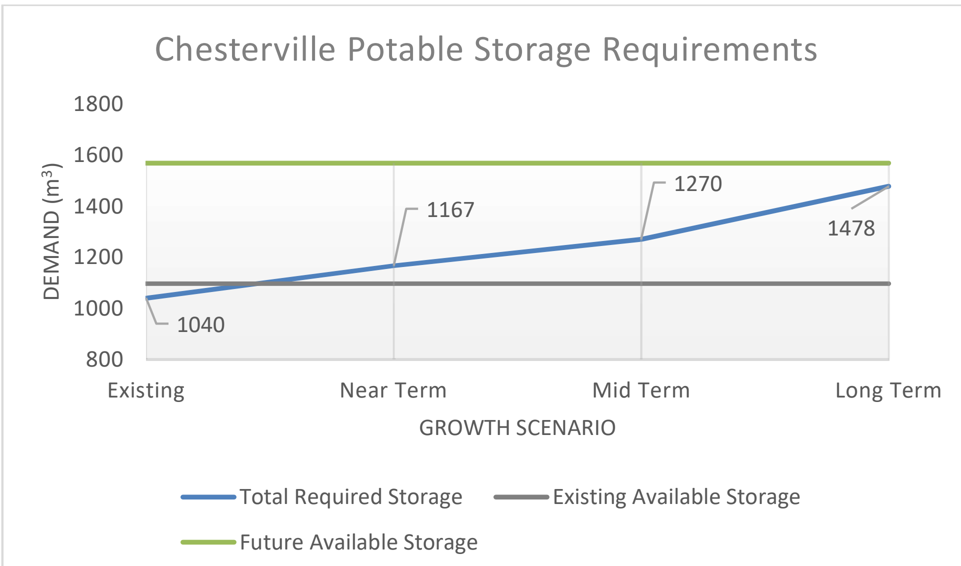

Figure 3: Chesterville Potable Storage Requirements

3.5 Potable Water Reservoir Requirements

As illustrated in Table 6 and Figure 3, the existing Chesterville potable storage capacity of approx. 1,096.5 m^3 is below projected requirements before the near-term (1-5 year) scenario and significantly lower than the municipality's long term MECP recommendations for storage. Additional storage is required in the near-term to meet projected growth within Chesterville.

The proposed water storage reservoir for this project will be designed to service the anticipated build-out population and associated water storage needs identified in Table 6. The proposed reservoir will be an above grade tank sized to accommodate approx. 450 m^3 of useable storage capacity.

3.5.1 Mixing Requirements

Potable water storage facilities should be designed to prevent stagnation of water and minimize detention times which can lead to deteriorated water quality and potential freezing. There are generally two types of mixing systems available for treated water storage facilities: passive and active mixing.

A passive mixing system uses energy from the incoming water flow to create turbulence and mix the water inside a tank. A series of nozzles are installed on an inlet pipe, either vertically or horizontally, (depending on the storage tank geometry), positioned to promote a circulation pattern throughout the tank. Mixing is typically achieved during a fill cycle only; there is no mixing during a draw cycle. One of the advantages of this type of system is that no power is required. Design best practice for passive mixing systems is to target 1/3 of the tank volume turned over daily to mitigate freezing potential and water quality issues. If a lower turn-over is anticipated, an active mixing system may be necessary.

An active mixing system uses a mechanical mixer or pump to circulate the water inside a tank. This system has the advantage that it is independent of the fill/draw cycle and can be operated continuously or as required. The drawback to this type of system is that power is required to operate the mechanical equipment and this equipment requires periodic maintenance.

Based on the proposed storage volumes, water demand and operating strategy for the upgraded Chesterville reservoir and PS, the tank turnover is anticipated to be approximately 30% daily at existing (2019) average day flows. Due to the slightly lower turnover at existing flow rates, an active mixing system will be installed in the reservoir to prevent freezing and ensure proper mixing at all times. Refer to Section 4 for details regarding the proposed treatment systems.

3.6 Distribution Pumping System Pressure Requirements

The main objective of a communal water distribution system is to provide a reliable source of potable water to all users. Water demands are met through a combination of pumping, storage and transmission watermains. The Municipality's existing water distribution pumps are located at the Chesterville reservoir site. Upgrades to the distribution pumping system are not included within the scope of this project; however, a cursory review of the pump data was completed to evaluate their performance against future demands. Based on the MECP Design Guidelines [6], that water distribution pumping systems are to be designed to satisfy the maximum day demand.

The existing duty pumps were recently replaced and from the pump curve information received by the Township, the duty pumps at the Chesterville reservoir have an optimal pump flow rate of approximately 12 L/s at 55 m TDH.

Comparing the existing pump curve data to the water demand projections identified in Table 5, it is expected that the existing pumps should satisfy the maximum demand flow rate for the near-term timeframes. The Township should continue to monitor actual water demand and review the need for pumping system upgrades as required.

3.7 Water Quality Data

The Township has reported aesthetic drinking water concerns associated with elevated levels of both iron and manganese. The Ontario Drinking Water Quality Standards (ODWQS) [6] establishes minimum water quality requirements for drinking water in the province of Ontario. The standard identifies Maximum Allowable Concentrations (MAC), Operational Guidelines (OG), and the Aesthetic Objectives (AO) for various elements and compounds. The ODWQS indicates AOs of 0.3 mg/L for iron and 0.05 mg/L for manganese. In addition to the ODWQS, Health Canada issued a Technical Document in 2019 “Guidelines for Canadian Drinking Water Quality: Guideline Technical Document – Manganese” [8] that established a stricter AO for manganese and established a MAC for manganese. The Technical Document further indicates that utilities establish a treated water goal that is lower than the AO for the design and operation of manganese treatment systems. While these requirements are not currently reflected in the ODWQS and remain under evaluation, they are likely to be adopted by the MECP in the near future. Table 7 provides a summary of the water quality requirements to be met for this project.

Table 7: Water Quality Design Requirements

Parameter	Concentration
Iron AO	0.3 mg/L
Manganese AO	0.02 mg/L
Manganese MAC	0.12 mg/L
Manganese Design Concentration	0.015 mg/L

Analysis of water quality at Wells 5 and 6 and throughout the Chesterville distribution system was completed as part of the Treatment Options Memorandum [4]. A summary of the key findings of the memorandum are provided below:

- Well 5 & 6 – Iron levels remain below the AO.
- Well 5 & 6 – Manganese levels (many readings) above 0.02 mg/L.
- Well 5 – 2020-2021 samples exceed 0.05 mg/L.
- Distribution system – Iron levels at various points exceed 0.3 mg/L.
- Distribution system – Manganese levels at most test points exceed 0.02 mg/L.
- Distribution system – Manganese levels at several test points exceed 0.12 mg/L.
- Recommended treatment solution is a manganese dioxide pressure filtration system to reduce source levels of iron and manganese.

The proposed DWSS treatment upgrades will be designed to maintain the iron and manganese AO and MAC targets noted above. Refer to Section 4 for details regarding the proposed treatment systems.

3.8 Disinfection

The disinfection objective of the Chesterville water supply is to inactivate potential viruses (primary disinfection) and maintain a free chlorine residual in the distribution system (secondary disinfection). In this regard, the MECP Procedure for Disinfection of Drinking Water in Ontario [9] notes the following guidelines for ground water sources:

3.8.1 Primary Disinfection

- Achieve a minimum of 2-log (99%) removal or inactivation of viruses before the water is delivered to the first consumer.

3.8.2 Secondary Disinfection

- Maintain a free chlorine residual of at least 0.05 mg/L at a pH of 8.5 or lower at all times and at all locations within the distribution system.
- The maximum free chlorine residual at any time and at any location within the distribution system should not exceed 4.0 mg/L.
- The recommended minimum free chlorine residual concentration is 0.2 mg/L at a pH of 8.5 or less.

The proposed DWSS upgrades will be designed to provide primary disinfection and maintain the secondary disinfection targets noted above. Refer to Section 4 for details regarding the proposed treatment systems.

4.0 Process Design

4.1 Above Grade Reservoir Configuration

It is noted that detailed design of the above grade reservoir, including piping, mixing system and foundation will be completed by the tank manufacturer carried under the construction contract. This report, however, includes general commentary on the reservoir's design intent.

The new above grade reservoir infrastructure will include one cylindrical, glass-fused to-steel tank at 1 Brannen Dr. near the existing below-grade reservoir, with a minimum total storage capacity of 450 m^3 to meet the build-out storage deficit identified in Table 6 (Section 2.3). Through consultation with glass-fused-to-steel tank suppliers, it is understood that one optimal configuration to support the minimum storage capacity requirement is an 8.5 m diameter by 8.9 m tall tank, including 610 mm freeboard and excluding the domed roof to provide a total operating capacity of approximately 472 m^3.

The above grade reservoir will generally be equipped with an overflow, ladder, roof access via an access hatch, manway access at the bottom of the tank, and will include an active mixing system.

Above grade reservoir dimensions and interim operating levels, based on design criteria presented in Table 6, are summarized in Table 8, as follows:

Table 8: Above Grade Reservoir Dimensions

Parameter	Criteria
Total Usable Reservoir Storage Volume	472 m^3
Reservoir Inside Diameter(1)	8.5 m
Reservoir Height(1)	8.9 m
Minimum tank water level(2)	0.3 m
Maximum tank water level(2)	8.29 m

(1) Reservoir diameter and height are based on consultation with tank suppliers.
(2) Operating levels are referenced to the reservoir base elevation.

4.1.1 Above Grade Reservoir Mixing System

The reservoir will have an active mixing system inside the tank to circulate water. The mixing system is located at the bottom of the tank where it draws water and discharges it upwards. The mixing system will operate continuously to help ensure a well-mixed tank. No components associated with the mixing system, other than the power cable, will penetrate the tank walls or roof. A dedicated access hatch on the roof will allow the mixing system to be installed and removed without entry into the tank. Provisions will be provided for a davit to be installed to facilitate installation and removal of the mixer from the roof of the tank. In consultation with tank suppliers, a preliminary selection for the active mixing system has been completed. Design criteria for the mixing system is summarized in Table 9.

Table 9: Mixing System Design Criteria

Parameter	Criteria
Mixer Type	Submersible Mixer
Maximum Mixing Volume	11,000 m^3
Minimum operating water level(2)	0.6 m
Power Requirements	120 V, 11.0 A, 800 W
(1) Reservoir diameter and height are based on consultation with tank suppliers. (2) Operating levels are referenced to the reservoir base elevation.	

