JLR No.: 32508-000.1
Revision: 01

August 12, 2024

Prepared for:

MUNICIPALITY OF CENTRE HASTINGS
7 Furnace Street
Madoc, ON
K0K 2K0

and

ONTARIO CLEAN WATER AGENCY
2085 Hurontario Street, Suite 500
Mississauga, ON
L5A 4G1

Prepared by:

J.L. RICHARDS & ASSOCIATES LIMITED
203-863 Princess Street
Kingston, ON
K7L 5N4
TEL: 613-544-1424

Project File
Schedule B Municipal Class Environmental Assessment for a New Treated Water Storage Facility in Madoc, Ontario (FINAL)

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS

Value through **service** and **commitment**

Table of Contents

List of Tables

List of Figures

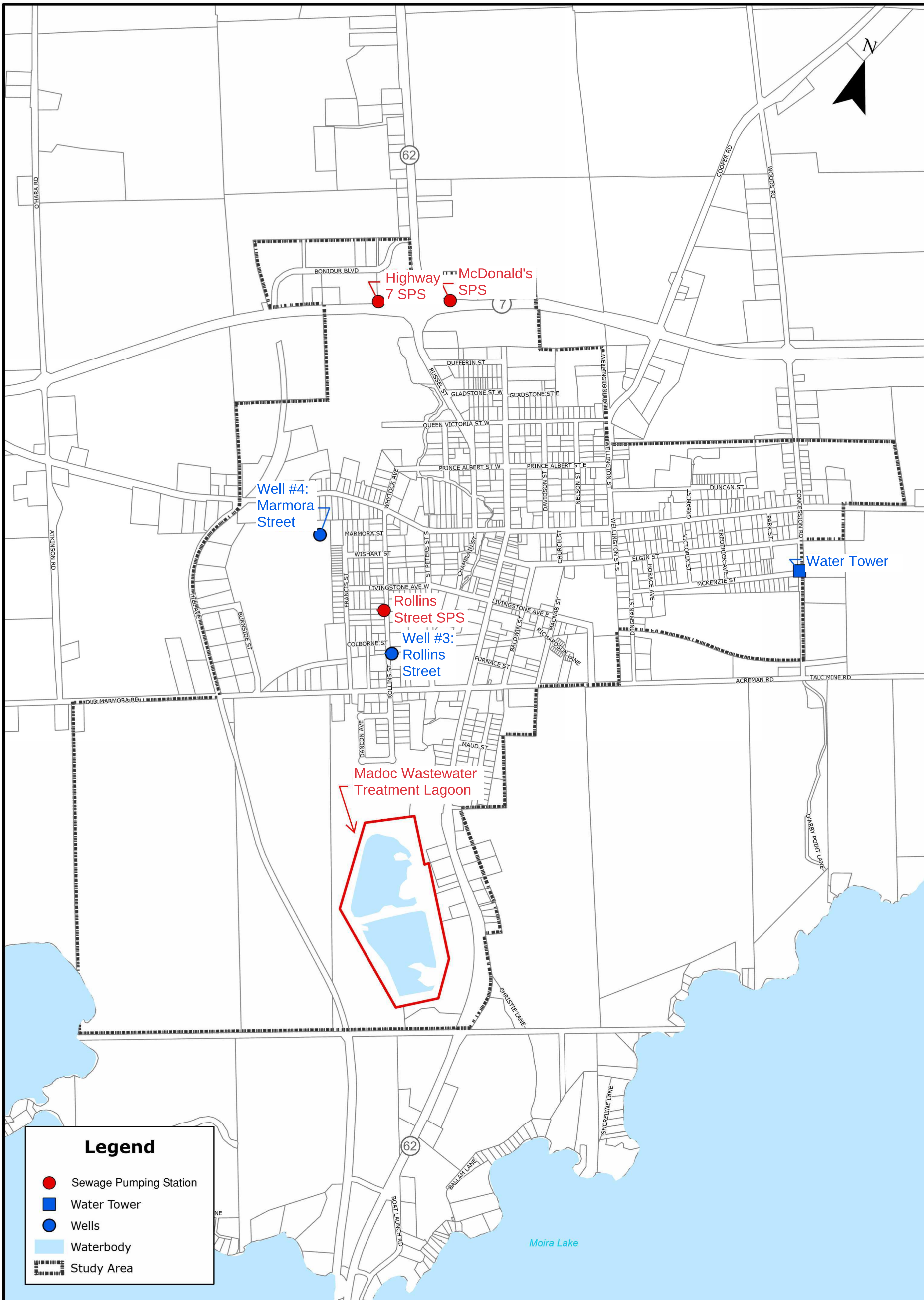
List of Appendices

1.0 Introduction

1.1 Background

The Village of Madoc is located within the Municipality of Centre Hastings, at the intersection of Trans-Canada Highway 7 and Provincial Highway 62 and is bordered by the rural Township of Madoc. The water infrastructure in Madoc is owned by the Municipality and operated by OCWA. The Study Area (Madoc) includes the urban boundary of the Village of Madoc and potential future developments located within the Township of Madoc and the Municipality of Centre Hastings, as show in Figures 2 to 9 of the Phase 1 Madoc Water, Wastewater and Stormwater Master Plan. The Phase 1 Master Plan was completed by JLR in 2024 and is available for public review at www.centrehastings.com/masterplan.

Madoc's water supply and distribution system consists of two groundwater wells and pumphouses, one elevated storage tank, and over 16 km of watermains. Well #3, located on Rollins Street, has a maximum daily rated capacity of 1,150 m^3/day and includes filtration and disinfection. Well #4 located on Marmora Street, has a maximum daily rated capacity of 1,470 m^3/day and includes an ion-exchange arsenic removal system in addition to filtration and disinfection. Both wells are defined as groundwater under the direct influence of surface water (GUDI). There is an elevated water storage tank with a total volume of 1,250 m^3 that maintains the hydraulic grade line and required water storage within the distribution system. The Madoc Drinking Water System is operated under the Ministry of Environment, Conservation and Parks (MECP) Municipal Drinking Water License (MDWL) Number 153-101 and Drinking Water Works Permit (DWWP) Number 153-201.Locations of water and wastewater plants are shown in Figure 1.



MADOC WATER, WASTEWATER, AND STORMWATER MASTER PLAN

MADOC, ONTARIO

KEY INFRASTRUCTURE AND MASTER PLAN STUDY AREA

J.L.Richards

ENGINEERS · ARCHITECTS · PLANNERS

DESIGN:	CK
DRAWN:	CK
CHECKED:	RC
JLR #:	32508-000.1

FIGURE 1

File Location: P:\32000\32508-000 - Madoc W-WW-SW MP\05-Production\01-Civil\GIS\32508_ArcGIS_Pro\32508_ArcGIS_Pro.aprx

Plot Date: February 15, 2024 9:07 AM

1.2 Madoc Water, Wastewater and Stormwater Master Plan

In August 2023, the Municipality of Centre Hastings and OCWA retained J.L. Richards & Associates Limited (JLR) to undertake a Master Plan exercise to identify existing conditions, residual capacity in the current system, and future upgrades to the water, wastewater and stormwater infrastructure to accommodate future growth in Madoc. The following Problem/Opportunity Statement was developed at the conclusion of the Madoc Water, Wastewater, and Stormwater Phase 1 Master Plan:

"Madoc is serviced by communal water and wastewater systems consisting of Well #3 and Well #4, a water tower, over 16km of watermains, a sewage treatment system, three sewage pumping stations, over 16km of sanitary sewers, and minor storm systems on main road corridors. Water supply, treatment, **treated water storage** and lagoon treatment systems **will not be sufficient to support projected growth within the Madoc servicing area for the next 20 years and beyond**. In addition, there are various locations within the sanitary sewer and storm sewer systems that currently experience capacity constraints."

It has been identified in Phase 1 of the Master Plan that the existing water tower storage would be insufficient in the next 0 to 5 Years (2024 to 2029).

1.3 Schedule 'B' Class EA for Treated Water Storage

Subsequent to the completion of Master Plan Phase 1 work, the Municipality and OCWA retained JLR (through a scope change request process) to further advance the Schedule 'B' Class EA for treated water storage, in parallel with the ongoing Master Plan Phase 2 work.

This Project File is prepared to identify and evaluate feasible alternative solutions to address the deficiency in treated water storage. The objective is to determine an overall "generalized solution" to the problem, where further details will be developed during the implementation phase (i.e., design and construction).

1.4 Class Environmental Assessment Process

The Ontario Environmental Assessment Act (Act) sets out a planning and decision-making process to consider potential environmental effects before a project begins. The purpose of the Act is to provide for the protection and conservation of the natural environment (R.S.O. 1990, c.E.18, s.2).

The Municipal Class EA (MCEA) process is followed for common types of projects to streamline the review process while ensuring that the project meets the requirements of the Act. In 1987, the first Class EA document prepared by the Municipal Engineers Association (MEA) on behalf of Ontario Municipalities was approved under the Act. Amendments were subsequently made in 1993, 2000, 2007, 2011, 2015, and 2023.

The MCEA process includes the following stages:

- Phase 1: Problem and/or opportunity identification.
- Phase 2: Identification and evaluation of alternative solutions.
- Phase 3: Preparation of alternative design concepts to support a preferred solution.

- Phase 4: Preparation of an Environmental Study Report (ESR) for posting and review on the public record.
- Phase 5: Project implementation and monitoring.

Since projects may vary in their environmental impact, they are now classified in terms of the following schedules, pursuant to the most recent amendment to the MCEA process in 2023:

- 'Exempt' projects, most of which were formerly classified as Schedule A and A+ projects, include various municipal maintenance, operational activities, rehabilitation works, minor reconstruction or replacement of existing facilities, and new facilities that are limited in scale and have minimal environmental effects. While these projects are exempt from the MCEA process, proponents should consider whether notice about the project should be given or consultation on the project should be carried out. Furthermore, proponents are also responsible for obtaining any other applicable permits, approvals, and authorizations for the project.
- 'Eligible for Screening to Exempt' projects may be eligible for exemption based on the results of a screening process. Proponents may choose to complete the applicable screening process to determine whether the project is eligible for exemption or proceed with the applicable Schedule 'B' or Schedule 'C' process, as noted below.
- Schedule 'B' projects have the potential for some adverse environmental impacts and therefore, the proponent is required to undertake the first two phases of the MCEA process. This includes mandatory consultation with Indigenous Communities, the public and other affected stakeholders as well as relevant review agencies; and the preparation of a Project File which documents the Class EA process and is placed on the public record for review and comment. If there are no outstanding concerns and the regulatory process has been completed, then the proponent may proceed to implement the project. Generally, these projects include improvements and minor expansions to existing facilities or smaller new projects.
- Schedule 'C' projects have the potential for greater environmental impacts and are subject to the full MCEA process. This includes mandatory consultation with Indigenous Communities, the public and other affected stakeholders as well as relevant review agencies; identifying, assessing, and refining alternative solutions to determine a preferred solution; and preparing the ESR which documents the Class EA process and is placed on the public record for review and comment. If there are no outstanding concerns and the regulatory process has been completed, then the proponent may proceed to implement the project. Generally, these projects include the construction of new facilities and major expansions to existing facilities.

Based on the following excerpt from the MEA Guidelines, this project is being undertaken as a Schedule 'B' Class EA that is eligible for screening:

"6c. Establish new water storage facilities where the facility is not located in or adjacent to an environmental sensitive natural area, residential or other sensitive land use, or on lands with cultural heritage or archaeological potential".

2.0 Phase 1: Problem and Opportunity Identification

2.1 Condition Assessment

The existing elevated storage tank, located at 119 McKenzie Street, Madoc, was constructed in 1981. Record drawings indicate rehabilitation works completed in 1986 which included new waterproofing and insulation. An inspection completed by Authorized Inspection Services Inc. in 2019 revealed that the tank is in poor condition. The condition report found corrosion of the inlet pipe and tank walls and sediment, debris and styrofoam was found suspended throughout the treated water in the tank. The complete Madoc Elevated Tank Video Inspection report is available in Appendix A.

2.2 Design Basis (Summary of Master Plan Phase 1 Report)

The following table summarizes the key parameters of the elevated water tower.

Table 1: Madoc Water Tower Parameters

Parameter	Value
Physical Characteristics of the Water Tower	
Internal Tank Diameter	11.6 m (1)
Total Tank Height	12.85 m (1)
Operating Characteristics of the Water Tower	
Operating Level – High	219.86 m (1)(2)
Operating Level – Low	218.76 m (1)(2)
Top Water Level (Max)	220.83 m (1)
Low Water Level (Min)	208.66 m (1)
Existing Available Storage	1,250 m^3 (1)

(1) Obtained from Elevated Water Tank As-Built Drawings (1981).
(2) Operating level calculated from OCWA's Start and Stop setpoints of 83% to 92%.

Per MECP Design Guidelines for Drinking-Water Systems (2008), total available treated water storage within the system should at least amount to the sum of the required equalization storage (B), fire storage (A), and emergency storage (C) allowances, as depicted in Figure 2. The elevated water tank has a total effective storage of 1,250 m^3.

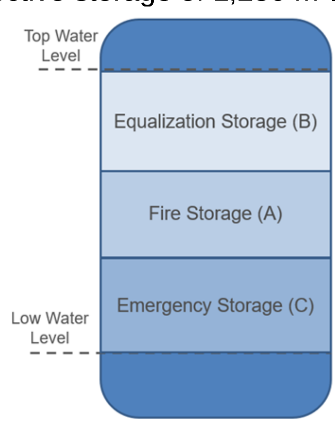


Figure 2: Total Required Treated Water Storage

In Phase 1 of the Master Plan, the future water storage requirements were determined using a design flow rate of 300 L/person/day and MECP flow rates for institutional, industrial, and commercial development types. Refer to Section 4.2 of the Master Plan Phase 1 report for the full analysis. The storage requirements are summarized the following table. Water storage requirements will exceed the available storage in the short-term.

Table 2: Future Water Storage Requirements

Parameter	**Existing (2023)**	**Short-Term (2024-2029)**	**Mid-Term (2029-2034)**	**Long-Term (2034-2044)**
Non-Cumulative Equivalent Population (1)	1,477	997	1,250	2,651
Cumulative Equivalent Population (1)	1,477	2,474	3,724	6,375
Fire Flow (2) (L/s)	78	102	120	162
Duration (2) (Hours)	2	2	2	3
A – Fire Storage (3) (m^3)	564	735	862	1,748
B – Equalization Storage (4) (m^3)	231	386	581	995
C – Emergency Storage (5) (m^3)	199	280	361	686
Total Storage Requirement (m^3)	993	1,401	1,804	3,428
Existing Available Storage (m^3)	1,250	1,250	1,250	1,250
Deficit (m^3)	**-257**	**151**	**554**	**2,178**

(1) Estimated to be equal to average day demand / per capita usage of 300 L/cap/d. The equivalent population also includes ICI flow contribution.
(2) Values interpolated from Table 8-1 of the MECP Design Guidelines (2008) based on equivalent service population. Fire flow is described as the largest expected fire flow requirement in L/s and duration is length of time fire flow shall be sustained.
(3) Largest expected fire volume = fire flow x duration.
(4) 25% of Maximum Day Demand.
(5) 25% of the sum of A and B.

2.3 Hydraulic Water Distribution System

In Phase 1 of the Master Plan, the WaterCAD® hydraulic water model was developed to reflect existing conditions using updated data. Existing demands were distributed based on the historical demands, number of units, and proximity of units to nodes as determined through satellite imagery. This process is described in more detail in the Phase 1 report.

The Master Plan Phase 2 modelling consisted of determining the average day, maximum day, and peak hour demands for the short- and long-term growth periods, then assigning them to nodes in the model. New watermains were added to connect the existing potable water system to future development areas.

It has been recommended in the Master Plan Phase 2 report that the existing hydraulic grade line (HGL) can be maintained and can continue to meet the system demand in the long-term, i.e., there is no need to raise the height of the elevated storage. Refer to the Master Plan Phase 2 Report for water modelling results. As such, all potential elevated storage solutions will match the height of the existing elevated water storage tank (i.e., HGL).

2.4 Problem and Opportunity Statement

The following Problem and Opportunity Statement was developed for this Schedule 'B' Class EA and will be used as the basis for proceeding to Phase 2:

"Madoc is serviced by a municipal drinking water system consisting of Well #3 and Well #4, a water tower and water distribution network. The existing water tower is in need of repair and rehabilitation. Treated water storage will not be sufficient to support projected growth within the Madoc servicing area for the next 20 years and beyond. There is an opportunity through the Class EA process to ensure that Madoc has a treated water storage solution which will address the existing and future conditions on the drinking water storage and distribution system."

3.0 Phase 2: Identification and Evaluation of Alternative Solutions

3.1 Evaluation Methodology

To facilitate the evaluation and selection of the preferred solutions during Phase 2, a transparent and logical three-part assessment process was established. This process included:

- Initial screening of alternative solutions.
- Detailed evaluation of screened alternative solutions.
- Selection of a preferred alternative solution.

3.2 Initial Screening of Alternative Solutions

The initial screening process considers the overall feasibility of the potential alternative solutions and identifies which alternatives fully address the Problem/Opportunity Statement as identified in the Phase 1 Report. This step ensures that unsuitable alternatives are not carried forward to a more detailed evaluation stage.

As discussed in Section 2.0, new potable water storage is required to service Madoc into the long term. Alternative potable water storage solutions will need to consider the location and configuration (i.e. type) of new storage, and whether the existing standpipe should be decommissioned or maintained.

These solutions were developed and sorted for the initial screening process as listed in Table 3.

Table 3: Alternative Solutions

Solution Category	Alternate Solutions Identified
Approach	Approach 1: Do Nothing
	Approach 2: Decommission Existing Elevated Storage and Build New Storage
	Approach 3: Maintain Existing Elevated Storage and Build New Storage
Location	Location 1: 119 McKenzie Street (Current elevated storage location)
	Location 2: 71 Davidson Street
	Location 3: 29 Rollins Street
	Location 4: At Well #4 via Marmora Street
Configuration	Configuration 1: Below-Grade Reservoir with Pumping Station
	Configuration 2: At-Grade Reservoir with Pumping Station
	Configuration 3: Elevated Storage Tank
	Configuration 4: Standpipe

3.2.1 Approach

3.2.1.1 Approach 1: Do Nothing

The 'Do Nothing' approach examines what may occur if none of the alternatives are implemented.

Recommendation: It is carried forward to detailed evaluation as a comparison and baseline.

3.2.1.2 Approach 2: Decommission Existing Elevated Water Storage and Build New Storage

Approach 2 involves the decommissioning of the existing elevated water tower and building new storage to accommodate a total volume of 3,428 m^3. Costs incurred include the construction of a storage reservoir, connections from the new storage to existing water infrastructure, and decommissioning of the existing elevated storage.

The water model results demonstrated the existing elevated water tower's ability to continue to provide storage and pressure to the system, i.e., the Hydraulic Grade Line (HGL) will be maintained for long-term scenario.

Recommendation: This approach addresses the storage capacity limitations in the system and maintains the existing HGL. Therefore, Approach 2 is recommended to be carried forward into detailed evaluation.