4.2 Iron and Manganese Filtration System

As part of the Treatment Options Memorandum [4] previously discussed, this project will include the provision of a manganese dioxide pressure filtration system to reduce the levels of iron and manganese in the raw water coming from the existing Well #5. Refer to Section 3.7 for the water quality design requirements for this project.

The proposed manganese dioxide filtration system will be installed within a new dedicated filtration building on the existing Chesterville pumping station site. The filtration system will be installed upstream of the water reservoirs (above and below grade) to ensure that all stored water is treated and ready for use within the distribution system.
JLR received proposals from two suppliers for pressure filtration systems, AdEdge Water Technologies and Magnor. These proposals can be found in Appendix B and C. The key design parameters for the filtration system are summarized in Table 10.

Table 10: Filtration System Design Criteria

Parameter	Value
Average Flow	689 m^3/d (8.0 L/s)
Maximum Flow(1)	1841 m^3/d (21.3 L/s)
Number of Filter Vessels	2
Max Flow Per Filter Vessel	920.5 m^3/d (10.7 L/s)
Vessel Diameter	1829 mm

Parameter	Value
Vessel Height	1524 mm to 1829 mm
Max Hydraulic Loading Rate	15 m/h
Maximum Operating Pressure	689 kPa (100 psi)
Design Pressure Drop	68.9 kPa (10 psi)
Backwash Flow Rate (per Filter)	30.6 L/s
Backwash Pressure Drop	13.8-20.7 kPa (2-3 psi)
Backwash Duration	10 min
Rinse Flow Rate (per filter)	21.3 L/s
Rinse Duration	8-10 min
Backwash Frequency	Every 10,000 m^3
Power Requirements	120 V, 20 A
(1) Corresponds to Well #5 max flow	

4.3 Sodium Hypochlorite Feed System

4.3.1 Primary Disinfection

The existing sodium hypochlorite feed located at the well pump house will be isolated from the Well #5 feed to Chesterville and its use will be discontinued with the new treatment system during normal operation. The existing system will remain to serve the water being distributed to Winchester from Well 6 and will be used for primary disinfection of the Well 5 feed to Chesterville when the pump station and reservoirs are taken offline for cleaning or maintenance.

A new sodium hypochlorite feed system will be provided and installed in a dedicated chemical room within the new filtration building. The injection point for the system will be immediately upstream of the new filtration system to regenerate the filter media and provide primary disinfection (Section 3.8.1) for the raw water from Well 5. The new system will include the following key elements:

- Two solenoid driven diaphragm pumps with VFD to modulate chemical injection rate to suit the Well 5 pump flow rate.
- Two 1300 L sodium hypochlorite storage tanks.
- Continuous free chlorine monitoring provided downstream of the filtration system prior to the above grade storage tank

To ensure adequate primary disinfection is achieved, the contact time and required chlorine residual for the above grade storage tank was evaluated. Per MECP Procedure for Disinfection of Drinking Water in Ontario [9], where drinking water systems obtain water from a raw water supply which is groundwater, such as this instance, the treatment system must provide at a minimum 2-log (99%) removal/inactivation of viruses. Per Table 7 of this Procedure at the worst-case scenario (i.e., groundwater temperature of 0.5 °C at a typical groundwater pH range of 6-9) this would correspond to a CT value of 6.

The required chlorine residual was evaluated based on worst-case conditions: CT of 6 to achieve 2-log virus removal, peak hour flow demands at 20+ year build-out (see Table 5), only emergency storage at 20+ year buildout available (see Table 6), and poor tank baffling. This is summarized in Table 11.

Table 11: Disinfection Storage Requirements for New Above Grade Storage Tank

Parameter	Value
Peak Hour Flow Demands (1)	2,171 m^3/d
Total Emergency Storage (2)	296 m^3
Hydraulic Retention Time	196 min
Storage Baffling Factor (3)	0.3
Minimum Contact Time T_{10}	59 min
C residual required to achieve a CT 6	0.102 mg/L

(1) Build-out (20+ year) peak hour flow (see Table 5)
(2) Assumed worst-case conditions of only emergency storage available (i.e., 'C' storage component at 20+ year build-out; see Table 6)
(3) Assumed worst-case, poor storage baffling conditions per MECP Procedure

Based on the above, the disinfection requirements for groundwater supplies are satisfied per MECP Procedure, provided that the above-noted water storage requirements are met.

4.3.2 Secondary Disinfection

The Chesterville reservoir is equipped with an existing sodium hypochlorite feed system that is used to maintain adequate secondary disinfectant chlorine residual in the distribution system at all times, as described in Section 3.8.2. The existing system generally includes:

- Two solenoid driven diaphragm pumps with VFD to modulate chemical injection rate.
- A sodium hypochlorite storage tank.
- Continuous free chlorine monitoring provided downstream of the high lift distribution pumps.

The existing system will be maintained for additional operational flexibility to provide a chlorine residual boost to the distribution water should it be required.

5.0 Site Wide Considerations

5.1 Site Layout

The above grade reservoir and filtration building will be located on the site of the existing below grade reservoir and pumping station. The two structures will need to be positioned such that they do not interfere with existing infrastructure, and to allow new watermain to connect from the existing watermain to each structure, as well as between each other. The property provides adequate space for each structure, vehicular access and a parking zone.

The site currently contains a large ditch which receives flow from the existing swab recovery piping. This ditch will require re-construction/re-routing to facilitate installation of the new structures and associated piping. The site will be graded such that surface drainage will be directed away from structures towards existing drainage pathways.

5.2 Watermains

The existing 200 mm watermain enters the northeast side of the site and then enters the existing station at the northeast corner of the northern wall. The existing watermain will be intercepted with a new 200 mm watermain which will direct flow to the proposed filtration system and then to the new above grade reservoir through the base of the tank. A 200 mm discharge from the base of the above grade storage tank will reconnect to the existing watermain prior to the existing entrance to the pumping station. Bypasses will be provided to allow direct connection to the exiting pumping station for both un-filtered and filtered water. Refer to the Process & Instrumentation Drawings (PIDs) for further information.

5.3 Sanitary Service

The station's existing sanitary service and the immediate downstream sewer leading from Brannen Drive to Industrial Drive is not adequately sized to account for the additional flow required with the treatment system structure. The treatment system incorporates an approx. 30.6 L/s (485 gpm) backwash flow that will outlet to the sanitary system.

The existing sewer from the station to the manhole on Brannen Drive (MH1) is 150 mm @ 2.91%, providing a capacity of approx. 26 L/s. The existing sewer from MH1 to the manhole at the Brannen Drive Industrial Drive Intersection (MH2) is 150 mm @ 1.0%, providing a capacity of approx. 15.2 L/s.

Considering the backwash flow exceeds the capacity of these sewers, they will require upgrading to accommodate the increased flow. A new manhole will be placed between the existing station and MH1, where the existing 150 mm sewer will connect, bringing flow from the station. A new 250 mm sewer from the treatment system structure will connect to this manhole as well. The downstream sewer towards MH1, and from MH1 to MH2 will be removed and replaced with a 250 mm sewer that matches existing inverts. With the lower 1.0% slope, the 250 mm sewer will provide a capacity of approx. 59.5 L/s.

5.4 Stormwater Management

On-site stormwater management is currently provided via overland flow towards the municipal ROW. The site has adequate drainage and contains two ditches which bring water off-site.

With the addition of the treatment system structure and the reservoir, the impermeable surface will minorly increase on the site, though the actual runoff quantities will very minorly increase. Grading on-site will ensure adequate drainage away from the buildings, and towards the existing drainage paths.

5.5 Electrical Power

The existing MCC will have to be modified to allow for power to be distributed to the new filtration building. It should be noted that the MCC is nearing the end of its service life and will have to be replaced in the near future. The MCC contains all service entrance equipment and will be costly to replace. The proposed solution which utilizes the existing MCC is being proposed for budgetary reasons. It is recommended that the MCC be replaced when budget allows.

5.1 Communications

The existing OCWA outpost panel and radio communications system is to remain.

6.0 Process Mechanical Systems

6.1 Backwash Pumps

The filtration system will be equipped with two backwash pumps. The pumps will be base-mounted, end suction, centrifugal pumps. The preliminary design criteria for the pumps is presented in Table 12. The pumps are designed to meet the backwash flow demands as described by the filtration system suppliers.

Table 12: Backwash Pump Design Criteria

Parameter	Value
Design Flow Rate	30.6 L/s (485 gpm)
Design Total Dynamic Head	27.7 m
Motor Rating	14.9 kW (20 HP)
Motor Electrical Information	600 V, 3Ph, 60 Hz

6.1.1 Pump Operations Summary

The backwash pumps will operate in a duty/standby configuration, rotating the duty pump on an operator adjustable schedule. The backwash pumps will be equipped with VFDs, but are to operate at pre-set constant speeds. The pump operation will be controlled by the filtration system control panel when backwash is initiated for each tank. Refer to Section 11.0 for the proposed operations strategy.

6.2 Pumping Station Equipment and Piping Configuration

Refer to Drawing P01 for the filtration equipment, backwash pump, chemical equipment, and primary piping layouts.

The backwash pumps and filtration skid will be located within the main filter area and the new primary disinfection sodium hypochlorite system will be located within a dedicated chemical room.

The filtration system will be located along the east wall of building with the inlet and outlet piping coming from below grade to the south of the filter skid, between the skid and the chemical room. Space has been allowed for a third filter vessel should the Township elect to add redundancy to the system or should demand increase above the noted buildout projections. Process piping between the backwash pumps and the filter skid will be run overhead, supported from the roof.

The sodium hypochlorite system including storage tanks, and pumping systems will be located within the dedicated chemical room within a containment area. Small diameter sampling and chemical injection piping will be routed between the sodium hypochlorite system and the filtration skid.

7.0 Building Mechanical Systems

The following section provides a technical description of the proposed mechanical systems for the filtration building. As previously mentioned, design of the filtration building is not currently included within the project scope of work and as such, preliminary design details associated with the filtration building mechanical systems are limited at this time.

7.1 Heating and Ventilation

Dedicated HVAC systems will be provided for the main filter area and the chemical room. HVAC systems will be designed in accordance with OBC and ASHRAE standards.

HVAC systems will include ventilation and heating. No cooling systems are proposed for the new filtration building.

7.2 Plumbing

Municipal water for the filtration building will be drawn off the distribution piping as it leaves the existing pumping station. A reduced pressure principal back flow preventer on the building water entry will protect the distribution system. The municipal water will serve hose connections at the facility, as well as the combination safety eyewash/shower in the Sodium Hypochlorite Room. An electric water heater and thermostatic mixing valve will supply the combination safety eyewash/shower with tempered water.