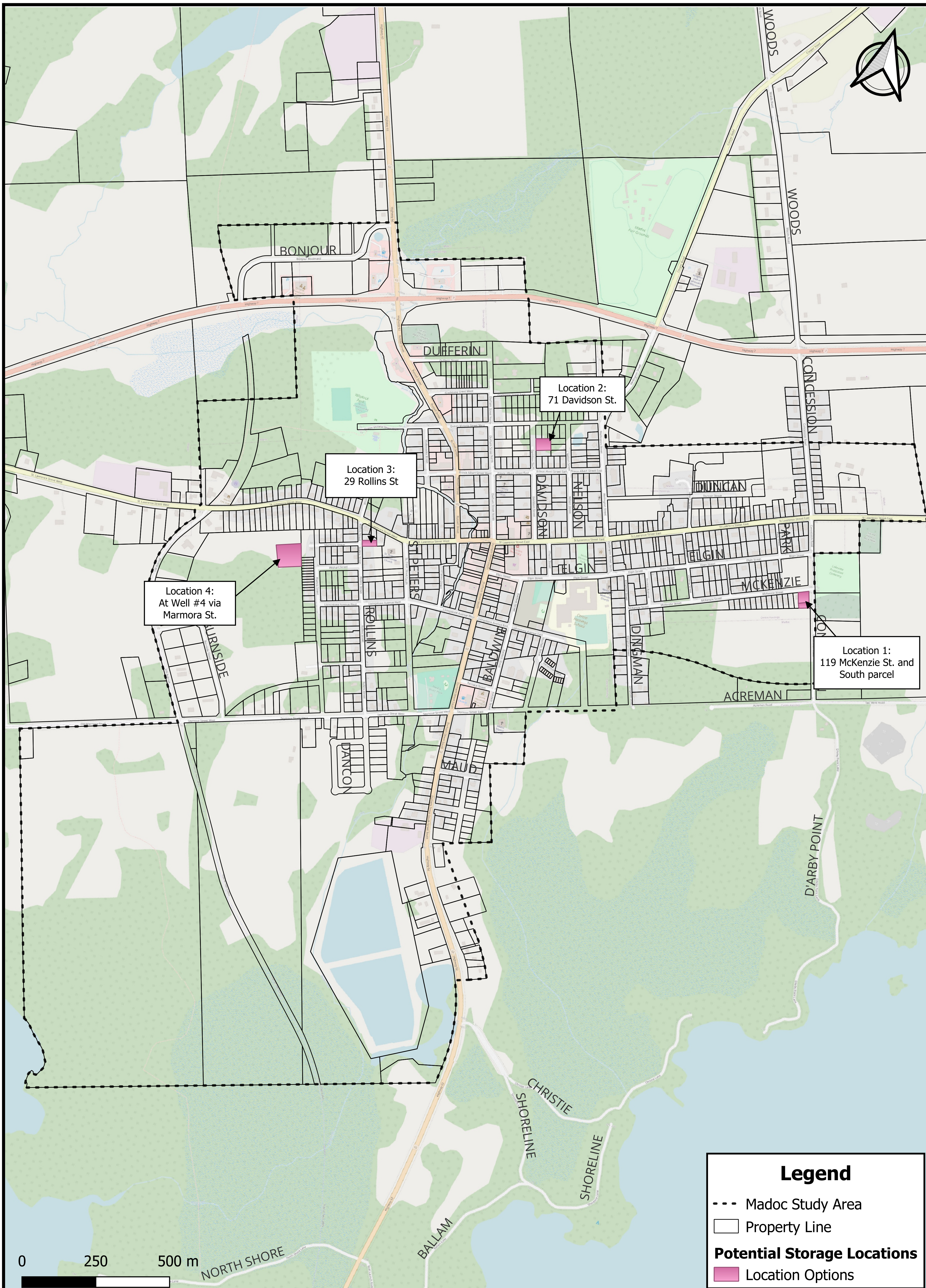
3.2.1.3 Approach 3: Maintain Existing Elevated Water Storage and Build New Storage

Approach 3 will involve the construction of a new water storage facility to make up the storage volume deficiency of 2,178 m^3 identified in Section 2.2. The existing elevated water storage will also require rehabilitation to address damage to the insulation and corrosion of tank elements. Costs will also include connections from the new water storage to existing infrastructure.

Recommendation: Due to the poor condition of the existing elevated water storage tank and capital expenditure required to rehabilitate the tower, it is not recommended to carry this option forward into detailed evaluation.

3.2.2 Potential Storage Locations

In consultation with the Municipality, it was determined that the potential storage solution will be located at 4 potential locations, as shown in Figure 3 below.



PROJECT:

SCHEDULE B MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT FOR A NEW TREATED WATER STORAGE FACILITY IN MADOC

Madoc, ON

DRAWING:

POTENTIAL STORAGE LOCATIONS

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS

DESIGN:		JLR NO:	32508-000
DRAWN:	RC	DRAWING NO:	**Figure 3**
CHECKED:	SJS		

3.2.2.1 Location 1: 119 McKenzie Street with Acquisition of South Parcel

119 McKenzie Street is located on a high-lying area in the east quadrant of Madoc. The parcel has an area of 0.13 hectares. This is the current address of the existing elevated water storage. The parcel consists of few trees and a lawn area and is located at the east-end of a residential area.

The existing water storage site provides the highest grade elevation (183.7 m) out of the location options provided; this is a desired feature for elevated storage solutions to reduce the amount of structural concrete (for an elevated tank) or water (for a standpipe) to achieve the existing hydraulic grade line.

The new water storage would be constructed next to the existing elevated storage tower in order to maintain water storage throughout construction. The south property line is located 13 m from the existing water tower structure. The current elevated storage tank has a diameter of 11 m and the available storage configurations could potentially have a diameter bigger than the existing tank. Therefore, there is insufficient space within the current parcel for side-by-side construction of Approach 2.

The parcel south of 119 McKenzie Street (MPAC Roll No.:123013801526405) is zoned as general industrial (M1) can potentially be acquired by the Municipality to provide enough space for the new water storage. There are no dwellings within the parcel, however a private paved driveway exists. Construction of the new water storage is not expected to encroach the south tree-line or the private driveway access located in the south parcel. The preferred storage configuration can be connected to the existing watermain on McKenzie Street or extended from Concession Street. The storage solution can potentially be placed within the area presented in Figure 4.

A field review of Location 1 should be completed to confirm presence of Species at Risk (SAR) and species designated under the Endangered Species Act (ESA), such as the red-headed woodpecker and butternut trees. Vegetation clearing on site should occur outside the breeding bird season, between April 1 to August 31 (Cambium 2024).

Recommendation: Location 1 will provide sufficient space for construction of a new water storage. If an elevated water tank or standpipe is constructed at this location, the hydraulic grade line can be maintained. Location 1 is recommended to be carried forward to the detailed evaluation.

PROJECT:

SCHEDULE B MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT FOR A NEW TREATED WATER STORAGE FACILITY IN MADOC

Madoc, ON

DRAWING:

Location 1 - 119 McKenzie Street and South Parcel

J.L.Richards ENGINEERS · ARCHITECTS · PLANNERS

DESIGN:		JLR NO:	32508-000
DRAWN:	RC	DRAWING NO:	**Figure 4**
CHECKED:	SJS		

3.2.2.2 Location 2: 71 Davidson Street

71 Davidson Street is located north of Prince Albert Street at the unopened road allowance for Davidson Street. The property is located in a residential area, south of a future potential development identified in the Phase 1 Master Plan. Location 2 has an area of 0.2 hectares and is zoned for Development (D). Watermain connection for this location is available on Davidson Street. There are no other structural features on site and, based on satellite measurement, appears to have adequate space for a storage solution.

Based on municipal infrastructure elevations, it was estimated that Location 2 has a grade elevation of 177.5m. Location 2 has a lower elevation than Location 1, therefore additional structural concrete or water will be required to achieve the existing hydraulic grade line. An aerial photo of 71 Davidson Street is shown in Figure 5a.

This property consists of trees and shrubs with small, manicured areas and debris piles. Construction within Location 2 will include clearing of trees and vegetation. A field review should be completed to confirm presence of Species at Risk (SAR) and species designated under the Endangered Species Act (ESA), such as the red-headed woodpecker and butternut trees. Vegetation clearing on site should occur outside the breeding bird season, between April 1 to August 31 (Cambium 2024).

Recommendation: Due to its proximity to the existing infrastructure and size, this is a feasible location for the storage solution. Location 2 is recommended to be carried forward for detailed evaluation.

3.2.2.3 Location 3: 29 Rollins Street

29 Rollins Street is located south of St. Lawrence Street West. The parcel is approximately 50 m long with a frontage width of 20 m. A new elevated storage tank or standpipe has a typical diameter of approximately 13 m. This parcel will allow a minimum of 3.5 m maintenance access to the tank. Additional buffer is required on all sides of the tank for maintenance access. An aerial photo of 29 Rollins Street is shown in Figure 5b.

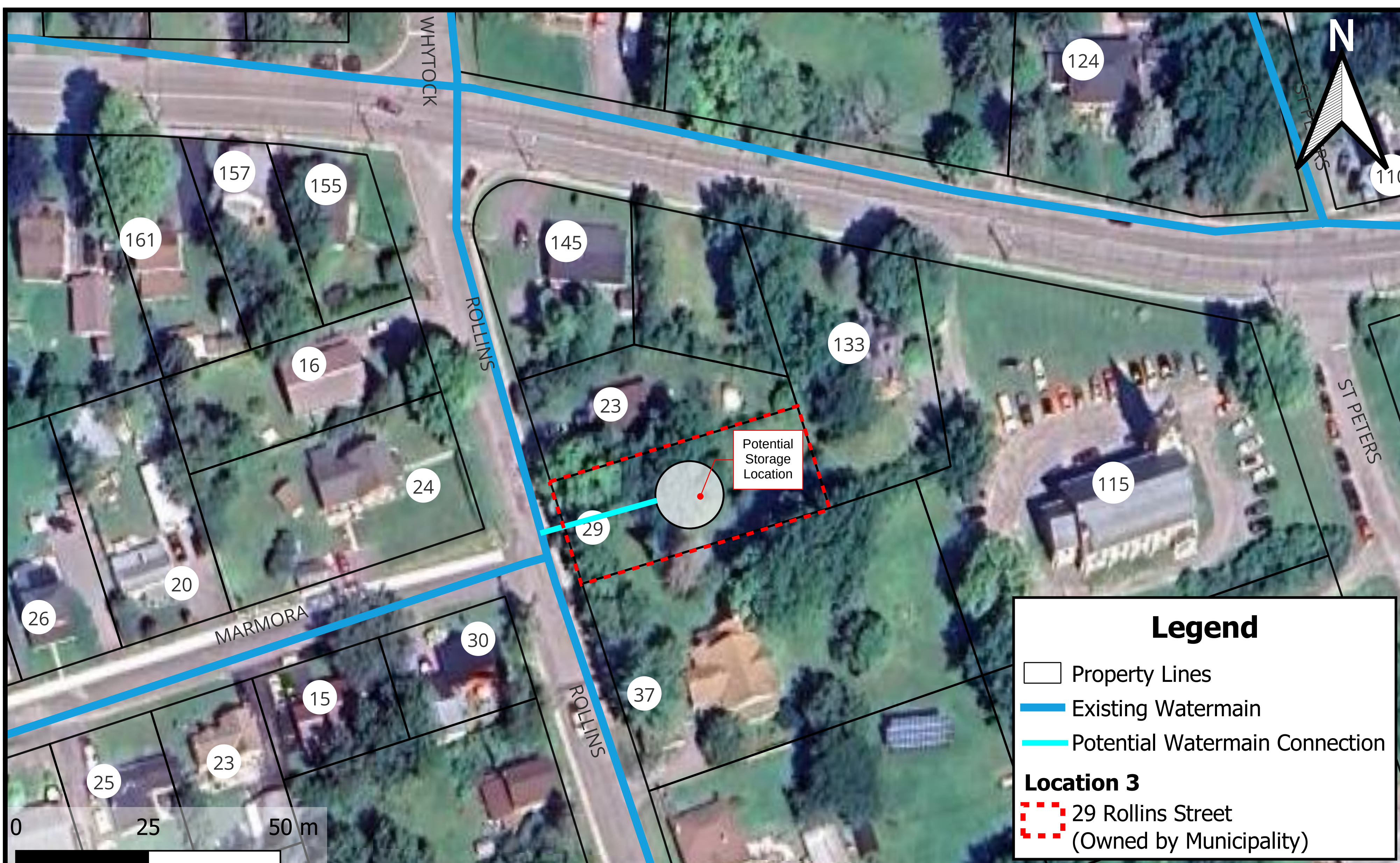
Recommendation: Due to the width of the parcel, Location 3 does not have adequate space for a storage solution. It is recommended for Location 3 not to be carried forward for detailed evaluation.