There will be floor drains and hub drains throughout the facility to drain away water on the ground and to drain the filter backwash water. An automatic trap seal primer will be provided. Sanitary will discharge into the upgraded sanitary service located along the drive lane to the existing pumping station.

7.3 Fire Protection

Fire protection for the facility will be provided to meet the requirements of the Ontario Fire Code and will consist of fire extinguishers located throughout the filtration building.

8.0 Structural/Architectural Design

8.1 Geotechnical Conditions

At the time of the 30% design submission, JLR had yet to receive a draft Geotechnical Investigation Report from Thurber. Further structural design development will be completed following receipt of the geotechnical report.

8.2 Reservoir

As previously mentioned, detailed design of the above grade reservoir, including piping, mixing system, and foundations will be completed during construction by the tank Manufacturer's engineer. The following sections describe the general structural design intent of the reservoir for information.

8.2.1 Structural System

The above grade reservoir is proposed to be an 8.5 m diameter by 8.9 m tall cylindrical glass-fused-to-steel potable water storage tank (the tank). An exterior fixed ladder will provide access to the roof area with a roof access hatch. Interior tank access will be provided by an at-grade manway bolted to a flanged panel on the structure.

8.2.2 Design Loads

The design of the above grade reservoir will be required to be undertaken in accordance with the American Water Works Association (AWWA), the Ontario Building Code 2012 (OBC 2012) and the National Building Code of Canada 2015 (NBCC 2015) Structural Commentaries.

8.2.3 Foundation

Foundation information for the above grade reservoir will be based on the findings and recommendations provided in the draft Geotechnical Investigation Report.

8.3 Filtration Building

As previously mentioned, design of the filtration building is not currently included within the project scope of work and as such, architectural and structural preliminary design information associated with the building have not been developed at this time.

8.4 Non-Structural Components

Any non-structural components will be seismically restrained in accordance with the OBC 2012 and the 2015 National Building Code of Canada Structural Commentaries, as well as the design guidelines outlined in CSA S832-14 – seismic risk reduction of Operational and Functional Components (OFCs) of buildings.

9.0 Electrical Systems

9.1 Process Systems

9.1.1 Service Distribution

The new filter building will be serviced by a 100 A, 600 V feed from the existing reservoir building MCC. The existing MCC currently does not have space for a new breaker to service the filter building. To make space the 15kVA Transformer section of the MCC is to be demolished and replaced with a 100 A breaker to service the new filter building as well as a 20A breaker to feed a new external 15 kVA transformer to back feed the existing reservoir building 120 V loads. A 600

V distribution panel complete with a main 100A breaker will act as a local disconnect for electrical power in the filter building. The distribution panel will service the power intensive equipment such as the backwash pump VFDs, electric unit heater and 30kVA transformer. The smaller filter building process and house service loads will be serviced by a 225 A 208/120 V lighting panel. Refer to the single line diagram for further details.

9.1.2 Communications Infrastructure

Building communications are broadcasted via radio tower to the Township SCADA system. New signals are to be marshalled at the local OCWA outpost panel in the reservoir building.

9.1.3 Standby Power

The existing automatic transfer switch and 80kW natural gas standby generator are to remain. The new process infrastructure associated with the filtration system and new chemical feed systems will not be connected to the existing standby power system.

9.1.4 Surge Suppression

A surge protective device (SPD) will be provided on the new lighting and distribution panels to minimize surges from the Utility and generator power sources. Both SPDs will be equipped with filtering capabilities to filter out some electrical noise on the distribution system.

9.1.5 Motor Starters

The two backwash pumps will be controlled by wall mount Variable Frequency Drives (VFDs). The VFD will be used to fine tune the speed during commissioning. VFDs will be equipped with line and load reactors. Run commands are received from the packaged filter skid control panel. Each VFD will output fault and run signals to the OCWA outpost panel.

9.2 Filtration Building House Services

9.2.1 Lighting

All interior and exterior lighting for the filtration building will be via energy efficient industrial grade LED fixtures. Interior lighting will be controlled via toggle switches while the exterior lights will be controlled via photocell, with manual override. Interior light levels would be designed to Illuminating Engineering Society (IES) Industrial Illuminance recommendations. Exterior light fixtures will illuminate doorways.

9.2.2 Emergency Lighting

Emergency lighting will be provided to illuminate the paths of egress to facilitate safe exiting during a loss of power. Emergency lighting will be industrial grade 120 V LED with battery backup.

9.2.3 Receptacles

All interior and exterior receptacles, will be Ground Fault Circuit Interrupter (GFCI) with weatherproof covers. All receptacles will be 120 V, 20 A industrial grade.

10.0 Controls and Instrumentation

10.1 Process Automation

10.1.1 SCADA

System fault signals, backwash pump running signals and sodium hypochlorite level monitoring signals are to be added to the signals monitored by the OCWA outpost panel and relayed back to the Township's SCADA system.

10.1.2 Control Panels

The above grade storage tank mixer come complete with a surface mount control panel which is to be mounted to the outside of the outdoor storage tank. The control panel will contain an internal starter, controls and a local control switch mounted to the panel exterior to operate the mixer. Fault and Running signals will be relayed back to the OCWA outpost panel.

The packaged filter skid comes complete with a surface mount local control panel which is to be mounted to a unistrut frame on the filter skid. The control panel is a self-contained unit which operates the filter skid valves and sends run commands to the back wash pump VFDs. A fault signal will be relayed back to the OCWA outpost panel.

The packaged sodium hypochlorite skid comes with an array of instruments and pumps which are to be controlled by the filter control panel.

10.2 Instrumentation

Instrumentation will be provided per the Process and Instrumentation Diagram (P&ID), to facilitate monitoring of the process and feedback into the OCWA outpost panel. A central Instrumentation Board will be provided inside the filter building to house all new transmitters located inside that building for central monitoring and maintenance.

In addition to the instrumentation shown on the PID drawing additional instruments will be provided for general filter building system monitoring, including room temperature transmitters, flood detection floats and heat detectors. All instruments will generally be from Siemens, Endress and Hauser, Swan, and Prominent.

A pressure sensor in the underground chamber is to relay an analog signal back to the OCWA outpost panel which is to be used to control the flow of raw water from wells 6 and 5. The level switches in the clearwell which previously provided this function will continue to monitor the clearwell level but will no longer control the wells.

10.3 Security

A door contacts will be provided for the filtration building which is to be monitored by the OCWA outpost panel.

11.0 General Process Control Narrative

The complete control narrative will be included as part of the technical specifications during detailed design. Preliminary control philosophy is summarized as follows:

11.1 Normal Operation

11.1.1 Well Pump 5

1. Well Pump 5 is currently controlled based level transmitters on the distribution pump suction well. Following the upgrades, Well Pump 5 will be controlled based on level transmitters on the above grade reservoir. See points below for control of Well Pump 5.
2. The above grade reservoir water level will be monitored by level transmitters installed on the above grade reservoir. The above grade reservoir level monitoring system will include the following set levels:
    a. HHWL: Tank overfilled; alarm
    b. HWL: Tank filling complete, stop Well Pump 5
    c. LWL: Tank fill required, start Well Pump 5
    d. LLWL: Tank empty; alarm
3. Existing SCADA controls to start and stop Well Pump 5 will be used; however, the level input will be switched over from the existing distribution suction well to the new above grade reservoir.
4. Well Pump 5 is equipped with a VFD but will operate as a constant speed pump to match existing operations.

11.1.2 Existing Clear Wells

1. The existing clear wells are currently filled by Well Pump 5 based on level controls on the distribution pump suction well. Once the system is upgraded, the existing clearwells will be filled by a gravity drain from the new above grade reservoir.
2. The water level in the distribution pump suction well will continue to be monitored by the existing level instrumentation. The level monitoring system is understood to include the following set levels:
    a. HHWL: Tank overfilled; alarm
    b. HWL: Tank filling complete, close control valve
    c. LWL: Tank fill required, open control valve
    d. LLWL: Tank empty; alarm
3. New SCADA controls will receive input from the existing distribution pump suction well level instrumentation to control a modulating control valve on the gravity discharge line from the above grade reservoir.

11.1.3 Above Grade Reservoir Mixing

1. Mixing operations mitigate free chlorine residual decay and freezing in the above grade reservoir by mixing to prevent thermal stratification.
2. Operators are able to locally start and stop the above grade reservoir mixer as required.

11.1.4 Filtration and Backwash Pumping

1. The filtration system will be installed between Well Pump 5 and the above grade reservoir. All flow to the above grade reservoir will be directed through the filtration system.
2. The filtration system will be equipped with a control panel to monitor and control all instrumentation and control valves to provide a completely functional system.
3. Filter Mode
    a. The filtration system control panel will receive signals from SCADA indicating that Well Pump 5 is running and will control the filtration system automatic valves accordingly to provide filtered water to the above grade reservoir.
    b. The filtration skid will be equipped with flow meters at the inlet of each filter tank which will be monitored by the control panel and SCADA.
    c. The filtration skid will be equipped with a chlorine analyzer at the outlet of the skid which will be monitored by the control panel and SCADA.
4. Backwash Mode
    a. Filtration system backwash cycles can be schedule by Operators based on total flow through the system or based on a set time schedule.
    b. All integral instrumentation and control valves will be controlled by the Supplier control panel to ensure proper backwash operation.
    c. During a backwash, the filtration system control panel will send a signal to SCADA to prohibit operation of Well Pump 5.
    d. A filtration sequence will include a timed backwash and a timed rinse of each filter tank all controlled by the control panel.
    e. Water for backwashing and rinsing will be drawn from the above grade storage tank through the backwash pumps.
    f. The filtration system control panel will start and stop the backwash pumps and rotate operation as a duty-standby system.
    g. The backwash pumps will be equipped with VFDs for system commissioning and flexibility but will normally operate as constant speed pumps for backwashing operations.
    h. If a duty backwash pump fails, the standby pump will operate and an alarm will be sent to SCADA.

11.1.5 Sodium Hypochlorite Dosing

1. Primary Disinfection:
    a. When the above grade reservoir is being filled, sodium hypochlorite will be injected into the filtration system inlet piping.
    b. The filtration system control panel will start and stop the chlorine pumps and modulate speed based on incoming flow rate as measured by the filter tank inlet flow meters and free chlorine residual measured by the downstream online chlorine analyzer.
    c. If a duty sodium hypochlorite pump fails, the standby pump will operate and an alarm will be sent to SCADA.

   d. If low flow is detected by the low flow switch associated with the current pump to be operating, it is to be assumed that the duty sodium hypochlorite pump has failed.
2. Secondary Disinfection:
   a. The existing sodium hypochlorite feed system controls will remain in place to allow an additional does of chlorine to the water downstream of the distribution pumps.
   b. It is understood that the system is controlled based on outgoing flowrate and free chlorine residual measured at the outlet of the pumping station.

11.2 Chesterville Pumping Station Offline

11.2.1 Well Pump 5

1. When the Chesterville pumping station is taken offline for cleaning and/or maintenance, Well Pump 5 will be used to pump directly to the elevated storage tank.
2. The existing control system can control Well Pump 5 based on level of the elevated storage tank when the Chesterville pumping station is taken offline and the existing controls will remain.
3. Operators will manually adjust Well Pump 5 VFD to a suitable speed for this operation. This matches existing operational strategy.
4. In this mode of operation the above grade reservoir will not be used. Associated manual valves should be operated to isolate the tank and route flow from Well Pump 5 directly to distribution.

11.2.2 Existing Clear Wells

1. In this mode of operation the clear wells and distribution pumps will not be used. Associated manual valves should be operated to isolate the clear wells and route flow from Well Pump 5 directly to distribution.

11.2.3 Above Grade Reservoir Mixing

1. In this mode of operation the above grade reservoir is isolated and the associated mixing system should be locally stopped by Operators if the tank is empty.
2. If the tank is to remain full, Operators can opt to keep the mixing system operating.

11.2.4 Filtration and Backwash Pumping

1. In this mode of operation, the filtration system will operate with same operating strategy as normal operation.

11.2.5 Sodium Hypochlorite Dosing

1. Primary Disinfection:
   a. When the Chesterville pumping station is offline, the above grade reservoir and existing clearwells are not available for the required primary disinfection contact time.
   b. In this mode of operation, the existing sodium hypochlorite feed system located at Well Pump 5 should be operated using existing controls to provide primary

disinfection based on flow and free chlorine residual as measured at the well house.

c. All existing controls to remain for this system.

2. Secondary Disinfection:
   a. The existing sodium hypochlorite feed system controls will remain in place to allow an additional does of chlorine to the water downstream of the distribution pumps.
   b. It is understood that the system is controlled based on outgoing flowrate and free chlorine residual measured at the outlet of the pumping station.
   c. All existing controls to remain for this system.

12.0 Construction Phasing Sequence

Phasing of the reservoir and filtration building construction will need to consider the following constraints:

- Well pumps and the Chesterville Reservoir and Pumping Station must always remain operational. Limited duration shutdowns are anticipated to facilitate new system piping tie-ins.

- It is expected that the entire filtration system will be constructed and largely commissioned prior to making the final integration into the DWSS.

- It is expected that the new above grade storage tank will be constructed, tested and accepted prior to making the final integration into the DWSS.

- Access to the existing Pumping Station shall be available to OCWA throughout construction.

13.0 Required Approvals

A number of approvals are required prior to implementing the proposed works. These include:

- Amendments to the Drinking Water Works Permit (DWWP) from the Ministry of the Environment, Conservation and Parks (MECP).

- Building Permit from the Township.

- Electrical Safety Authority (ESA) Permit.

It is noted that approval from the South Nation Conservation Authority (SNCA) is presumed to be unrequired for the proposed works. This will be confirmed through consultation with the SNCA. It is also presumed that Site Plan Approvals through the Municipality is not a formal requirement, with the Client to confirm the assumption.

14.0 Schedule

The following key dates are anticipated for this project:

- Submit a DWWP Amendment Application to the MECP – April 2023
- Finalize Contract Drawings and Specifications – April 2023
- Tender and Contract Award – April 2023
- Initiate Construction –May 2023
- Achieve Project Completion – February 2024

15.0 Opinion of Probable Construction Costs

The capital budget to upgrade the Chesterville DWSS as described in this PDR is currently estimated at $3.2M, which includes some construction contingencies, overhead costs, mobilization, insurance/bonding, etc., but excluding HST.

Considering the level of design completed to date (approximately 30% for process and 5% for filtration building), it should be noted that this can be considered a Class “D” OPC for a relatively complex project (the literature suggests a variance of +/- 30%). It should not be considered a prediction of the low tender price. Tendered prices will be influenced by factors such as the tenderers’ interpretations of their probable efforts as well as, market competition at the time of tendering, etc., all which are subject to varying circumstances. It is also intended to further update the OPC prior to tendering.

Refer to Appendix A for an OPCC cost breakdown by process and division.

16.0 References

[1] “Municipal Class Environmental Assessment – Phase 1 Report”, J.L. Richards & Associates Limited, Golder Associates Limited, Ottawa, ON, CA, Sept. 2020.

[2] A. Williams, M. Buchanan, “Township of North Dundas Water and Wastewater Servicing Study,” J.L. Richards & Associates Limited, Ottawa, ON, CA, 2020.

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[4] A. Duncan, M. Morkem, “Chesterville Drinking Water Supply System – Iron and Manganese Treatment Options – REVISED”, J.L. Richards & Associates Limited, Ottawa, ON, CA, May 2022.

[5] “Design Guidelines for Drinking-Water Systems,” MECP, Ottawa, ON, CA, 2008

[6] “Ottawa Design Guidelines – Water Distribution, First Edition”, City of Ottawa, Ottawa, ON, CA, 2010.

[7] *Ontario Drinking Water Quality Standards*, Ontario Regulation 169/03, 2020. [Online]. Available: https://www.ontario.ca/laws/regulation/030169

[8] *Guidelines for Canadian Drinking Water Quality: Guideline Technical Document – Manganese*, ISBN: 978-0-660-07496-2, 2019. [Online]. Available: https://www.canada.ca/en/health-canada/services/publications/healthy-living/guidelines-canadian-drinking-water-quality-guideline-technical-document-manganese.html

[9] Procedure for Disinfection of Drinking Water in Ontario, 2021. [Online]. Available: https://www.ontario.ca/page/procedure-disinfection-drinking-water-ontario

This report has been prepared for the exclusive use of the Township of North Dundas, for the stated purpose, for the named facility. Its discussions and conclusions are summary in nature and cannot be properly used, interpreted or extended to other purposes without a detailed understanding and discussions with the client as to its mandated purpose, scope and limitations. This report was prepared for the sole benefit and use of the Township of North Dundas and may not be used or relied on by any other party without the express written consent of J.L. Richards & Associates Limited.

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Appendix A

Opinion of Probably
Construction Costs (OPCC)

THE TOWNSHIP OF NORTH DUNDAS	CHESTERVILLE DWSS RESERVOIR AND FILTRATION		PRELIMINARY-DESIGN ESTIMATE "Opinion of Probable Costs"
PROCESS SUMMARY			30-Aug-22
Component	**Sub-Total Basic Facility Cost (A) (Excluding Various Mark-ups)**	**Sub-Total Facility Cost (B) (Including Various Mark-ups, such as profit, overhead, bonding, insurance, escalation, etc.)**	**Comments**
Division 1 (General Requirements)	$ 46,000	$ 52,210	
Above Grade Reservoir	$ 568,575	$ 645,333	
Filtration System	$ 789,850	$ 896,480	
Filtration Building	$ 589,259	$ 668,809	
Site Works	$ 324,364	$ 368,153	
SUB-TOTAL A/B	$ 2,318,048	$ 2,630,984	
Construction Contingency (Design and Pricing Uncertainty)	20% of B	$ 526,197	
Total Estimated Construction Capital Costs - Excluding Engineering & HST		**$ 3,160,000**	

Notes:

1. The Construction Document "Opinion of Probable Costs" shown has been prepared for guidance in project evaluation and implementation from the information available at the time of the estimate. The final "Opinion of Probable Costs" of the project will depend on actual labor and material costs, competitive market conditions, final project scope, implementation schedule and other variable factors. As a result, the final "Opinion of Probable Costs" will vary from the "Opinion of Probable Costs" presented herein. Because of this, project feasibility and funding needs must be carefully reviewed prior to making specific financial decisions to help ensure proper project evaluation and adequate funding. This "Opinion of Probable Costs" does not include any costs for acquiring the necessary permits or rights-of-way for the above-specified equipment.
2. Percentage calculations are based on historical cost data from wastewater projects tracked over a span of many years.

THE TOWNSHIP OF NORTH DUNDAS	CHESTERVILLE DWSS RESERVOIR AND FILTRATION	PRELIMINARY-DESIGN ESTIMATE "Opinion of Probable Costs"

DIVISION SUMMARY 30-Aug-22

Component Description	Quantity	Unit	Unit Cost	Material Cost	Installation % of Material	Installation Cost	Total Cost
Division 1 - General Requirements							$ 46,000
Division 2 - Sitework							$ 324,364
Division 3 - Concrete							$ 175,000
Division 4 - Masonry							$ -
Division 5 - Metals							$ -
Division 6 - Wood and Plastics							$ -
Division 7 - Thermal and Moisture Protection							$ 580,250
Division 8 - Doors and Windows							$ -
Division 9 - Finishes							$ -
Division 10 - Specialties							$ -
Division 11 - Equipment							$ 833,050
Division 12 - Furnishings							$ -
Division 14 - Conveying Systems							$ -
Division 15A - Process Mechanical							$ 160,500
Division 15B - Building Mechanical							$ -
Divisions 16&17 - Electrical, Instrumentation and Control							$ 198,884
Sub-Total Basic Facility Costs (A)							**$ 2,318,048**
General Contractor's Overhead		% of A	7.0%				$ 162,263
General Contractor's Profit		% of A	3.0%				$ 69,541
Mobilization, De-Mobilization Bonds and Insurance		% of A	2.0%				$ 46,361
Allowances (record drawings, final cleaning, commision, etc.)		% of A	1.5%				$ 34,771
Escalation Contingency (2% per Year to mid point of construction		% of A	included above				$ -
Market Contingency - Bidding Marke		% of A	0.0%				$ -
Total Estimated Construction Costs (B) Comparable with the Bid Amount							**$ 2,630,984**
Construction Contingency (Change Orders		% of B	20.0%				$ 526,197
Total Estimated Construction Capital Costs - Excluding Engineering & HST							**$ 3,157,000**

Notes:

1. The Construction Document "Opinion of Probable Costs" shown has been prepared for guidance in project evaluation and implementation from the information available at the time of the estimate. The final "Opinion of Probable Costs" of the project will depend on actual labor and material costs, competitive market conditions, final project scope, implementati schedule and other variable factors. As a result, the final "Opinion of Probable Costs" will vary from the "Opinion of Probable Costs" presented herein. Because of this, project feasibility and funding needs must be carefully reviewed prior to making specific financial decisions to help ensure proper project evaluation and adequate funding. This "Opinion of Probable Costs" does not include any costs for acquiring the necessary permits or rights-of-way for the above-specified equipment.