DRAWING:

Location 2 - 71 Davidson Street

DRAWING NO:

Figure 5A



DRAWING:

Location 3 - 29 Rollins Street

DRAWING NO:

Figure 5B

PROJECT:

SCHEDULE B MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT FOR A NEW TREATED WATER STORAGE FACILITY IN MADOC

Madoc, ON

DRAWING:

Potential Storage Location 2 and 3

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS

DESIGN:		JLR NO:	32508-000
DRAWN:	RC	DRAWING NO:	
CHECKED:	SJS		**Figure 5**

3.2.2.4 Location 4: At Well #4 via Marmora Street

Location 4 is a 30 m x 30 m (0.1 hectares) site east of the Well #4 pumphouse, which is accessible via Marmora Street. Location 4 is situated within a larger 10 hectare parcel with potential for future development as identified in Phase 1 of the Master Plan. Location 4 is generally clear of trees as the area was developed for the construction of Well #4. Location 4 is zoned for Development (D). An aerial photo of Location 4 is shown in Figure 6.

Based on record drawings of Well #4, Location 4 has a grade elevation of 173 m. This site's grade elevation is 10.7 m lower than the grade elevation at the existing water tower (Location 1). The natural environment for Location 4 was considered in the Schedule C Class Environmental Assessment for a New Treatment Plant Option (Well #4) completed by Greer Galloway Group in 2019. There were no SAR risks identified through the desktop analysis.

Recommendation: Location 4 is adequately sized for all storage configurations with minimal impact to natural heritage. The site has a relatively low elevation which may not be feasible for maintaining the HGL for standpipe and elevated water tower configurations however, this location may be feasible for a reservoir. Therefore, it is recommended for Location 4 to be carried forward for detailed evaluation.

PROJECT:
SCHEDULE B MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT FOR A NEW TREATED WATER STORAGE FACILITY IN MADOC
Madoc, ON

DRAWING:
Location 4: At Well #4 via Marmora Street

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS

DESIGN:		JLR NO:	32508-000
DRAWN:	RC	DRAWING NO:	**Figure 6**
CHECKED:	SJS		

3.2.3 Potential Storage Configurations

Water storage is typically built in one of four configurations:

- a below-grade reservoir with a pumping station,
- an at-grade reservoir with a pumping station,
- an elevated storage tank, and
- a standpipe.

Each configuration was reviewed for initial screening to determine whether it would be carried forward for detailed evaluation at the short-listed locations previously identified.

3.2.3.1 Configuration 1: Below-Grade Reservoir with Pumping Station

Below-grade reservoirs are constructed underground, then covered by earth and vegetation. This hides the reservoir from view, which improves visual aesthetics. However, excessive costs can be incurred depending on the depth of bedrock. This also enables the reservoir to have two or more cells that can be taken offline independently, which allows for maintenance or inspection activities to proceed without losing the facility's entire storage capacity. These reservoirs are typically constructed with concrete.

The associated pumping station can be to be at-grade or below-grade, but at-grade buildings are more operator friendly and are typically used. The usage of a pumping station increases the complexity of this solution relative to others, such as an elevated tower. It incurs higher operational and maintenance costs. The new pumping station would require redundant pumping capacity to allow flexible operations if a pump is removed from service for routine maintenance or a potential equipment failure.

Pumping capacity is also required to meet the full range of everyday domestic demands up to fire protection demands. Maintaining a constant, adequate water distribution system pressure requires higher electrical consumption from continual pump operation. The pumping station will also require a backup power supply, such as diesel driven generators.

The below-grade and pumping station will have the highest capital and life cycle costs among the configurations considered.

Recommendation: Due to the high capital and life cycle costs, it is recommended for Configuration 1 not to be carried forward for detailed evaluation.

3.2.3.2 Configuration 2: At-Grade Reservoir with Pumping Station

At-grade reservoirs are typically made of coated/glass-fused-to steel. Glass-fused-to-steel tanks are preferred due to ease of installation, longevity, lower maintenance, and lower cost. During maintenance or inspection, all storage capacity is unavailable since there are no internal baffles that would allow some capacity to remain in service.

However, these reservoirs can be constructed in phases. Instead of constructing a large reservoir to meet the entire storage required to supply the long term, an initial reservoir module can be constructed that meets the short and mid-term needs. As the water storage needs increase in the long term, a second phase of construction can commence, where a second module is added to the short-term storage to increase its capacity to satisfy long-term requirements. This is a cost-effective method that prevents storage from being unused in the short term, which may cause water quality issues, and allows for flexibility in timing in case developments do not proceed as projected.

The footprint of an at-grade steel tank is flexible, as there are a wide variety of diameters and heights available. This means they usually take up less space than a below-grade reservoir of comparable volume. The cost of at-grade reservoirs is also less depending on the bedrock depth than that of a below-grade reservoir. Therefore at-grade reservoirs have slightly lower capital and life cycle costs compared to a below-grade reservoir.

Like a below-grade reservoir, an at-grade reservoir configuration requires pumping station infrastructure. As discussed in Configuration 1, these operational and maintenance costs are higher than that of an elevated tank, due to their higher complexity and pumping requirements.

Recommendation: Due to the need for more storage, rather than a raised HGL, and the flexibility of a phased modular construction, this configuration is recommended to be carried forward to detailed evaluation.

3.2.3.3 Configuration 3: Elevated Storage Tank

Composite elevated tanks are located at the top of a support structure such as a pedestal. The water level in the elevated tank sets the pressure in the water distribution system. The usable capacity of an elevated tank is the volume of water that can be stored in the tank between the high and low water levels. Therefore, the diameter determines the functional capacity. No additional pumping station is required to maintain the head beyond the existing well pumps that fill the elevated tank.

3.2.3.3.1 Configuration 3A: Rehabilitation

Madoc has an existing elevated storage tank which was found to be in poor condition. Initial construction costs will include rehabilitation of the existing tank and construction of a 600 m^3 reservoir and booster station in order to meet short-term and mid-term storage requirements. The total initial capital cost is estimated to be greater than Configuration 4 (Standpipe). An additional 1620 m^3 of storage will be required to meet long-term demand.

Recommendation: Rehabilitation of the existing water storage and additional storage required for the mid-term will result in a higher initial capital cost than Configuration 4 (Standpipe), therefore it is not recommended to carry Configuration 3A forward for detailed evaluation.

3.2.3.3.2 Configuration 3B: New Construction

For Madoc, the cost to construct a new elevated tower will be more than double the capital cost of Configuration 4 (Standpipe). Operational costs include recoating every ten or so years and coating inspection every five years.

Recommendation: Due to the significant capital cost and ongoing O&M costs, its recommended not to carry Configuration 3B forward for detailed evaluation.

3.2.3.4 Configuration 4: Standpipe

Standpipes are storage tanks constructed at ground level to a height that will provide adequate system pressure in the operating range. They are entirely filled with water, i.e., for the entire height. They can be made of glass-fused-to-steel or coated steel. As with the other configurations, glass-fused-to-steel tanks are easier to install, last longer, and require less maintenance.

The taller design of a standpipe allows for water above the operating range to provide gravity-fed pressure, and chlorine contact time, if it is located before users in the distribution system. Standpipes are often used in small systems where less volume is needed, or in situations where the site has a high ground elevation relative to the system pressure.

Standpipe manufacturers were consulted in order to identify available sizes and volumes for Configuration 4. To maintain the current HGL at the existing grade elevation (Location 1), a typical 13 m diameter standpipe can provide a maximum effective storage volume of 2,900 m^3. This storage volume is sufficient for the mid-term however, 600 m^3 of additional storage will be required to meet the long-term demand.

For other locations with a lower grade elevation than Location 1, the total effective storage is reduced as additional water column is required to maintain the HGL. Additional volume does not translate to useable volume.

Recommendation: Replacement or major rehabilitation of the existing elevated tower is imminent. The system's HGL can be provided by a standpipe and has a lower capital cost than an elevated tower. Available standpipe volume is not sufficient to meet long-term demand. Therefore, it is recommended that this configuration be combined with Configuration 2 and be carried forward for detailed evaluation.

3.3 Summary of Initial Screening

A summary of the results of the initial screening described above is provided in Table 4.

Table 4: Results of the Initial Screening of Solutions

Solution Category	Alternate Solutions Identified	Initial Screening Result
Approach	Approach 1: Do Nothing	✓ Carried forward as baseline.
	Approach 2: Decommission Existing Elevated Storage and Build New Storage	✓ Feasible solution. Carried forward.
	Approach 3: Maintain Existing Elevated Storage and Build New Storage	× Not feasible due to poor condition of the tank
Location	Location 1: 119 McKenzie Street with acquisition of south parcel	✓ Feasible solution. Carried forward.
	Location 2: 71 Davidson Street	✓ Feasible solution. Carried forward.
	Location 3: 29 Rollins Street	× Inadequate parcel size for any storage configuration.
	Location 4: At Well #4 via Marmora Street	✓ Feasible solution for reservoir. Carried forward.
Configuration	Configuration 1: Below-Grade Reservoir with Pumping Station	× Unnecessary, inflexible, and high costs. Not carried forward.
	Configuration 2: At-Grade Reservoir with Pumping Station	✓ Feasible solution. Carried forward.
	Configuration 3: Elevated Storage Tank	× Unnecessary, inflexible, and high costs. Not carried forward.
	Configuration 4: Standpipe	✓ Feasible solution. Carried forward.

3.4 Development of Alternative Solutions

Upon completion of the initial screening process, the following alternative solutions have been developed that combines the various approach, configuration and location of new treated water storage.