2. Percentage calculations are based on historical cost data from wastewater projects tracked over a span of many years.

Appendix B

AdEdge Water Technologies
Filtration System Proposal

Intelligent thinking.....clean water

Chesterville, ON

Site Profile

Contact Information

End User / Utility:	Township of North Dundas	Date:	8/16/2022
Site / Well Identity / Location:	Well #5 Chesterville, ON	Project Contact:	Andrew Duncan
Local Engineer / Firm:	J.L. Richards & Associates Limited	Contact Phone:	343-804-4383
Target Date for Installation:	Spring 2023	Contact Email:	aduncan@jlrichards.ca
Funding Source:		Rep Contact:	Yianni Siamandouros
Treatment Goals:		Rep Phone:	416-835-8851
		Rep Email:	

Site Information

System Type / Application:	Municipal	
Population Served:	3,027	
Number of Connections:	NA	(for municipal applications)
Number of Wells:	1	
Max Flowrate (gpm):	338	(design flowrate)
Ave Flowrate (gpm):	180	
Ave Gallons per Day:	182,149	
Ave Well Runtime (hr/day):	17	
Operating Pressure (psi):	35	
Discharge Options Available:	Wastewater Treatment Plant	
System Redundancy Required:	No	
Existing Treatment or Disinfection:	Replacing existing primary disinfection, existing secondary disinfection to remain	
Available Electrical Supply:	120V, 240V, 600V	
Atm Storage Tank Present / Size:	450m3 above grade, 400m3 below grade	
Hydropneumatic Tank Present / Size:		
Indoor or Outdoor Installation:	Indoor	
Additives (Phosphates, Fluoride, etc.):	NA	
Site Internet Connectivity:	Internet - Ethernet Connection	
Available Service Provider(s):		

Site Specific Notes:

Site Shipping Address:

Prepared by:	Reviewed by:

Additional Water Quality Information:

Please specify:

Rev 02.16.21

Water Chemistry

	Parameters			Parameters	
pH	8.08		Ammonia	<0.01	mg/L NH_3-N
Total Arsenic		mg/L As	Nitrate	<0.1	mg/L NO_3-N
Arsenic (III)		mg/L As(III)	Sodium	39	mg/L Na
Total Sulfides		mg/L Total Sulfides	Chloride	73	mg/L Cl
Alkalinity	195	mg/L (as $CaCO_3$)	Sulfate	38	mg/L as SO_4
Bicarbonate		mg/L (as $CaCO_3$)	Fluoride	<0.1	mg/L F
Hardness	257	mg/L (as $CaCO_3$)	Total Dissolved Solids		mg/L TDS
Calcium	60	mg/L Ca	Total Suspended Solids		mg/L TSS
Magnesium	26	mg/L Mg	Gross Alpha		pCi/L
Phosphate		mg/L PO_4	Combined Radium		pCi/L Ra 226/228
Silica		mg/L SiO_2	Uranium		mg/L U 238
Vanadium		mg/L V	Turbidity		NTU
Iron	0.17	mg/L Fe	Temperature		^{o}F
Manganese	0.08	mg/L Mn	Dissolved Oxygen		mg/L DO
TOC	<1	mg/L TOC	Chromium VI		mg/L Cr(VI)

Oxidation-Filtration System

AdEdge Packaged System:	APU26-7260CS-2-AVH	Design Flow Rate:	338 gpm
Media:	AD26L	Daily Volume Treated:	182,149 gal/day
Number of Vessels:	2	Hydraulic Utilization %:	37%
Vessel Information:	100 psi ASME-Code Carbon Steel	Hydraulic Loading Rate:	6.0 gpm/sqft
Size of Vessels:	72 in D x 60 in Side Shell	Backwash Configuration:	Auxiliary Backwash
Operation:	Parallel	Backwash Frequency:	Every 14.6 days
Approximate System Footprint:	171" L x 127" W x 135" H	Backwash Loading Rate:	17 gpm/sqft
Piping Material:	Sch 80 PVC	Backwash Flow Rate:	485 gpm
Total Volume of AD26L Media:	168 cuft	Backwash Volume / Event:	9,700 gal
Estimated Media Life:	10 Years		

*All parameters are based on hydraulic utilization provided.

System Costs

	Capital Cost		Annualized O&M Cost	
Standard Packaged Treatment System:	Included	Est. Annual Oper. Costs:	**$2,262**	(Media, NaOCl)
Equipment Shop Drawings:	Included	Costs per 1,000 gal:	**$0.03**	
AdEdge Startup and Commissioning:	Included			
Engineering / Permitting:	By Engineer			
Freight & Taxes (if applicable):	Not Included			
Total Capital & Startup (sans freight):	**See Scope Table**			

AdEdge Water Technologies - Scope of Supply

Chesterville, ON

AdEdge Filtration System for Iron and Manganese Removal

Chris Savino, Technical Sales Manager - Northeast
908-507-6274
csavino@adedgetechnologies.com

8/16/2022

			Model	
			APU26 for Iron and Manganese Removal	
Item	**Detail**	**Design**	**Supply**	**Install**
	APU26-7260CS-2-AVH, Skid Mounted Carbon Steel Vessel System, Automatic Operation Pre-packaged Skid Mounted System with Vessels, Interconnecting Piping, and Valve Harness designed to run in parallel. System is shipped Factory Assembled, Skid Mounted, Pre-piped and Wired, Pressure and Flow Tested, and Ready for Installation.	**AdEdge**	**AdEdge**	**Others**
A	**Carbon Steel Pressure Vessels** Skid Mounted Carbon Steel Vessels Operating in parallel with Media and Underbedding 100 psi ASME-Code Vessels with CRN Vessels are lined with internal NSF61 Epoxy Liner One (1) Drain Valve per Vessel One (1) Manway for Media Loading; One (1) Manway for Vessel Inspection 304 Stainless Steel Internal Inlet Distributor and Hub and Lateral Underdrain One (1) Combination Air/Vacuum Release Valve per Vessel	**AdEdge**	**AdEdge**	**Others**
B	**Process Valves and Piping** 6" Sch80 PVC Inlet, Treated Outlet, and Backwash Headers with Flanged Tie Points 6" Sch80 PVC Harness Piping on Each Vessel Valve Harness with Five (5) Lug-Style Bray Butterfly Control Valves with 120VAC RCEL Electric Actuators Manual Isolation Valve at the Inlet of Each Vessel Manual Flow Control Valve on System Backwash Outlet Manual Flow Control Valve on System Treated Outlet Treated Water Backwash Supply: Auxiliary Inlet Connection w/ (2) Check Valves and (1) Lug-Style Butterfly Control Valve	**AdEdge**	**AdEdge**	**Others**
C	**PLC and Controls Detail** Automatic System Operation (Service, Backwash, and Rinse Modes) Allen Bradley CompactLogix PLC Installed Inside Control Panel for Automatic Operation C-More 10" Color Touch Screen HMI Mounted on Control Panel Operator "Touch" Graphics Screens for Automatic and Manual Operation 304SS NEMA 4X Skid-mounted Control Panel to House Electrical and System Controls Terminal Locations on Control Panel for Ancillary Controls and Device Inputs/Outputs (factory installed and labeled)	**AdEdge**	**AdEdge**	**Others**
D	**Instrumentation / Monitoring** 304SS Hydraulic Panel with System Inlet/Outlet Pressure Gauges and Sample Ports, One (1) per system Pressure Gauges and Sample Ports on Each Vessel's Inlet and Outlet E+H Electromagnetic Promag W 400 Flow Meter on Each Vessel's Inlet Pressure Sensors on System Inlet/Outlet for System DP measurement	**AdEdge**	**AdEdge**	**Others**
E	**Oxidation Filtration Media and Underbedding** AD26L Oxidation Filtration Media 84 cuft per vessel (168 cuft total) Garnet Underbedding	**AdEdge**	**AdEdge**	**Others**

AdEdge Water Technologies - Scope of Supply

Chesterville, ON

AdEdge Filtration System for Iron and Manganese Removal

Chris Savino, Technical Sales Manager - Northeast
908-507-6274
csavino@adedgetechnologies.com

8/16/2022

Item	Detail	Design	Supply	Install
			Model: APU26 for Iron and Manganese Removal	
	46 cuft per vessel (92 cuft total)			
F	**Included Field Services and Miscellaneous**	**AdEdge**	**AdEdge**	**NA**
	Electronic O&M Manual including Engineering Drawings, Design Report, and Control Description			
	System Commissioning Plan and Coordination of Installation with Installer (Pre-Startup)			
	System Startup and Comissioning On-Site Including Media Loading Supervision and Initial Media Flush			
	Three (3) x 8 hour Days Included for Start-Up and Training. Additional Work Billed on Time and Materials Basis			
	Operator Training During System Startup			
G	**Factory Testing**	**AdEdge**	**AdEdge**	**NA**
	Factory Acceptance Testing in accordance with AdEdge QC procedures and SOPs			
	Hydraulic and Mechanical Testing to Ensure System Meets Requirements			
	Pressure Testing per AdEdge Standard Procedures to Test for Leaks			
H	**Warranty and Maintenance**	**NA**	**AdEdge**	**NA**
	Standard 1-year Equipment Warranty			
I	**Freight for Media, Sub-Fill, and System**		**Not Included**	
J	**Taxes (end use, sales or duty taxes as applicable)**		**Not Included**	
316 Stainless Steel Piping and Valve Harness Option				
	APU26-7260CS-2-AVH-SS, Skid Mounted Carbon Steel Vessel System, Automatic Operation			
	Pre-packaged Skid Mounted System with Vessels, Interconnecting Piping, and Valve Harness designed to run in parallel. System is shipped Factory Assembled, Skid Mounted, Pre-piped and Wired, Pressure and Flow Tested, and Ready for Installation.			
	Section B above to be replaced with B.1 below			
B.1	**Process Valves and Piping**	**AdEdge**	**AdEdge**	**Others**
	6" 316 Stainless Steel Inlet, Treated Outlet, and Backwash Headers with Flanged Tie Points			
	6" 316 Stainless Steel Harness Piping on Each Vessel			
	Valve Harness with Five (5) Lug-Style Bray Butterfly Control Valves with 120VAC RCEL Electric Actuators			
	Manual Isolation Valve at the Inlet of Each Vessel			
	Manual Flow Control Valve on System Backwash Outlet			
	Manual Flow Control Valve on System Treated Outlet			
	Treated Water Backwash Supply: Auxiliary Inlet Connection w/ (2) Check Valves and (1) Lug-Style Butterfly Control Valve			

AdEdge Water Technologies - Scope of Supply

Chesterville, ON

AdEdge Filtration System for Iron and Manganese Removal

Chris Savino, Technical Sales Manager - Northeast
908-507-6274
csavino@adedgetechnologies.com

8/16/2022

			Model	
			APU26 for Iron and Manganese Removal	
Item	**Detail**	**Design**	**Supply**	**Install**
Estimated Fabrication and Delivery Schedule				
	***Note: The following schedule is based on receiving signed contract within 10 business days of proposal issue date to secure vessels.**			
1	Produce Shop Drawings / Submittals from Award / PO	*3-4 weeks*		
2	Fabrication of System upon approval of Shop Drawings (based on shop availability and project timing)	*24-26 weeks*		
3	Shipping to the site	*TBD*		
4	Installation of the System	*TBD by others*		
5	Startup, Commissioning, Training following Mechanical/Electrical Completion	*2-3 days*		
6	AdEdge's manufacturing schedule is only a best estimate at the time of proposal and will be adjusted, if necessary, at time of submittal approval and release to manufacturing. Where the delivery of materials is delayed due to supply chain volatility, and/or, through no fault of the customer or AdEdge, AdEdge shall not be liable for any additional costs or damages associated with such delay(s).			