The main driver when developing the alternatives is the ability to phase construction as growth occurs in the Village. The proposed solutions all consider the expandability of the storage system to avoid large upfront capital spending and potential water quality issues with over-sized storage tanks.

- Alternative #1 – Do Nothing
- Alternative #2 – Decommission Existing Elevated Storage; Build a New Standpipe (1,800 m^3 Usable Volume) at McKenzie Street and Supplement Storage with At-Grade Reservoir (1,620 m^3) and Booster Station at Well #4
- Alternative #3 – Decommission Existing Elevated Storage; Build a New Standpipe (2,900 m^3 Usable Volume) at McKenzie Street and Supplement Storage with At-Grade Reservoir (600 m^3) and Booster Station at Well #4
- Alternative #4 - Decommission Existing Elevated Storage; Build a New Standpipe (1,800 m^3 of Useable Volume) at Davidson Street and Supplement Storage with At-Grade Reservoir (1,620 m^3) and Booster Station at Well #4

3.5 Detailed Evaluation and Selection of Alternative Solutions

Based on the initial screening process, a detailed assessment of the shortlisted alternatives was conducted. Evaluation criteria were developed based on a review of the background information, experience on similar assessments, stakeholder comments, and consultation with Municipality and OCWA staff. The evaluation was conducted using criterion in the following five categories:

- Natural Environment
- Climate Change Resiliency
- Social, Cultural, and Heritage Environment
- Technical Feasibility
- Financial Considerations

The relative level of impact of each potential alternative solution on each criterion is assessed based on the color weighting system summarized in Table 5. The relative impact for each criterion to each potential alternative solution was assessed based on whether the alternative solution is ‘Preferred’, ‘Less Preferred’, or ‘Least Preferred’ with respect to that criterion. The option that has the least negative impact or has the strongest positive impact was recommended as the preferred solution and presented to stakeholders to solicit input before finalizing.

Table 5: Detailed Screening Impact Level Colouring System

Impact Level	Color	Relative Impact
Strong Positive Impact	Green	Preferred
Minor Impact	Yellow	Less Preferred
Strong Negative Impact	Red	Least Preferred

The evaluation criteria are described in Table 6 below. The five (5) major criteria were assigned equal weights as they were considered to have equal importance in this evaluation at the Master Plan stage.

Table 6: Summary of Evaluation Criteria

Major Criteria	Description
Natural Environment	Impacts on natural features, water, and wildlife. • Proximity to and impact on natural areas, terrestrial ecosystems, and wetlands. • Effect of construction and operations on aquatic and terrestrial species & habitat, including species at risk. • Effect on ground and/or surface water quality. • Effect on ground and/or surface water quantity.
Climate Change Resiliency	Impacts on climate change resiliency. • Susceptibility to extreme weather events (e.g., drought, flood, strong winds) and climate change (e.g. increasing ambient temperature and increasing rainfall) • Impact to water security under extreme weather events and climate change. • Expected impact to greenhouse gas (GHG) emissions and carbon sinks.
Social, Cultural and Heritage Environment	Impacts on the social environment, including archaeological, cultural, built heritage resources, and planning. • Impacts on Indigenous communities and lands, and/or way of life. • Impacts to Madoc residents, institutions, businesses, and public resources (ex. parks). • Impacts of location and storage type on visual aesthetic. • Effect of noise and/or vibration from construction. • Impacts on archeological, cultural heritage landscapes, and built heritage resources. • Impacts of location on existing and future land use planning.
Technical Feasibility	Constructability, maintaining or enhancing water quality, reliability and security of drinking water system, and approvals framework of the option. • Ability to expand infrastructure to best service future development. • Constructability. • Ease of operation and maintenance. • Impacts to public health and safety including fire fighting.
Financial Considerations	Financial costs incurred by the option. • Estimated capital cost. • Estimated operation & maintenance costs.

Table 7: Detailed Evaluation of Alternative Solutions

Option:	#1	#2	#3	#4
Phase 1:	**Do Nothing / Status Quo**	**Build New Standpipe with 1800 m^3 of Useable Volume at 119 McKenzie Street (Location 1); Decommission Existing Tower**	**Build New Standpipe with 2900 m^3 of Useable Volume at 119 McKenzie Street (Location 1); Decommission Existing Tower**	**Build New Standpipe with 1800 m^3 of Useable Volume at 71 Davidson Street (Location 2); Decommission Existing Tower**
Phase 2:		**Add 1620 m^3 At-Grade Reservoir and Booster Pump Station at Well #4 (Location 4)**	**Add 600 m^3 At-Grade Reservoir and Booster Pump Station at Well #4 (Location 4)**	**Add 1620 m^3 At-Grade Reservoir and Booster Pump Station at Well #4 (Location 4)**
Natural Environment	• No impact on natural areas, terrestrial ecosystems, and wetlands. • No construction and operational impact. • No effect on ground and/or surface water.	• 119 McKenzie St. is mostly developed and manicured space. Tree clearing may be required in the south parcel. Well #4 is a developed and manicured space, therefore a reservoir at this location will not increase impacts. • Construction and operations are not anticipated to have a significant negative impact on aquatic and terrestrial species & habitat within 119 McKenzie St. • 119 McKenzie St. is located outside of the WHPA therefore, no threat is expected. • Well #4 is located within WHPA A. However, no threat is expected from an at-grade reservoir and booster pump station. • Minor provisions required for fuel storage on site for future backup generator.	• 119 McKenzie St. is mostly developed and manicured space. Tree clearing may be required in the south parcel. Location 4 is a developed and manicured space, therefore a reservoir at this location will not increase impacts. • Construction and operations are not anticipated to have a significant negative impact on aquatic and terrestrial species & habitat within 119 McKenzie St. • 119 McKenzie St. is located outside of the WHPA therefore, no threat is expected. • Well #4 is located within WHPA A. However, no threat is expected from an at-grade reservoir and booster pump station. • Minor provisions required for fuel storage on site for future backup generator.	• 71 Davidson St. is unmanicured with trees, debris, and vegetation. Location 2 is anticipated to have low risk of SAR and ESR species. Due to the amount of tree clearing and site preparation required, Option 4 will have the greatest impact to the terrestrial environment. • There is a potential for wetland species near 71 Davidson St. which may be affected by new construction. • Well #4 is a developed and manicured space, therefore a reservoir at this location will not increase impacts. • Both locations are located within WHPA A and E, respectively. No threat is expected from an at-grade reservoir, booster pump station and standpipe. Minor provisions required for fuel storage on both sites for future backup generator.
Evaluation	**Preferred**	**Less Preferred**	**Less Preferred**	**Least Preferred**
Climate Change Impacts	• No infrastructure to be impacted by climate change. However, not enough water storage available to mitigate climate change impacts on the community such as floods, drought, and fires. • Does not produce greenhouse gases or impact carbon sinks. • Endangers the resiliency and security of Madoc due to inadequate water storage for fire protection.	• Some GHG production from pump and other power usage. • Improves water system resiliency with additional storage.	• Some GHG production from pump and other power usage. • Improves water system resiliency with additional storage.	• Some GHG production from pump and other power usage. • Improves water system resiliency with additional storage.
Evaluation	**Least Preferred**	**Preferred**	**Preferred**	**Preferred**
Social, Cultural and Heritage Environment	• Madoc residents negatively impacted due to lack of water storage. • Land use planning negatively impacted due to inability to support future growth. • No impact on Indigenous communities, visual aesthetic, noise and vibration. • No change in location and therefore no impact to local archaeological, cultural, and heritage resources.	• Madoc residents positively impacted due to available storage. • Land-use planning positively impacted by ability to increase required storage in unison with community growth, starting in the mid-term or when standpipe volume is exceeded. • Potential noise and vibration disruption during construction for residents in nearby residential areas. • Both sites were not within area of archaeological potential identified through	• Madoc residents positively impacted due to available storage. • Land-use planning positively impacted by ability to increase required storage in unison with community growth, starting in the long-term or when standpipe volume is exceeded. • Potential noise and vibration disruption during construction for residents in nearby residential areas.	• Madoc residents positively impacted due to available storage. • Land-use planning positively impacted by ability to increase required storage in unison with community growth, starting in the mid-term or when standpipe volume is exceeded. • Potential noise and vibration disruption during construction for residents in nearby residential areas.