Pricing Schedule

Scope of Supply Total:	Included	
Subtotal:	**$335,000**	**US Dollars**
Stainless Steel Piping Option	$64,000	
Freight:	Not Included	
Taxes:	Not Included	
Total:	***$399,000***	**US Dollars**

Pricing in this proposal is valid for 10 business days from date issued.

Payment Schedule and Terms and Conditions

- *Progress Invoice #1: 10% on contract*
- *Progress Invoice #2: 30% upon design release to manufacturing / fabrication; due on approved shop drawings & initiation of fabrication*
- *Progress Invoice #3: 55% upon shipment*
- *Progress Invoice #4: 5% upon successful startup or 45 days after shipment, whichever is first*
- *All invoices due net 30 days*
- *Project schedule is subject to timely receipt of progress payments. T his is not a pay when paid contract, therefore delayed payments will result in a temporary hold on the project until received.*
- *Late payments subject to 18% per annum interest .*
- *Alternative payment terms may result in an interest charge being added to the price to cover interest associated with financing.*

Notes, Clarifications and Exceptions

1. Freight for media and equipment supplied, IF included in the pricing accounts for one joint shipment. Customer requested split shipments will be at customer's expense for the additional shipment(s).
2. AdEdge will coordinate closely with Installer and the Engineer on all equipment and design related items.
3. No state and local permits or building, use or environmental permits will be secured by AdEdge.
4. No site engineering is included; primary interface with regulators will be completed by engineer with support from AdEdge. Work by AdEdge includes shop drawings and submittals for attaining Regulatory approval.
5. System will be shipped for offloading by personnel other than AdEdge personnel with appropriate equipment and trained operator.
6. Media will be shipped in pallets or supersacks for offloading by forklift. - By Others
7. No system foundations, offloading, placement, piping, pipe supports, insulation or tie-ins will be completed by AdEdge.

AdEdge Water Technologies - Scope of Supply

Chesterville, ON

AdEdge Filtration System for Iron and Manganese Removal

Chris Savino, Technical Sales Manager - Northeast
908-507-6274
csavino@adedgetechnologies.com

8/16/2022

			Model	
			APU26 for Iron and Manganese Removal	
Item	**Detail**	**Design**	**Supply**	**Install**
8	Owner or others will be responsible for furnishing chemicals, unless otherwise specified in Scope.			
9	Wiring and tie in of any external devices not part of the AdEdge scope e.g., SCADA shall be by the Owner or Others.			
10	Unless otherwise specified in scope of supply, no seismic engineering or seismic related design or equipment modifications are considered in the pricing; can be incorporated as appropriate for the project.			
11	If, during the performance of this contract, from the date of the contract signing until the release to manufacturing milestone only, the price of materials significantly increases through no fault of AdEdge, a change order will be issued to equitably adjust the contract value by an amount reasonably necessary to cover any such significant price increase. AdEdge shall provide documentation from the impacted manufacturer that substantiates any such increase. As used herein, a significant price increase shall mean any increase in price exceeding 5%, as compared to prices used at the date of contract signing.			
12	AdEdge Standard Purchase Agreement applies unless otherwise noted.			
13	AdEdge will request a 48-hour delivery window for treatment equipment delivery. AdEdge will closely coordinate with the customer/contractor during system shipment.			
14	Unless otherwise specified in scope of supply, treatment System does not meet American Iron & Steel (AIS) requirements. AIS requirements can be met upon request at an additional cost.			
15	Delays / Schedule: AdEdge has presented its offer and firm pricing in this proposal for a system that will be fabricated within provided project specific schedule. If after execution of the contract, Purchaser delays the equipment fabrication for whatever reason beyond four (4) months (including that from late payments) AdEdge reserves the right to assess reasonable escalation charges in the form of a change order to the project at the rate of 1% of the contract value per month for each month the project is delayed after four (4) months and/or adjust prices to pass on materials cost increases which exceed 5% incurred due to customer fabrication delays over four (4) months			
16	Start Up Services Delays / Schedule: AdEdge has presented its offer and firm pricing in this proposal for a system that will be started up within provided project specific schedule. If after execution of the contract, Purchaser delays the startup for whatever reason beyond two (2) months (including that from late payments) AdEdge reserves the right to assess travel related escalation charges, if 5% or more, in the form of a change order to the project for increased travel expenses which may result from this delay.			

Items Supplied By Others / Contractor

A	*Interconnecting pipe to the system, appropriate electrical connections to AdEdge Equipment*
B	*Pressurized water supply for use during start-up*
C	*Non-AdEdge system related site, civil, or structural engineering or support costs from Owner*
D	*Safety equipment as required for media loading, startup/commissioning*
E	*Offloading, storage and placement of all equipment and media*
F	*Site work and any building structure / facility or shade structure to be provided; HVAC*
G	*Construction of structural concrete pad as necessary for treatment equipment provided by AdEdge*
H	*Anchoring Equipment, tanks and other equipment to the building's foundation/structural pads*
I	*Dedicated power supply to AdEdge equipment; Interconnecting control and instrumentation wiring to control panel*
J	*Multiple Laborers for Media loading with AdEdge Supervision*
K	*Interface with Regulators / Permitting and all permits for successful completion of the project*

AdEdge Water Technologies - Scope of Supply

Chesterville, ON

AdEdge Filtration System for Iron and Manganese Removal

Chris Savino, Technical Sales Manager - Northeast
908-507-6274
csavino@adedgetechnologies.com

8/16/2022

			Model	
			APU26 for Iron and Manganese Removal	
Item	**Detail**	**Design**	**Supply**	**Install**
Acceptance				

The parties hereto acknowledge that the signatory below is authorized to represent the respective party and bind that party to the terms and conditions contained herein.

Acceptance by Purchaser:

By: ____
Signature

Name (print): ____

Title:____

Date of Acceptance: ____

Purchase Order # ____

AdEdge Water Technologies, LLC
2055 Boggs Road
Duluth, Georgia 30096
678-835-0052 Fax: 678-835-0057

By: ____
Signature

Name (print): ____

Title:____

Date of Acceptance: ____

Appendix C

Magnor Filtration System Proposal

MAGNOR Since 1965

MAGNOR BUDGETARY PROPOSAL

WATER TREATMENT SYSTEM – VILLAGE OF CHESTERVILLE

J.L. Richards & Associates Limited

Attention: Mr. Andrew Duncan

aduncan@jlrichards.ca

TOWNSHIP OF North Dundas

Our Reference # 9-7118

Presented by MAGNOR

Rick Sen, Eng.
Technical Sales Representative
rsen@magnor.ca

Guy-Olivier Carrier, Eng., MBA
Sales Director
gocarrier@magnor.ca

June 28th, 2022

TABLE OF CONTENTS

1 LETTER OF INTRODUCTION

Boucherville, June 28, 2022

ENGLOBE
Attention: Mr. Andrew Duncan
aduncan@jlrichards.ca

Subject: **Village of Chesterville**
Our proposal: **9-7118R1**

Dear Andrew,

We are pleased to submit our revised budgetary proposal for the Village of Chesterville.

Should you have any questions, require further information or clarifications, please do not hesitate to contact us.

Best regards,

MAGNOR INC.

Rick Sen, Eng.
Technical Sales Representative

cc. Guy-Olivier Carrier, Eng., MBA
Sales Director

2 CORPORATE PROFILE

2.1 Who We Are

As recognized specialists in water treatment since 1965, MAGNOR designs and manufactures a complete line of equipment dedicated to drinking and process water applications for municipalities, worker camps and a variety of industries. Over our more than 55-year history, we have developed the expertise and ingenuity to become a responsible and reliable partner capable of satisfying your specific water quality requirements using proven water treatment techniques.

The strong reputation that MAGNOR has developed over time is built on the peace of mind we provide our clients in their water treatment projects. We achieve piece of mind for our clients by offering a Personalised Service throughout the project, Long Term Support and by guaranteeing the performance of our systems.

2.2 Our Resources and Partnerships

Located in Boucherville, on the south shore of Montreal (QC), and in Pickering (ON), MAGNOR operates in a modern manufacturing and assembly plant along with ready access to an in-house state-of-the-art engineering department and analysis laboratory. Together, these resources contribute to ensure quality workmanship and results.

2.3 Our People

MAGNOR is supported by a highly qualified team of professionals and technicians including:

- Engineers
- Chemists
- Draftspersons
- Project Managers
- Service Technicians
- Assemblers - Pipe Fitters

MAGNOR employees are not unionized.

2.4 What We Offer

MAGNOR offers a variety of services through every stage of the project, from water analysis to treatment train recommendations, customized design and fabrication. MAGNOR assists its client with the following services:

- Evaluation of the customer's needs
- Analysis in our laboratories
- Results interpretation
- Solutions research
- Equipment and process recommendations
- Laboratory simulations of solutions
- Custom equipment design
- Specification drafting
- Equipment fabrication in our plant
- Equipment start-up and calibration
- Preventive maintenance and repair service programs

2.5 Our Line of Equipment

MAGNOR is specialized in the removal of various contaminants using the following equipment:

- Multi-media pressure filters
- Activated carbon filters
- Greensand filters
- Cationic-Anionic exchangers
- UV systems
- Water softeners
- Feed and monitoring
- Injection and Control Systems
- Membrane processes

2.6 Our Savoir-Faire

Over the years, MAGNOR acquired a unique savoir faire and enviable reputation servicing both the industrial process and drinking water sectors. As of 2021, MAGNOR equipment is used to treat drinking water supplied to over 200 municipalities and process water for over 50 industrial applications.