Option:	#1	#2	#3	#4
Phase 1:	Do Nothing / Status Quo	Build New Standpipe with 1800 m^3 of Useable Volume at 119 McKenzie Street (Location 1); Decommission Existing Tower	Build New Standpipe with 2900 m^3 of Useable Volume at 119 McKenzie Street (Location 1); Decommission Existing Tower	Build New Standpipe with 1800 m^3 of Useable Volume at 71 Davidson Street (Location 2); Decommission Existing Tower
Phase 2:		Add 1620 m^3 At-Grade Reservoir and Booster Pump Station at Well #4 (Location 4)	Add 600 m^3 At-Grade Reservoir and Booster Pump Station at Well #4 (Location 4)	Add 1620 m^3 At-Grade Reservoir and Booster Pump Station at Well #4 (Location 4)
		correspondence with MCM (Section 4.3.3). Both sites have been disturbed due to developments. Both sites have no impact to built heritage resources and cultural heritage landscapes. • Visual impact of above-ground reservoir within residential area and future residential development area. • Relatively minor change to visual impact of new standpipe at McKenzie St. • South parcel is not municipally owned land. • No anticipated impact on indigenous communities, lands, and/or way of life.	• Visual impact of above-ground reservoir within residential area and future residential development area. • Relatively minor change to visual impact of new standpipe at 119 McKenzie St. • South parcel is not municipally owned land. • Both sites were not within area of archaeological potential identified through correspondence with MCM (Section 4.3.3). Both sites have been disturbed due to developments. Both sites have no impact to built heritage resources and cultural heritage landscapes. • No anticipated impact on indigenous communities, lands, and/or way of life.	• Visual impact of above-ground reservoir within residential area and future residential development area. • Greater visual impact of standpipe at a new location within a residential area. • Both locations are owned by the Municipality. • Both areas are not within the area of archaeological potential noted by MCM. Location 2 Is undeveloped, therefore there is potential impact to built heritage resources and cultural heritage landscapes. • No anticipated impact on indigenous communities, lands, and/or way of life.
Evaluation	**Least Preferred**	**Preferred**	**Preferred**	**Less Preferred**
Technical Feasibility	• Unable to service future development. • Rehabilitation of existing elevated storage required. • No additional construction, operation, or maintenance required. • Negative impacts to public health and safety including fire fighting and water quality.	• Supports existing and future development. • Additional storage supports public health and safety, including firefighting capacity. • Standpipe is sized according to mid-term demand, which allows standpipe treated water turnover every 6-days, during the short-term, and every 4-days, during the mid-term. A turnover rate of 3 to 5 days is generally recommended to maintain water quality. • Close to existing watermain infrastructure.	• Supports existing and future development. • Additional storage supports public health and safety, including firefighting capacity. • Standpipe is sized according to long-term demand, which allows standpipe treated water turnover every 7-days, during the short-term, and every 5-days, during the mid-term. This has a greater negative impact on water quality. • A smaller additional reservoir is required compared to Option #2 and #4. • Close to existing watermain infrastructure.	• Option #4 can be phased to grow in unison with community water demand starting in the long-term, when the available standpipe volume is exceeded. • The Standpipe is sized according to mid-term growth but requires a higher water column due to the lower site elevation at 71 Davidson St. The turnover rate for this option is anticipated to be every 7-days, during the short-term, and every 5-days, during the mid-term. This has a greater negative impact on water quality. • Close to existing watermain infrastructure.
Evaluation	**Least Preferred**	**Preferred**	**Less Preferred**	**Least Preferred**
Financial Considerations	• No additional maintenance costs associated with this option. • Costs may be incurred from failure to supply system with adequate water, such as by trucking in water for firefighting.	• Phase approached can be implemented. • Mid-term (Phase 1) cost to build standpipe is estimated to have the lowest initial capital cost. • Long-term (Phase 2) cost to build reservoir is estimated to have the moderate capital cost. • Lowest total estimate out of screened options. • Similar operational costs as Option #3 and #4.	• Mid-term (Phase 1) cost to build standpipe is estimated to have the moderate initial capital cost. • Long-term (Phase 2) cost to build reservoir is estimated to have the lowest capital cost. • Similar operational costs as Option #2 and #4.	• Mid-term (Phase 1) cost to build standpipe is estimated to have the highest initial cost. • Long-term (Phase 2) cost to build reservoir is estimated to have the highest cost. • Highest overall total capital cost out of screened options. • Similar operational costs as Option #2 and #3.
Evaluation	**Less Preferred**	**Preferred**	**Less Preferred**	**Least Preferred**
Overall Evaluation	**Least Preferred**	**Preferred**	**Less Preferred**	**Least Preferred**

4.0 Preferred Solution

4.1 Project Overview

The preferred solution as determined through the detailed evaluation summarized in Table 7 is **Option #2: Decommission Existing Elevated Water Tower, Build a 1,800 m^3 Usable Volume Standpipe South of the Existing Water Tower Site and Construct 1,620 m^3 At-Grade Reservoir and Booster Station at Well #4.**

A preliminary site layout for Phase 1 and Phase 2 are shown in Figure 7 and Figure 8, respectively. The proposed phased approach involves construction of two separate water storage facilities Madoc to support future growth in two phases, including:

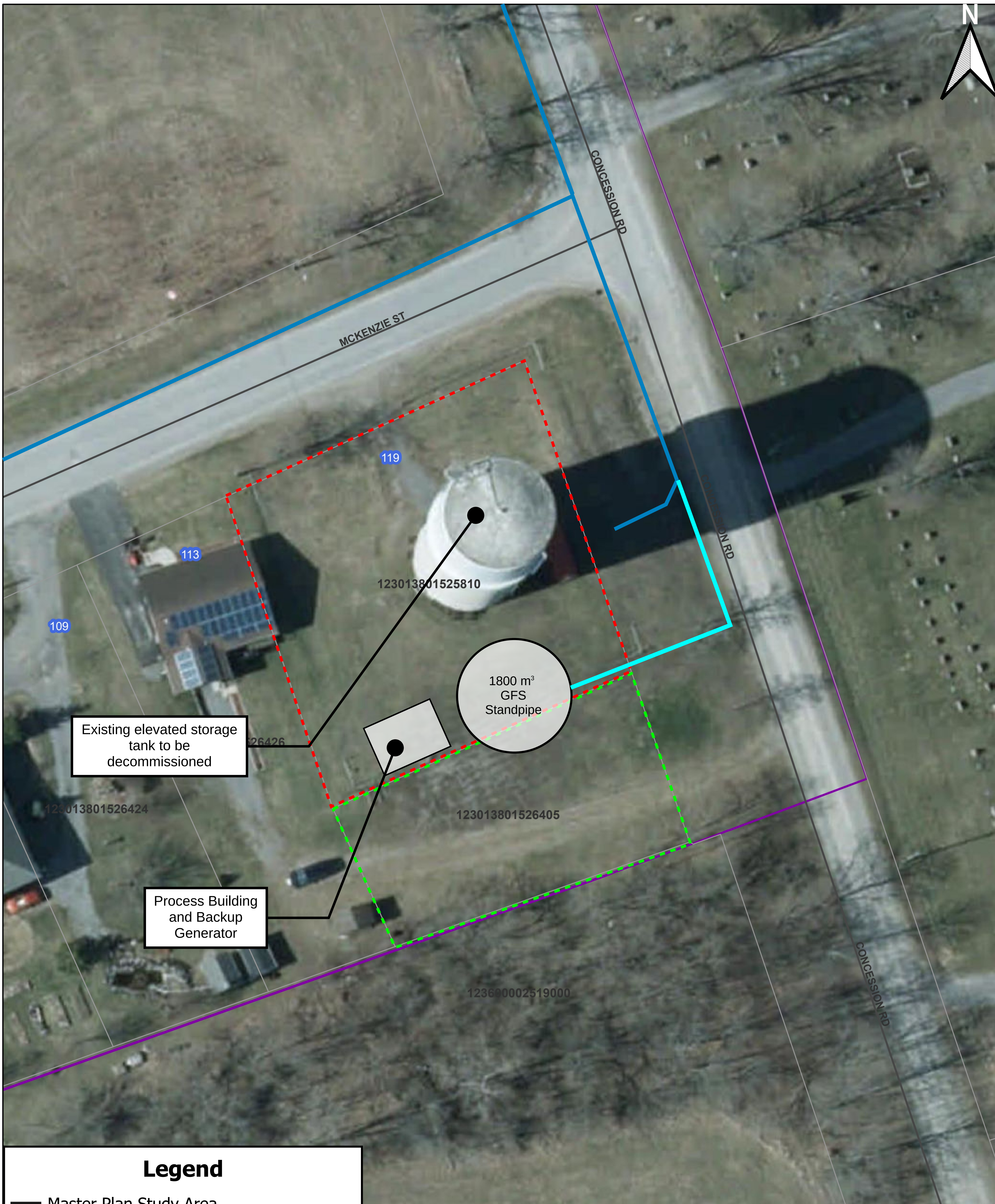
- Phase 1 – To Support Mid-Term Growth:
  - Construction of a glass-fused-to-steel standpipe on the land parcel immediately south of the existing elevated water storage tower. Land needs to be acquired for this option.
  - A summary of physical characteristics of the proposed standpipe and reservoir are summarized in Table 8.
  - Installation of a mixing system should be considered during design to mitigate water quality and freezing concerns.
  - The existing elevated storage will be decommissioned once the new standpipe is on-line.
  - Implementation of a standby generator to supply backup power to site utility functions.
  - Construction of a new building to house electrical and mechanical equipment.
  - Phase 1 construction activities will also include potential dewatering, general site works (site fencing, excavation, yard piping, site preparation), and new watermain section.
  - The proposed new standpipe will add significantly more volume to the system. The daily water turnover of the new water storage standpipe will need to be carefully considered during detailed design and operation of the system to avoid water quality issues. The recommended water turnover by US EPA is between 3 to 5 days at the starting point.
  - System-wide electrical, instrumentation and control upgrades.

- Phase 2 – To Support Long-Term Growth:
  - Design and construction of a new at-grade reservoir coupled with booster pump station at Well #4 is anticipated to commence in 2034, based on developments anticipated at the beginning of the long-term.
  - The at-grade reservoir is anticipated to be constructed of glass-fused-to-steel coupled with a mixing system.
  - Implementation of a standby generator to supply backup power to Well #4 and booster pump station.
  - Phase 2 construction activities will also include dewatering, general site works (concrete works, earthworks, site fencing), and new watermain section.

Table 8: Proposed Tank Characteristics

Tank Characteristics	Value	
Facility Type	Standpipe (McKenzie Street)	At-Grade Reservoir c/w Booster Pumping (Well #4)
Usable / Available Storage (m^3)	1,800	1,620
Grade Elevation (m)	183.7	173
Low Water Elevation (m)	200.4	-
Low Water Level (1) (m)	200.4	-
High Water Level (m)	213.4	180.7
Freeboard Depth (m)	1.0	0.3
Approx. Total Tank Height (m)	31	8
Approx. Internal Diameter (m)	13	16
Proposed Construction Start Year	2024	2034

(1) Minimum water level in the facility required to yield a minimum pressure of 20 psi in the watermain system.



Legend

- Master Plan Study Area
- Existing Watermain
- Proposed Watermain
- Property Lines

Location 1

- 119 McKenzie Street (Owned by Municipality)
- South Parcel - Roll No. 123013801526405 (Proposed Property Acquisition)

1:564

0 0 0.01 0.02 mi

0 0.01 0.01 0.02 km

Hastings County GIS

Information purposes only and may not be suitable for legal, engineering, or surveying purposes. The County of Hastings disclaims all responsibility for errors, omissions or inaccuracies in this publication. Data supplied

PROJECT:
SCHEDULE B MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT FOR A NEW TREATED WATER STORAGE FACILITY IN MADOC
Madoc, ON

DRAWING:
Location 1 - 119 McKenzie Street and South Parcel

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS

DESIGN:		JLR NO:	32508-000
DRAWN:	RC	DRAWING NO:	**Figure 7**
CHECKED:	SJS		

PROJECT:
SCHEDULE B MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT FOR A NEW TREATED WATER STORAGE FACILITY IN MADOC
Madoc, ON

DRAWING:
Proposed New At-Grade Reservoir (Phase 2) at Well #4

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS

DESIGN:		JLR NO:	32508-000
DRAWN:	RC	DRAWING NO:	**Figure 8**
CHECKED:	SJS		

4.2 Opinion of Probable Costs

Table 9 summarizes the Opinion of Probable Costs for the proposed upgrades as outlined previously. It shall be noted that the Opinion of Probable Costs (OPC) were completed using **2024** dollars value. An OPC with a Class 'D' (Indicative Estimate) level of accuracy was developed for each alternative solution and includes allowances for design elements that have not fully been developed. Class 'D' OPCs developed for this assignment are expected to be within +/- 30%. The OPCs were developed based on past experience on similar projects, professional judgment, and equipment costs provided by suppliers. Design completed as part of this Master Plan is conceptual in nature for the purpose of obtaining Class 'D' cost estimates. All design parameters should be confirmed during the upcoming Class EA and detailed design. Any provided estimate of costs or budget is an OPC that is based on historic construction data and does not include labour, material, equipment, manufacturing, supply, transportation or any other cost impacts in relation to COVID-19. JLR shall not be responsible for any variation in the estimate caused by the foregoing factors but will notify the Municipality of any conditions which JLR believes may cause such variation upon delivery of the estimate.