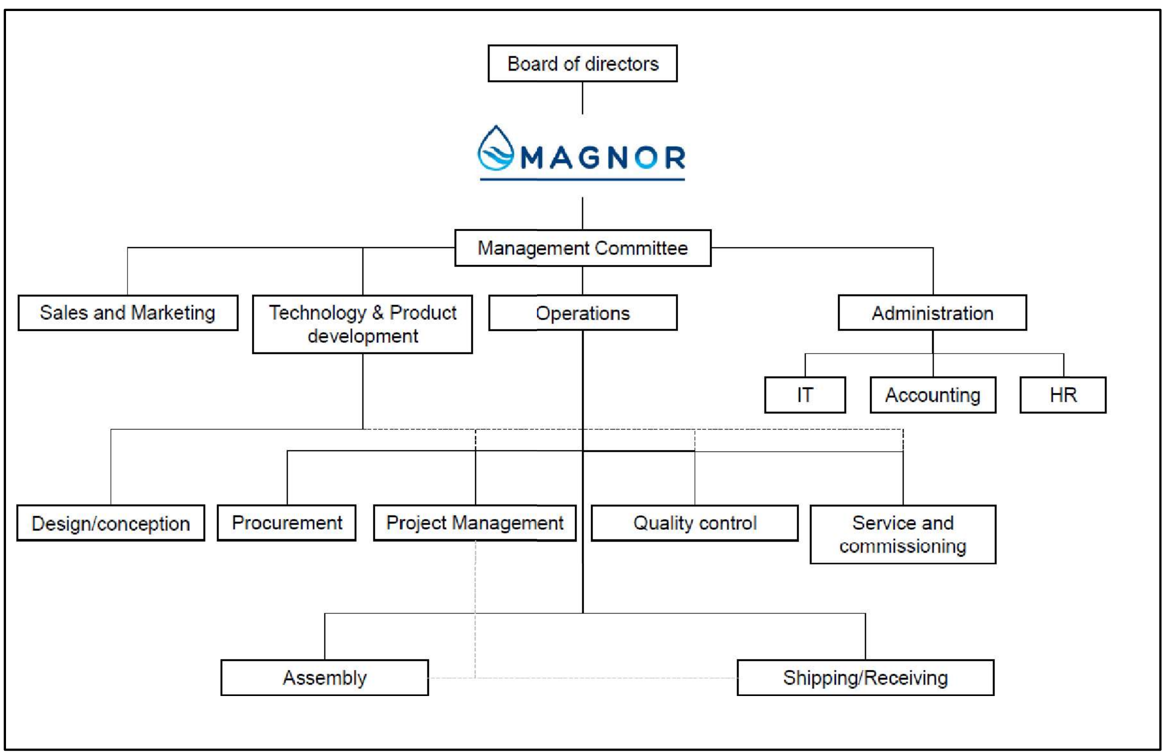
2.7 Technical Support

MAGNOR offers premium technical support. We make ourselves available on-site or remotely to answer all your needs in equipment repair and maintenance. Our technicians are on call 24/7 for emergencies.

MAGNOR also has in-house technicians, as well as service agreements with local partners across Canada to quickly cover on-site technical support needs rapidly. Depending on the location, we can offer as quick as an on-site response time in 24 hours for emergencies.

2.8 Project Team Organization

The following diagram is the MAGNOR Organizational Chart.



3 DESIGN AND DATA REQUIREMENTS

3.1 Design Data

- Average flowrate: 859 m^3/day
- Maximum flowrate: 1841 m^3/day
- Flow design: 338 usgpm
- There are two (2) supply wells:
- The design considers the highest concentrations for each well, worst case scenario.

3.2 Maximum Data for all Wells

			Maximum Data per Well	
	Units	AO	Well #5	Well #6
Flowrate	usgpm		To be provided	
Iron	mg/L	0.3	0.25	0.16
Manganese	mg/L	0.05	0.79	0.36

4 Technical Proposal

The provided well analysis reveals levels of iron and manganese slightly above or near the Aesthetic Objective (AO). The two wells are chlorinated before feeding the reservoir without any treatment. This results in having high peaks of iron and manganese above the Maximum Allowable Concentration (MAC) at different times and locations in the distribution network. To meet acceptable limits, MAGNOR suggests a treatment arrangement comprised of a green sand filter to treat the iron and manganese.

Greensand filtration is a reliable technology that has the capacity to efficiently remove manganese and iron. This process consists of a pre-oxidation phase followed by a filtration on a catalyzed filtering media, the greensand. To allow the precipitation of these metals, chlorine is injected into the water stream. Chlorine injection will oxidize the contaminants to their ferric (Fe III) and manganic (Mn IV) state.

The filters will trigger the backwash cycles automatically upon reaching a pre-determined volume of treated water or upon a high differential pressure reading across the filter. Backwash water will be supplied from the treated water distribution pump or a dedicated pump.

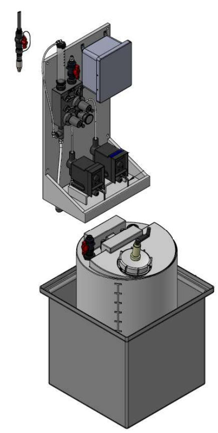
5 SCOPE OF SUPPLY

5.1 OPTION 1 – Duplex Greensand Filter for Iron and Manganese Reduction

5.1.1 Flowmeters

- Two (2) Endress & Hauser Magnetic Flowmeters, 75 mm Ø (3") on the raw water inlet of each filter;
- One (1) Endress & Hauser Magnetic Flowmeter, 150 mm Ø (6") on the common backwash inlet;

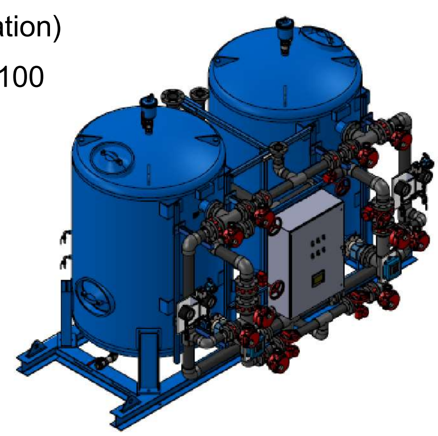
5.1.2 Sodium Hypochlorite Injection System



- One (1) 150 mm Ø (6 in) static mixer with integrated injection point;
- One (1) Sodium hypochlorite injection unit with two injection pumps, self-degassing option. The injection unit will be equipped with a DICE™ model DS dosing module comprising: a lot of back pressure, overpressure and isolation valves, interconnecting piping assembled on a wall panel, a manual agitator and a 200-liter tank with containment tank;

5.1.3 Greensand Filter

- One (1) Skid Mounted Duplex Greensand filter model FSV 7272 ADPD including:
  - Two (2) Painted Steel tanks, 72 in Ø x 72 in straight shell, built to ASME standards (without CRN certification) with a design pressure of 690 kPa (100 PSI), each including the following:
    - Two (2) Manholes, 350 mm Ø (14") x 450 mm (18") c/w covers and sealing joints.
    - One (1) Drain valve;
    - One (1) Apco vent on top of tank;



- One (1) Set of Bray butterfly valves with electric actuators O/F;
- One (1) Internal and external PVC 80 class piping assembly;
- One (1) Endress & Hauser Differential Pressure Transmitter;
- Two (2) Wika 0-100 PSI pressure gauges on entry and exit;
- Two (2) sampling (raw water/treated water);
- Filtration media: gravel, anthracite and green sand

▪ One (1) main control panel comprising an Allen Bradley Compact Logix Programmable Logical Controller (PLC) and a Human Machine Interface (HMI) for automatic control and easy access to process/equipment status.

▪ Pre-assembled and FAT tested at our manufacturing facility.

5.1.4 Miscellaneous Items

➢ Starting chemicals and test kits;

➢ Pre-assembled on a steel base and tested at our shop;

➢ Startup and personnel training by one MAGNOR technician;

➢ Instruction manual;

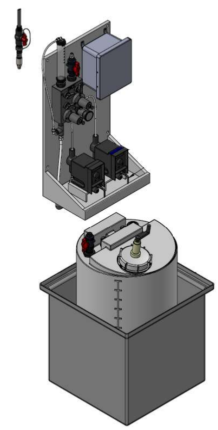
OUR BUDGETARY PRICE: --- $ 353,900.00

5.2 OPTION 2 – Triplex Greensand Filter for Iron and Manganese Reduction

5.2.1 Flowmeters

- Three (3) Endress & Hauser Magnetic Flowmeters, 75 mm Ø (3") on the raw water inlet of each filter;
- One (1) Endress & Hauser Magnetic Flowmeter, 150 mm Ø (6") on the common backwash inlet;

5.2.2 Sodium Hypochlorite Injection System



- One (1) 150 mm Ø (6 in) static mixer with integrated injection point;
- One (1) Sodium hypochlorite injection unit with two injection pumps, self-degassing option. The injection unit will be equipped with a DICE™ model DS dosing module comprising: a lot of back pressure, overpressure and isolation valves, interconnecting piping assembled on a wall panel, a manual agitator and a 200-liter tank with containment tank;

5.2.3 Greensand Filter

- One (1) Skid Mounted Triplex Greensand filter model FSV 7272 ATPD including:
  - Three (3) Painted Steel tanks, 72 in Ø x 72 in straight shell, built to ASME standards (without CRN certification) with a design pressure of 690 kPa (100 PSI), each including the following:
    - Two (2) Manholes, 350 mm Ø (14") x 450 mm (18") c/w covers and sealing joints.
    - One (1) Drain valve;
    - One (1) Apco vent on top of tank;

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- One (1) Set of Bray butterfly valves with electric actuators O/F;
- One (1) Internal and external PVC 80 class piping assembly;
- One (1) Endress & Hauser Differential Pressure Transmitter;
- Two (2) Wika 0-100 PSI pressure gauges on entry and exit;
- Two (2) sampling (raw water/treated water);
- Filtration media: gravel, anthracite and green sand

- One (1) main control panel comprising an Allen Bradley Compact Logix Programmable Logical Controller (PLC) and a Human Machine Interface (HMI) for automatic control and easy access to process/equipment status.
- Two (2) Remote (local) panel equipped with a communication device for the second filter.
- Pre-assembled and FAT tested at our manufacturing facility.

5.2.4 Miscellaneous Items

- Starting chemicals and test kits;
- Pre-assembled on a steel base and tested at our shop;
- Startup and personnel training by one MAGNOR technician;
- Instruction manual;

OUR BUDGETARY PRICE: --- $ 466,600.00

6 OPERATING DATA

Water required for backwash should be sourced from the distribution network and have a minimum supply pressure of 30 PSI.

6.1 OPTION 1 – Duplex Greensand Filter

- Service flowrate: 1,278 LPM (338 usgpm);
- Service flowrate per filter: 639 LPM (169 usgpm);
- Backwash flowrate: 1,284 LPM (339 usgpm) during 10 min;
- Rinse flowrate: 639 LPM (169 usgpm) during 10 min;
- Total backwash volume (per filter): 19,236 L (5,082 usg)
- Backwash frequency: 7,277 m^3 of raw water;
- Pressure loss: 10 psi.

6.2 OPTION 2 – Triplex Greensand Filter

- Service flowrate: 1,278 LPM (338 usgpm);
- Service flowrate per filter: 426 LPM (113 usgpm);
- Backwash flowrate: 1,284 LPM (339 usgpm) during 10 min;
- Rinse flowrate: 426 LPM (113 usgpm) during 10 min;
- Total backwash volume (per filter): 17,105 L (4,519 usg)
- Backwash frequency: 10,915 m^3 of raw water;
- Pressure loss: 10 psi.

7 CONSUMABLES AND OPERATING COSTS

The following values are based on removal of the assumed worst contaminant levels. Since these values have been determined through theoretical calculations, validation shall be required using actual field data once the system start-up is completed.

- Consumption of Cl_2 for oxidation: 3 L per 1,000 m^3
- Estimated cost for sodium hypochlorite: $ 0.40 per liter of Cl_2

8 OPERATING PHILOSOPHY AND SEQUENCE OF OPERATION

The proposed treatment process layout arrangement meets the requirements of the tender specifications and is designed to treat a maximum daily water flow of 1,841 m^3/ day. We are presenting two options:

OPTION 1: A duplex system which utilizes both filter reservoirs simultaneously to achieve 100% of the required production flow rate.

OPTION 2: A triplex system with N+1 redundancy which can accommodate 100% of the required production flow rate using two of the three filter reservoirs (the third being in standby or backwash mode) but in normal operation distributes the production flow rate evenly amongst the three filters.

The implemented method and technology for the reduction of iron and manganese will be filtration using Greensand Plus media preceded by oxidation with sodium hypochlorite. The filters will be operated in catalytic mode and therefore do not require continuous injection of potassium permanganate.

8.1 Filter Operating Strategy and Sequence of Operation

Duplex System: The operating strategy for the two (2) filters will be as follows:

- Two (2) filters will operate in parallel, each filtering 50% of the total flow.
- When a backwash sequence is initiated, the filter to be washed will be isolated and the remaining filter can be either shut down or can continue normal operation handling 50% of the total flow.

The filter control package PLC will be programmed to run the filters with the above-described strategy and sequence of operation.

Triplex System: The operating strategy for the three (3) filters will be as follows:

- Three (3) filters will operate in parallel, each filtering 33% of the total flow.
- When a backwash sequence is initiated, the filter to be washed will be isolated and the remaining two filters will either be shut down or continue normal operation – each handling 50% of the total flow.
- The filter control package PLC will be programmed to run the filters with the above-described strategy and sequence of operation.

8.2 Instrumentation

- Each filter will have a magnetic flow meter located at the raw water inlet pipe. The pulsed signal will be used to record the volume of raw water and allow the initiation of the backwashing cycles of the filters based on the volume of treated water. Each flow meter will send an analog signal to the main control panel (MCP) PLC.
- The analog signal will enable the PLC to transmit a 4-20 mA signal to the sodium hypochlorite metering pumps in proportion to the raw water flow rate.
- A magnetic flow meter will be installed on the common backwash supply header to the filters.

- The backwash cycles can also be triggered on a high differential pressure reading measured by differential pressure transmitters installed in the face piping of each filter. Pressure gauges will be installed to provide local readings.
- To avoid excessive compaction of the filter bed and the creation of preferential channels that could affect the treatment efficacy, a maximum time interval between the backwash cycles will be 7 days which will be programmed into the PLC to trigger automated backwash cycles.
- A backwash can also be triggered manually by the operator through a step-by-step command sequence to be used for troubleshooting.

8.3 Backwash Cycle Sequence

The backwash cycles will be comprised of the following two (2) stages:

- Backwash for ten (10) minutes – interval adjustable via operator interface.
- Backwashing will be carried out using treated water from the treated water reserve via the distribution pumps and/or dedicated pump (pumps and treated water reservoir supplied by others).
- Rinsing (filter to drain) will be performed using raw water. During this step, the raw water pumps will start unconditionally (even if the treated water reservoir is full). The duration of the rinsing will be ten (10) minutes with the interval adjustable via the operator interface.
- The backwash water flow rate will be automatically adjusted using a flow meter on the common backwash water supply header driving the VFD of the dedicated backwash pump.
- Filter backwashing will be performed sequentially, one filter at a time.
- The supply water flow will be evenly distributed to each filter.
- The chlorine dosing flow rate will be established as a function of the combined flow rates measured by the magnetic flow meters located at each filter inlet.

8.4 Automatic and Manual Modes of Operation

- Each filter will be equipped with five (5) electrically actuated butterfly valve to be controlled by the Filter Control Panel (FCP).
- The control sequence will be programmed by MAGNOR and will be tested upon start-up with adjustments as needed in accordance with end-user's requirements.
- Each butterfly valve will be equipped with a bypass handwheel for manual operation to be used only in the event of an actuator failure.

8.5 Backwash Cycle Frequency

- Backwash frequency will be determined in accordance with the loading rate of the filter media bed as a result of the filtration of oxidized iron and manganese.
- Based on the average of the received analysis data, we have established a theoretical frequency of **3.9 days** for the duplex system and **5.9 days** for the triplex at the maximum daily water flow of 1,841 m^3/ day.

8.6 Main Control Panel Process Description

8.6.1 HMI

- The status of each instrument will be represented on a single HMI page.
- Colour coding will be as follows:
  - The elements running or in the open position will be displayed in **GREEN**.
  - The elements not running will appear in **GREY**.
  - The elements either in fault or in alarm will be displayed in **RED**.
- Operators will be able to access graphs of the analog data read by each instrument by clicking on the graph icon to the right of the value to be displayed.

8.6.2 Chemical Dosing Controls

- The chemical injection system is equipped with two (2) dosing pumps.
- The operation of the dosing pumps is proportional to the total water flow.
- The operator will be able to control the operation of the dosing system via three (3) buttons:
  - "MAN" / "OFF" / "AUTO".
- In Manual mode, the operator can determine a percentage of dosage to make the calibration of the pump.
- In Off mode, the dosing pump is switched off.
- In "Semi-Auto", the metering pump will only operate when the process will be run at a fixed speed (semi-auto ratio). This mode is used strictly in the event of defective flowmeter.
- In Automatic mode, the metering signal is proportional to the flow.
- In manual mode, the dosing pumps will allow the operator to increase or decrease the addition of chemical products regardless of the water flow.
- The two chemical dosing pumps can be operated alternately or in priority mode. The alternating interval can be adjusted by the operator.

9 APPROXIMATE EQUIPMENT DIMENSIONS

Please refer to the table below for the approximate dimensions of the proposed equipment:

	Greensand Filters	Chemical Injection System
Footprint	84” x 117” per filter	28” x 28”
Height	121”	85”

10 EXCLUDED ITEMS

- On-site unloading and installation;
- Interconnection piping;
- Raw and distribution pump;
- Treated/washing water tank;
- On-site mechanical and electrical installation;
- All other items not included in this proposal.

11 PROPOSAL LIMITATIONS

The technical system design presented herein is provided for proposal purposes only. The final treatment design choice shall be the responsibility of the project consultant in accordance with the Authorization Certificate provided by a valid governing body such as the Department of the Environment.

12 WARRANTY

Equipment provided by MAGNOR for this project is guaranteed for 12 months from the date of delivery against defects in material and workmanship. This warranty does not cover the necessary labor to change a defective part.

Parts found defective must be returned Ex-Work to MAGNOR's plant, in Boucherville, Quebec for inspection. After inspection, MAGNOR will repair or replace defective parts. Parts changed under warranty are shipped Ex-Work from MAGNOR's plant.

Accessories not fabricated by MAGNOR are subject to these manufacturers' warranty. Warranty does not cover defects arising from misuse, misapplication, normal wear or corrosion.

13 TERMS AND CONDITIONS

Transportation: FOB, Village of Chesterville (ON)

Taxes: Applicable taxes are not included.

Price validity: Our price shall be valid for **30 days** from RFP closing date;

Currency: Canadian Dollars CDN$;

Equipment Delivery Date:

- Approval drawings are to be issued within fifteen (15) working days of receipt of the order.
- Equipment shall be delivered within 14-16 weeks from the reception of the drawings' approval and instructions to proceed with construction.
- Delivery times may vary considering fluctuations in current delivery times from our suppliers. The final delivery schedule shall be confirmed at a later date.

Payment Terms:

- 10% on engineering drawings submittal for approval;
- 30% upon reception of the main components (eg: tanks, most valves, most control panels, or others to be determined);
- 55% net 30 days upon delivery
- 5% net 90 days following start-up (completion date agreed to by the Contractor)

COVID 19, War in Ukraine and Supply Chain Disruption:

- We are currently experiencing a significant supply chain disruption (the "Disruption") due to, among other things, the COVID-19 pandemic and the war in Ukraine. Our prices may therefore be subject to significant variability. Furthermore, we cannot guarantee the delivery times established in this proposal, nor compliance with all terms and conditions. Final delivery times and confirmation of terms and conditions will be provided upon receipt of the purchase order or established upon termination of the Disruption, whichever is later.

Start-up, calibration and personnel training is included.
No mechanical or electrical installation is included in this price.

Should you have any questions, please do not hesitate to contact us at your convenience.

Best regards,

MAGNOR INC.

Rick Sen, Eng.
Technical Sales Representative

cc. Guy-Olivier Carrier, Eng., MBA
Sales Director