Table 9: Opinion of Probable Costs

Item	Phase 1 (2024)	Phase 2 (2034)
Design and Construction of New Water Storage Facility	$7,300,000	$4,400,000
Project Total (+/- 30%) Including Contingency and Engineering Excluding property acquisition costs	**$11,700,000**	

4.3 Considerations and Mitigation Measures

4.3.1 Natural Heritage

The desktop study determined that Location 1: 119 McKenzie St. has no significant woodlands, wildlife habitat and fisheries within the site or within 120 m of the site. Endangered Species Act (ESA) and Species at Risk Act (SAR) designated species have low risk of occurring at Location 1. A field survey will confirm presence of SAR and ESA species, such as the little brown myotis, red-headed woodpecker, and butternut.

If vegetation needs to be cleared on the site, it should occur outside the breeding bird season of April 1 to August 31. If clearing or construction must occur during this period, "vegetation should be investigated by a qualified biologist to confirm if any active nests are present, prior to site alteration." Vegetation clearing can proceed if there are no active nests. Active nests must be left undisturbed "until young have fledged or the nest is determined to be inactive.

Natural Heritage constraints for Location 4: Well #4 was reviewed in a Schedule 'C' Class EA the construction of Well #4 completed by Greer Galloway in 2019. The Schedule 'C' Class EA included a desktop investigation which found that there were no anticipated impacts to watercourses and fisheries as a result of constructing Well #4. Similarly, it is anticipated that construction of an at-grade reservoir has no anticipated impacts to watercourses and fisheries. A site assessment was recommended by the MECP to verify the presence of SAR.

The only potential constraints identified during this desktop screening is nesting habitat for migratory birds and potential habitat for SAR. Migratory birds can be mitigated through timing work to avoid their nesting period. There is potential for nesting and maternity roost habitat for red-headed woodpecker and little brown myotis within the threes of the sites. A preliminary site review will be required for the location selected during preliminary design to confirm the presence of SAR at each site.

Refer to the report prepared by Cambium in Appendix B for further details.

4.3.2 Source Water Protection

The Wellhead Protection Areas (WHPAs) in Madoc were identified in the Natural Environmental Constraints in Figure 10 of the Phase 1 Master Plan. The parcel selected for construction of the reservoir is within the WHPA-A zone of Madoc's Well #4.

Constructing a new above-grade water storage is not a Prescribed Drinking Water Threat activity under O.Reg 287/07 Clean Water Act, 2006 However, the handling and storage of fuel is a Prescribed Drinking Water Threat, and this activity may be needed to power the reservoir or booster pumping station. This is one of the most common drinking water threats within this zone.

The Quinte Region's Source Protection Plan dictates that a monitoring policy, reported to the Quinte Conservation Authority on February 1st of each year, is required for the storage of more than 250 L of liquid fuel in WHPA-A zones within Madoc. At minimum, a leak detection device and double bottom or double wall tank is required for at or above grade fuel storage. The storage of more than 2,500 L of liquid fuel is prohibited. Design of the fuel storage shall meet the Source Water Protection Plan. Further consultation with Quinte Conservation should be undertaken during design and permitting process.

4.3.3 Cultural Heritage and Archaeology

The Ministry of Citizenship and Multiculturalism (MCM) requires the screening of the project to determine whether an archaeological assessment is needed. MCM confirmed that Location 1 and Location 4 do not include any reported archaeological sites. Forms 0500e and 0478e were completed as an initial archaeological screening and are included in Appendix D. It was found that an archaeological assessment is not required as the proposed project areas have been disturbed in 1980 for construction of the elevated water storage and in 2019 for construction of Well #4.

5.0 Environmental Impacts and Mitigation Measures

Table 10 provides a summary of environmental impacts and mitigation measures.

Table 10: Summary of Environmental Impacts and Mitigation Measures

Impact	Mitigation Measure
The Environment	
Source Water Protection	Vulnerable areas, where drinking water sources are most at risk, were reviewed within the study area. These areas have been depicted in Figure 10 in the Phase 1 Master Plan Report. At this time there are two existing groundwater wells within the study area. Well #3, located on Rollins Street, has a maximum daily rated capacity of 1,150 m^3/day and includes filtration and disinfection. Well #4 located on Marmora Street, has a maximum daily rated capacity of 1,470 m^3/day and includes an ion-exchange arsenic removal system in addition to filtration and disinfection. Both wells are defined as groundwater under the direct influence of surface water (GUDI). The recommended projects and studies resulting from completion of this Master Plan are intended to improve the performance and reliability of the drinking water systems in the 20-years planning horizon. The proposed standpipe and at-grade reservoirs have been mapped in relation to Madoc's wellhead protection areas. The proposed standpipe location (119 McKenzie Street) is not located within Madoc's wellhead protection area, therefore development and construction activities are not anticipated to have any impact to source water. The proposed at-grade reservoir is located adjacent to Well #4 (Marmora Street) and located within WHPA A. It is also noted that the activity of constructing a new at-grade reservoir is not a Prescribe Drinking Water Threats activity. The location of the proposed projects in relation to the WHPAs are shown in Figure 9.
Climate Change	Climate change mitigation measures reduce the project's impacts on climate change, such as greenhouse gas (GHG) emissions and changes to the landscape that negatively affect its carbon sequestration and storage capacity. The project's GHG emissions can be categorized as operating carbon (emitted during the operation phase) and embodied carbon (emitted during the manufacturing and construction phase). Operating carbon consists of direct emissions from combustion of fossil fuels on site while indirect emissions are from consuming energy (ex. electricity) that was generated from off-site combustion of fossil fuels. The operating carbon of the Madoc Treated Water System can be reduced through energy efficiency measures, fuel switching and on-site renewable energy generation, and adjustments in

	specifications for materials can enable major reductions in embodied carbon as the infrastructure is upgraded. Climate change adaptation refers to the impact of climate change on a project, i.e., the resilience or vulnerability of infrastructure to changing climatic conditions. Impacts of climate change on municipal water and wastewater projects include property-specific concerns such as flooding and system-wide impacts on water demand and electricity consumption. The recommended additional storage will promote Municipality's climate adaptation. Future expansions on storage facilities should evaluate the water demand and fire requirements based on local drivers, rather than meeting the minimum of standard practices. This will ensure the availability of treated water storage for climate events. Refer to the Climate Change Technical Memorandum in Appendix A of the Phase 2 Master Plan.
Contaminated Sites	Additional studies to identify waste disposal sites, contaminated sites and underground storage tanks and excess material management may be required during project design. However, there is low risk for the proposed two sites.
Ecosystem Protection and Restoration	In general, any construction activities that may impact ecosystem form and function must be avoided where possible. Existing natural environmental features within the Master Plan study area are detailed in the Phase 1 Report and depicted in Figure 10. There are no ecosystem features of note within or located near the study area and the recommended long-term strategy will not propose risk posed to the immediate surrounding areas of the current water facilities.
Species at Risk	It is recommended that site investigations to confirm the presence of SAR at 119 McKenzie Street should be done during the design process. Construction activities can be maintained within the existing site boundary or right-of-way to minimize disruption to wildlife habitat; work can be staged to avoid spawning and breeding periods. The proponent/ consultant retained to complete the design should review the "Client's Guide to Preliminary Screening for Species at Risk" (MECP, May 2019) and Cambium's Natural Heritage Report in Appendix B.
Surface Water	Known surface waters within the Master Plan study area include the the Deer Creek that runs through the Municipality of Centre Hastings. Details on the location of surface waters and other

	existing natural environmental features have been detailed in the Phase 1 Report and depicted in Figure 10. Measures should be included in the planning and design process to ensure that any impacts to watercourses from construction or operational activities (e.g., spills, erosion, pollution) are mitigated as part of the proposed undertakings. For instance, a stormwater management plan should be developed during the design and implementation stage and sedimentation and erosion control should be implemented during construction.
Groundwater	There are areas designated groundwater recharge and groundwater quality vulnerability within the Municipality. These areas have been depicted in Figure 10 in the Phase 1 Master Plan Report. There are two existing groundwater wells within the study area. Well #3, located on Rollins Street, has a maximum daily rated capacity of 1,150 m^3/day and includes filtration and disinfection. Well #4 located on Marmora Street, has a maximum daily rated capacity of 1,470 m^3/day and includes an ion-exchange arsenic removal system in addition to filtration and disinfection. Both wells are defined as groundwater under the direct influence of surface water (GUDI). The construction and operation of the proposed standpipe and at-grade reservoir are not Presecribe Drinking Water Threats. Therefore, there are no anticipated impacts to groundwater.
Construction Strategy and Site Management	
Excess Material Management	Projects activities involving the management of excess soil should be completed in accordance with O. Reg. 406/19 and the MECP's current guidance document titled "Management of Excess Soil – A Guide for Best Management Practices" (2014). All waste generated during construction must be disposed of in accordance with Ministry requirements.
Air Quality, Dust and Noise	Increased dust and noise can be anticipated from the various construction works of the proposed projects. Dust and noise control mitigation measures (ex. the MECP recommends non-chloride dust-suppressants) should be addressed and included in the construction plans to ensure that nearby residential and other sensitive land uses within the projects area are not adversely affected during construction activities.
Servicing, Utilities and Facilities	In consultation with Hydro One, it was noted that there are existing distribution assets within the urban boundary of Madoc. There is no Ministry of Transportation (MTO) infrastructure adjacent to or within the proposed sites.

Mitigation and Monitoring	Design and construction reports/plans for the proposed projects should be based on a best management approach that centres on the prevention of impacts, protection of the existing environment, and opportunities for rehabilitation and enhancement of any impacted areas. A list of proposed mitigation and monitoring measures should be developed during detailed design of both projects.
Permits and Approvals	The projects identified in this Schedule B EA may require specific permits and approvals; these include, but may not necessarily be limited to: • Environmental Activity and Sector Registry (EASR) • Conservation authority permits • Species at risk permits • MTO permits • Building Permit • Site Plan Approval • Approvals under the Impact Assessment Act, 2019. The proponent / consultant retained to complete the proposed projects should obtain the required permits/approvals.
Cultural Heritage Resources	
Disturbance or destruction of archaeological resources Displacement of known and/or potential built heritage resources and/or cultural heritage landscapes by removal and/or demolition and/or disruption	• Undertake archaeological assessment(s) to identify and evaluate resources. All archaeological assessment work must be carried out by licensed archaeologists. • Identify and evaluate Built Heritage Resources and Cultural Heritage Landscapes. • Avoidance, through alternative route selection. • Demolition shall be considered a last resort. • Refer to Section 4.3.3.

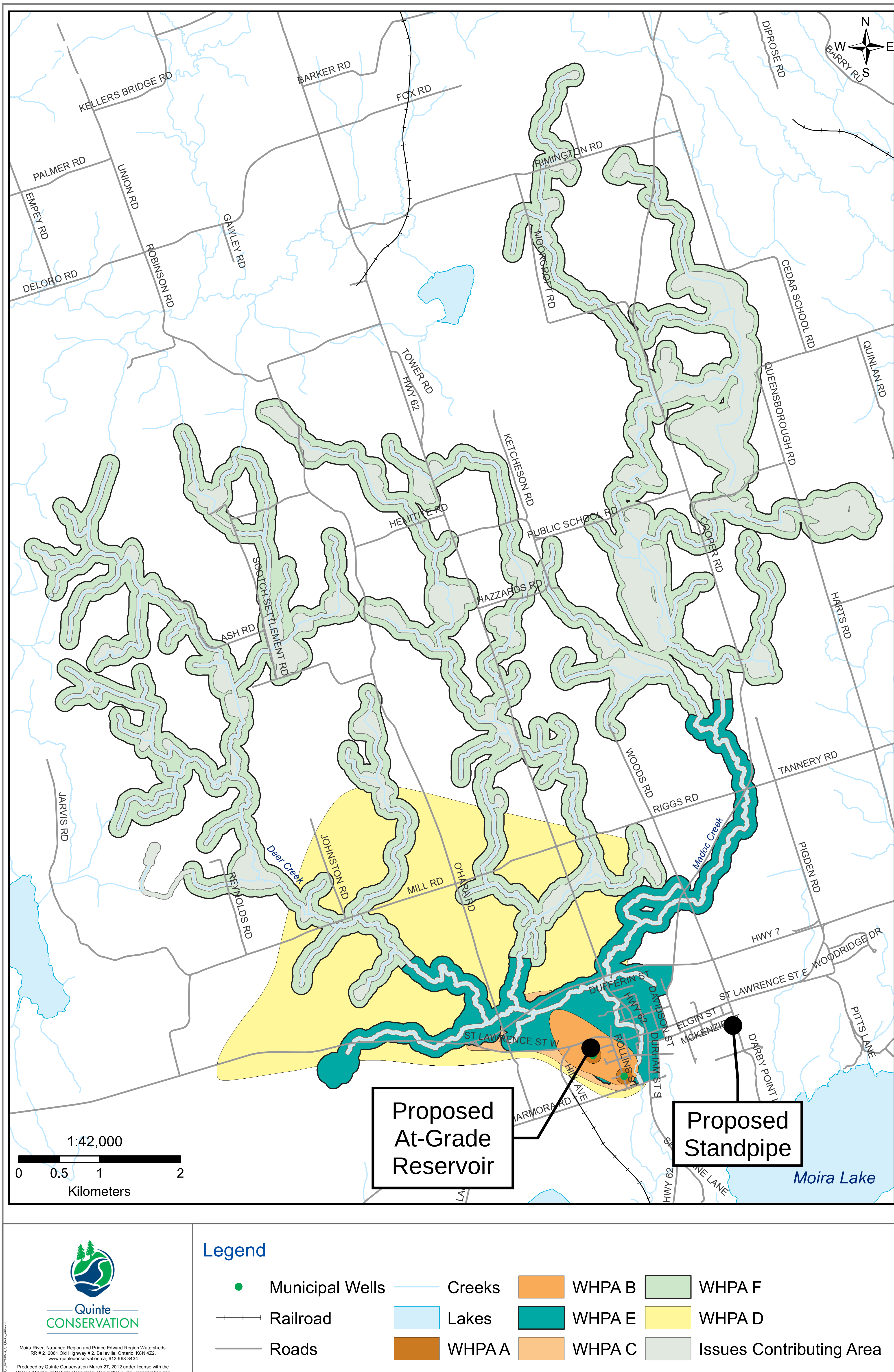


Figure 9: Madoc Wellhead Protection Area

6.0 Public and Agency Consultation

Effective consultation is key to successful environmental assessment planning. Through an effective consultation program, the proponent can generate meaningful dialogue between project planners and stakeholders, including, but not limited to, the public, stakeholder agencies and interest groups. Refer to Appendix E for documented consultation activities for this Schedule 'B' EA. Refer to Appendix

At the beginning of this Master Planning process, a Public Consultation Plan was developed and subsequently a Notice of Project Initiation was published in the local newspaper, on the Town's website and distributed to potential stakeholders. A project mailing list was developed identifying stakeholders, and list was updated throughout the process to reflect any changes.

Table 11 provides a summary for the comments from Review Agency and Developer regarding this Schedule 'B' EA. Refer to Appendix E for a copy of written correspondence from these groups.

Table 11: Review Agency and Developer Comments

Agency/Developer	Comment	Action
Ministry of Citizenship and Multiculturalism (MCM)	2024-05-17 – JLR announced the notice of Public Info Centre #2 which was about this Schedule B Class EA. 2024-06-20 – MCM responded with the following: 1. Archaeological Resources This EA project may impact archaeological resources and should be screened using the Ministry's Criteria for Evaluating Archaeological Potential to determine if an archaeological assessment is needed. MCM archaeological sites data are available at archaeology@ontario.ca. If the EA project area exhibits archaeological potential, then an archaeological assessment (AA) shall be undertaken by an archaeologist licenced under the Ontario Heritage Act (OHA), who is responsible for submitting the report directly to MCM for review.	1. Archaeological Resources MCM Form 478e – Criteria for Evaluating Archaeological Potential has been completed for and is included in Appendix D. Archaeological assessment is not needed for this case. 2. Built Heritage Resources and Cultural Heritage Landscapes MCM Form 500e – Criteria for Evaluating Potential for Build Heritage Resources and Cultural Heritage Landscapes has been completed and is included in Appendix D. A Cultural Heritage Evaluation Report is not needed for this case.

Agency/Developer	Comment	Action
	2. Built Heritage Resources and Cultural Heritage Landscapes The Ministry's Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes should be completed to help determine whether this EA project may impact known or potential built heritage resources and/or cultural heritage landscapes. If there is potential for built heritage resources and/or cultural heritage landscapes on the property or within the project area, a Cultural Heritage Evaluation Report (CHER) should be undertaken by a qualified person to determine the cultural heritage value or interest of the property (or project area). If the property (or project area) is determined to be of cultural heritage value or interest and alterations or development is proposed, MCM recommends that a Heritage Impact Assessment (HIA), prepared by a qualified consultant, be completed to assess potential project impacts. Please send the HIA to MCM for review and comment and make it available to local organizations or individuals who have expressed interest in review. Community input should be sought to identify locally recognized and potential cultural heritage resources. Sources include, but are not limited to, municipal heritage committees, historical societies, and other local heritage organizations. In addition, cultural heritage resources are often of critical importance to Indigenous communities.	

Agency/Developer	Comment	Action
	Indigenous communities may have knowledge that can contribute to the identification of cultural heritage resources, and we suggest that any engagement with Indigenous communities includes a discussion about known or potential cultural heritage resources that are of value to them.	

7.0 Limitations

This report has been prepared by J.L. Richards & Associates Limited for the Municipality's exclusive use. Its discussions and conclusions are summary in nature and cannot properly be 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 is based on information, drawings, data, or reports provided by the named client, its agents, and certain other suppliers or third parties, as applicable, and relies upon the accuracy and completeness of such information. Any inaccuracy or omissions in information provided, or changes to applications, designs, or materials may have a significant impact on the accuracy, reliability, findings, or conclusions of this report.

This report was prepared for the sole benefit and use of the named client and may not be used or relied on by any other party without the express written consent of J.L. Richards & Associates Limited, and anyone intending to rely upon this report is advised to contact J.L. Richards & Associates Limited in order to obtain permission and to ensure that the report is suitable for their purpose.

J.L. RICHARDS & ASSOCIATES LIMITED

Prepared by:

Regine Climaco, P.Eng.
Civil Engineer

Reviewed by:

Susan Jingmiao Shi, P.Eng., M.Eng.
Associate; Senior Environmental Engineer
Practice Lead, Regional Market

Appendix A

Madoc Elevated Tank Video Inspection (Authorized Inspection Services Inc., 2019)

Appendix B

Desktop Natural Heritage Review (Cambium, 2024)

Appendix C

MECP Location #4 Environmental Screening

Appendix D

Archaeological Assessment Forms

Appendix E

Consultation Documents

BEST MANAGED COMPANIES CANADA | Platinum member

www.jlrichards.ca

Ottawa

343 Preston Street
Tower II, Suite 1000
Ottawa ON Canada
K1S 1N4
Tel: 613 728-3571
ottawa@jlrichards.ca

Kingston

203-863 Princess Street
Kingston ON Canada
K7L 5N4
Tel: 613 544-1424

kingston@jlrichards.ca

Sudbury

314 Countryside Drive
Sudbury ON Canada
P3E 6G2
Tel: 705 522-8174

sudbury@jlrichards.ca

Timmins

834 Mountjoy Street S
Timmins ON Canada
P4N 7C5
Tel: 705 360-1899

timmins@jlrichards.ca

North Bay

501-555 Oak Street E
North Bay ON Canada
P1B 8E3
Tel: 705 495-7597

northbay@jlrichards.ca

Hawkesbury

326 Bertha Street
Hawkesbury ON Canada
K6A 2A8
Tel: 613 632-0287

hawkesbury@jlrichards.ca

Guelph

107-450 Speedvale Ave. West
Guelph ON Canada
N1H 7Y6
Tel: 519 763-0713

guelph@jlrichards.ca

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS