Mount Albert Water Supply Upgrades Class Environmental Assessment

Project File

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Regional Municipality of York

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Executive Summary

The Regional Municipality of York (York Region) initiated the Mount Albert Water Supply Upgrades Class Environmental Assessment (EA) process to identify means to mitigate aesthetic water quality issues and to meet or exceed potential changes in drinking water regulations and standards. The Region retained CH2M HILL Canada Limited, now a wholly owned subsidiary of Jacobs Engineering Group Inc. (Jacobs), to complete this Class EA study.

The Mount Albert groundwater supply contains elevated levels of naturally occurring iron and manganese, which are currently controlled by sequestration through sodium silicate addition. The distribution system has reported water quality issues, such as solids deposition and discoloured water. To determine the preferred solution to upgrade the Mount Albert Water Supply System, this Class EA study has examined feasible options to address the aesthetic water quality issues while improving the system redundancy and reliability.

The Notice of Study Commencement was issued on July 4, 2019 to announce the commencement of the EA and to briefly describe the study. Phase 1 of the Class EA study established the Problem/Opportunity Statement (Jacobs, 2020d):

> *"Mount Albert is currently supplied solely by groundwater that contains elevated levels of naturally-occurring iron and manganese above the aesthetic objectives. The current practice of sequestration does not provide effective control of these constituents, as evidenced by significant particulate deposition throughout the distribution system and frequent customer complaints associated with discoloured water. Additionally, the Mount Albert North Elevated Tank cannot be taken out of service for any prolonged period without creating significant constraints for the operation of the system. Optimization of existing water infrastructure can improve these issues but may not provide a complete resolution. To mitigate aesthetic water quality issues and comply with future manganese regulation, a preferred solution to upgrade the Mount Albert Water Supply System that is socially, environmentally and financially sustainable will be identified, with consideration given to treatment methodologies and improvement of overall system redundancy and reliability."*

Phase 2 involved the development of alternative solutions to address the problem or opportunity, considering the existing environment, as well as public and review agency input, to establish the preferred solution. As part of the EA process, comprehensive lists of potential alternative solutions were identified. Of the nine alternative solutions identified to improve the water quality, four were carried forward into subsequent phases of the Class EA study. Of the four alternative solutions, to improve storage maintenance, two were again carried forward into subsequent Class EA phases. A number of supporting investigations and comprehensive studies were completed as part of this Class EA study, and their key findings, conclusions, and recommendations were used as the foundation to establish the Problem/Opportunity Statement and to develop the alternative solutions.

The first Public Consultation Centre (PCC) for this Class EA took place online from July 2 to July 15, 2020. The purpose of this PCC was to provide a project update to the community, including details on the development of the Problem Statement and to seek feedback on the evaluation framework to be used for alternative solutions.

The alternative solutions were evaluated based on their technical considerations, potential impacts on the natural environment, potential impacts on the social-cultural environment, and overall lifecycle costs. The following alternative solutions provided the greatest benefit with the fewest impacts:

- Provide iron and manganese centralized removal technology for all wells at the Wells 1 and 2 Facility with process residuals discharged to sanitary sewer collection system to improve water quality in the Mount Albert Water Supply System.
- Develop procedures to operate the distribution system in pressure mode during maintenance of the North Elevated Tank.

The second PCC was held from October 30 to November 13, 2020. The purpose of this PCC was to review the project information and seek feedback on the preliminary preferred alternative solutions.

The Region provided appropriate public notifications and opportunities for comments. First Nations and Métis organizations with potential interest in this project were identified to solicit their input and to address their comments or concerns. Individual meetings were held with review agencies and stakeholders. Comments received during the study have been addressed, and will be considered further during preliminary and detailed design.

The Project File documents the project decisions to meet the requirements of the Ontario Municipal Engineers' Association's Municipal Class Environmental Assessment Schedule B process and the *Environmental Assessment Act*. The preferred alternative solutions resolve the Problem/Opportunity Statement, and the preliminary evaluation of potential impacts indicates minor impacts that can be addressed through typical mitigation measures. The proposed mitigation measures will be developed further during the preliminary and detailed design.

The Project File will be made available for review by the public, review agencies, and other interest groups for a 30-day period. At the completion of the comment period, if there are no outstanding concerns raised by those parties, the Region will complete preliminary and detailed design, including permit and approvals, and proceed with construction, as part of Phase 5- Project Implementation of the preferred solution.

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Appendices (Submitted under separate cover)

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Acronyms and Abbreviations

AA	archaeological assessment
ADD	average day demand
BHR	built heritage resource
CHL	cultural heritage landscape
AO	aesthetic objective
EA	environmental assessment
g/m/year	gram(s) per metre of pipe per year
Jacobs	Jacobs Engineering Group Inc.
km	kilometre(s)
LSCRA	Lake Simcoe Region Conservation Authority
m	metre(s)
m^3	cubic metre(s)
m^3/d	cubic metre(s) per day
MAC	maximum acceptable concentration
MDD	maximum day demand
MECP	Ontario Ministry of the Environment, Conservation and Parks
mg/L	milligram(s) per litre
MHSTCI	Ontario Ministry of Heritage, Sport, Tourism and Culture Industries
MLD	megalitre(s) per second
mm	millimetre(s)
North ET	Mount Albert North Elevated Tank
O. Reg.	Ontario Regulation
ORAC	Oak Ridges Moraine Aquifer Complex
ORMCP	Oak Ridges Moraine Conservation Plan
PCC	public consultation centre
PECP	Public Engagement and Communication Plan
POU	point of contact
SCADA	supervisory control and data acquisition
South ET	Mount Albert South Elevated Tank
SPS	sewage pumping station
TAC	Thorncliffe Aquifer Complex
VFD	variable-frequency drive
WWWMP	Water and Wastewater Master Plan
WPCP	water pollution control plant
WRRF	water resource recovery facility
York Region	Regional Municipality of York

1. Introduction

The Mount Albert community, located within the Town of East Gwillimbury, receives drinking water from groundwater wells owned, operated, and maintained by the Regional Municipality of York (York Region). York Region is also responsible for providing, maintaining, and operating treatment and water storage facilities within this drinking water system. York Region-owned Mount Albert Water Supply infrastructure currently includes three groundwater wells (Wells 1, 2, and 3), two treatment facilities (Wells 1 and 2 Facility and Well 3 Facility), 3.2 kilometres (km) of transmission watermains, and two elevated water storage tanks. The Town of East Gwillimbury owns and operates the local distribution system, which consists of the distribution network of watermains, hydrants, and service connections, as well as the sanitary sewer collection system.

The Mount Albert groundwater supply contains elevated levels of naturally occurring iron and manganese, which are currently controlled by sequestration through sodium silicate addition. The distribution system has reported water quality issues, such as solids deposition and discoloured water. Furthermore, Health Canada recently established two new guideline values for total manganese in drinking water, including a maximum acceptable concentration (MAC) of 0.12 milligrams per litre (mg/L) and a reduction of the aesthetic objective (AO) from 0.05 mg/L to 0.02 mg/L. For this study, it is assumed that the Ontario Ministry of Environment, Conservation and Parks (MECP) will eventually harmonize with these Health Canada Guidelines; however, at this time, MECP has not yet provided a timeline for consideration of potential changes to manganese regulations.

With the goals to mitigate aesthetic water quality issues and to meet or exceed potential changes in drinking water regulations and standards, York Region has engaged CH2M HILL Canada Limited, now a wholly owned subsidiary of Jacobs Engineering Group Inc. (Jacobs), to initiate a Schedule B Class Environmental Assessment (EA) study. The purpose of the study is to determine the preferred solution to upgrade the Mount Albert Water Supply System that is socially, environmentally, and financially sustainable, while considering improvements to system redundancy and reliability.

For this Class EA study, a Study Area was delineated to incorporate the following features:

- Residential and commercial land serviced by the Mount Albert Water Supply System
- Existing water supply infrastructure, including:
  - Well 1, Well 2 and its associated water treatment facility
  - Well 3 and its associated water treatment facility
  - The Mount Albert North Elevated Tank
  - The Mount Albert South Elevated Tank
- Existing Mount Albert Water Resource Recovery Facility (WRRF)

The Study Area is generally bound as follows (Figure 1-1):

- To the west, by Highway 48
- To the east, by York-Durham Line
- To the north, by Doane Road (this was extended to include the WRRF)
- To the south, Herald Road

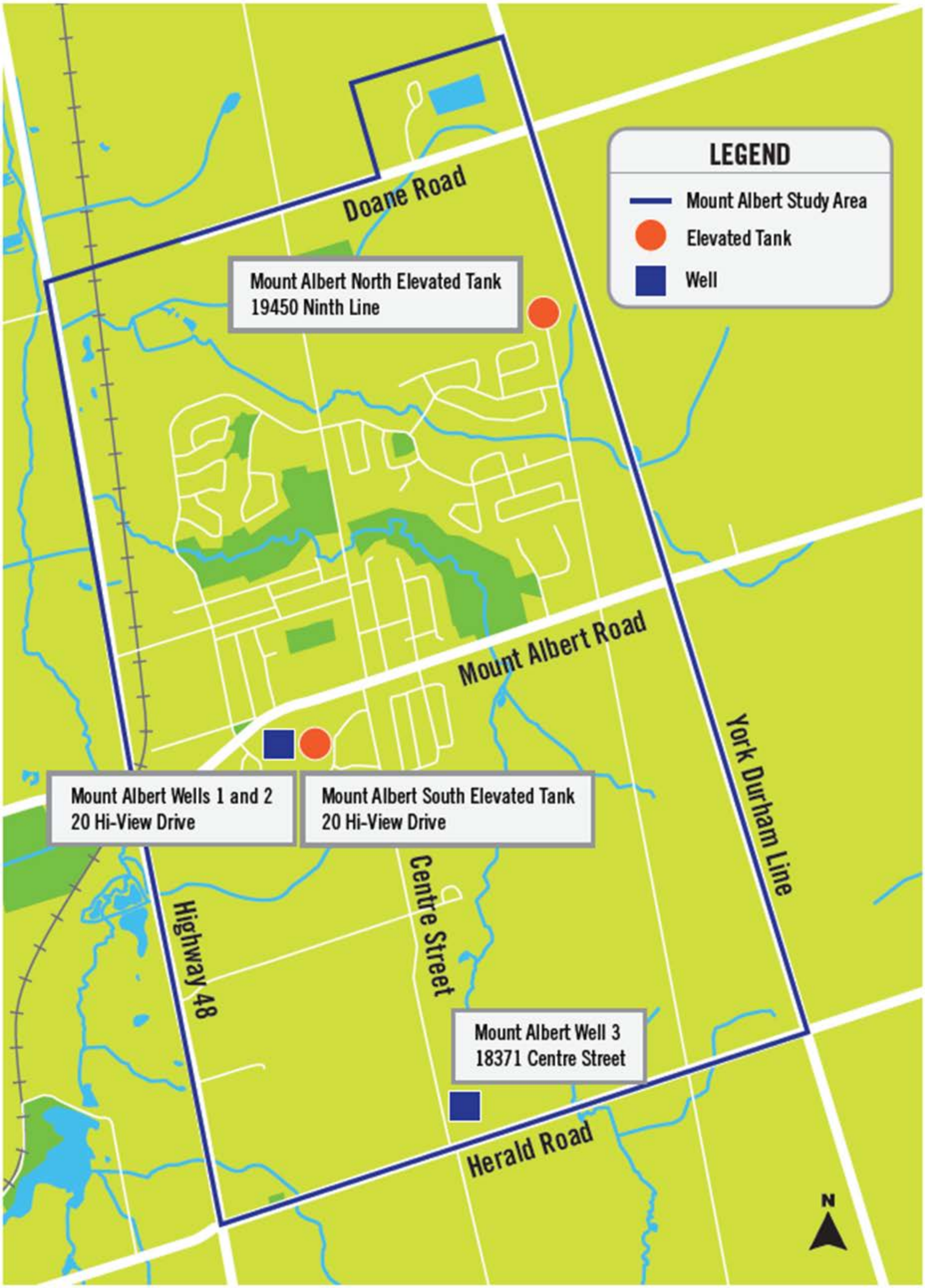

Figure 1-1. Mount Albert Water Supply Upgrades Study Area

1.1 Purpose of Report

Consistent with the requirements of the Class EA process, the purpose of this Project File report is to demonstrate the appropriate steps in Phases 1 and 2 have been followed to determine the preferred solution to the Mount Albert Water Supply System upgrades. This report documents the following information:

- The planning process
- The Study Area
- Background information
- The Problem/Opportunity Statement
- The alternative solutions considered
- The evaluation process
- The determination of the preferred alternative solution

This report also documents the public and stakeholder consultation process and how the concerns were addressed. This report then describes the preferred alternative solution and the follow-up commitments to implement the preferred alternative.

1.2 Municipal Class Environmental Assessment Process

1.2.1 Class Environmental Assessment Process

Ontario municipalities are subject to the provisions of the *Environmental Assessment Act*, R.S.O. 1990, c. E.18, s. 2. and its requirements to prepare a Class EA for applicable public works projects. The Ontario Municipal Engineers Association's Municipal Class EA document provides municipalities with a five-phase planning procedure approved under the *Environmental Assessment Act.* This procedure prescribes the requirements to plan and undertake municipal sewage, water, stormwater management, and transportation projects that occur frequently, are usually limited in scale, and have a predictable range of environmental impacts and applicable mitigation measures (OMEA 2015).

Municipal projects affect the environment to varying degrees; as such, projects are classified in terms of Municipal Class EA schedules. Based on the Ontario Municipal Engineers Association's Municipal Class EA document and subsequent amendments, projects are classified as Schedule A, A+, B, or C projects, each summarized here. Each classification requires a different level of review and public and stakeholder engagement to complete the Municipal Class EA requirements (Figure 1-2) and described as follows.

- Schedule A projects are limited in scale, have minimal adverse effects, and include the majority of municipal sewage, stormwater management, and water operations and maintenance activities. These projects are preapproved and may be implemented without following further phases in the Class EA planning process. Schedule A projects typically include normal or emergency operational maintenance activities, with typically minimal environmental effects.
- Schedule A+ projects are preapproved but require public notification because of their potential to affect local landowners during construction.
- Schedule B projects have the potential for some adverse environmental effects. The proponent is required to undertake a screening process involving mandatory contact with directly affected public and relevant review agencies to make them aware of the project and to provide an opportunity to address their concerns. Schedule B projects require that Phases 1 and 2 of the Class EA be followed and that a Project File report be prepared and filed for review by the public and the MECP. If there are no outstanding concerns raised by the public, stakeholders, or review agencies, the proponent may proceed to project implementation. Alternatively, the proponent may voluntarily elect to elevate the project to a Schedule C undertaking.
- Schedule C projects have the potential for greater environmental impacts and must proceed under the full planning and documentation procedures covered in Phases 1 to 4 specified in the Municipal Class EA document. Schedule C projects require that an Environmental Study Report be prepared and filed for review by the public, stakeholders, and review agencies. As with Schedule B projects, provided no significant impacts are identified, the project may then proceed to implementation.

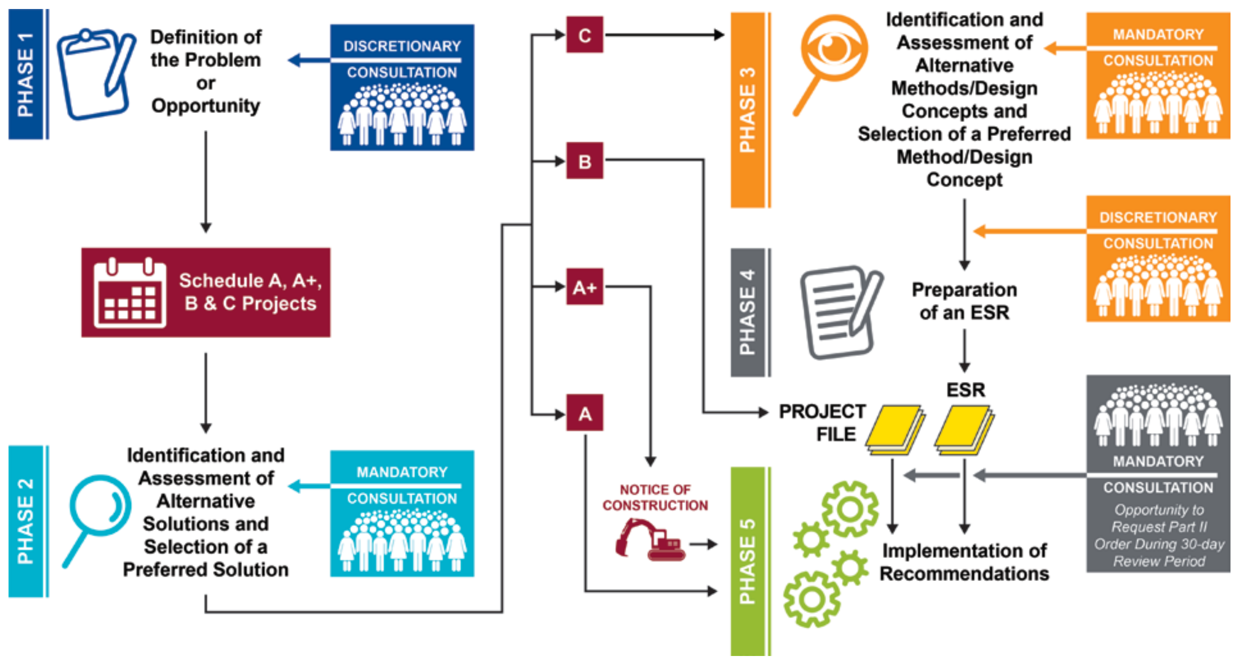

Figure 1-2. Environmental Assessment Process

The *Environmental Assessment Act*, recently amended through the *Covid-19 Economic Recovery Act*, 2020, focused on changes to the Part II Order request process. Once the Project File is finalized, a Notice of Completion will be issued providing a minimum 30-day period during which documentation may be reviewed by the public, interest groups, and review agencies. Comments and inputs will be submitted to and addressed directly by the proponent. However, Part II Order requests for issues relating to constitutionally protected Aboriginal and treaty rights should be addressed to MECP. The MECP may issue a Notice of Proposed Order on its own initiative to the proponent after the conclusion of the comment period on the Notice of Completion. If there is no response from the MECP within 30 days after the comment period conclusion (noted on the Notice of Completion), the project may proceed to Phase 5 of the Class EA process.

1.2.2 Mount Albert Water Supply System Upgrades Schedule B Class EA Process

The Mount Albert Water Supply upgrades were undertaken as a Schedule B activity. This EA requires the completion of a screening process involving mandatory contact with directly affected public and relevant review agencies, to make them aware of the project and to provide an opportunity to address their concerns. As mentioned, Schedule B projects require that Phases 1 and 2 of the Class EA be followed and that a Project File report be prepared and filed for review by the public and review agencies.

The project classification was confirmed after the preferred alternative solution was supplied (refer to Section 6). As a Schedule B activity, the following phases apply:

- Phase 1 – Problem or Opportunity: Identify the problems (deficiencies) or opportunities to be addressed.
- Phase 2 – Alternative Solutions: Identify and evaluate alternative solutions to address the problem or opportunity by considering the existing environment, and establish the preferred solution considering public and review agency input.
- Phase 5 – Implementation: Complete contract drawings and documents and proceed to construction and operations; monitor construction for adherence to environmental provisions and commitments. Where special conditions dictate, also monitor the operations of the completed facility.

2. Problem/Opportunity Statement

2.1 Background

The Community of Mount Albert is located in the Town of East Gwillimbury, in the northeastern portion of York Region, at the intersection of Highway 48 and Mount Albert Road. It is primarily a residential community with a supporting commercial and retail area. The population of Mount Albert was reported as approximately 4,925 residents in 2016 (Statistics Canada, 2017).

The community of Mount Albert receives drinking water from the Mount Albert Water Supply System, owned and operated by York Region. This is a standalone groundwater system that services the Community of Mount Albert in a single pressure zone. The local distribution system of watermains, services, and hydrants is owned and operated by the Town of East Gwillimbury.

As part of this study, an analysis was completed of the background information and related regulations, policies and standards, as well as supplementary field investigation and studies to develop the Problem / Opportunity Statement, and to support the development of the alternatives in Phase 2 of the Class EA process.

2.1.1 Regulatory Framework

A summary of the most relevant recent and proposed future changes to the drinking water guidelines that could impact the compliance requirements and approvals of groundwater supplies, as well as their potential implications to Mount Albert Water Supply System are provided in Table 2-1.

Table 2-1. Recent and Upcoming Updates to Drinking Water Quality Standards

Drinking Water Quality Standards	Considerations
Guidelines for Canadian Drinking Water Quality: Guideline Technical Document – Manganese, released in May 2019 by Health Canada	This technical document established two new guideline values (a health-based MAC and an AE) for manganese in drinking water. The MAC is 0.12 mg/L and the AO is 0.02 mg/L for total manganese in drinking water. The OG is ≤0.015 mg/L for facilities with manganese removal treatment. The reduction in AO from 0.05 mg/L to 0.02 mg/L for manganese in drinking water would minimize the occurrence of discoloured water and improve consumer confidence in drinking water quality. It is anticipated that MECP will harmonize with Health Canada Guidelines; however, MECP has not yet positioned itself or provided a timeline on this subject. The Mount Albert manganese concentration is less than Health Canada's recently adopted MAC of 0.12 mg/L but consistently exceeds the lowered AO of 0.02 mg/L, and Well 1 has recently reached the MAC. The current practice of sequestration by sodium silicate addition does not completely control iron and manganese, as shown by the particulate deposition and occurrence of discoloured water in the distribution system. The identification and selection of the preferred alternative to address this aesthetic water quality issue are one of the major triggers for this Class EA study.
Enteric Viruses in Drinking Water, released in October 2017 by Health Canada	This document proposes to maintain the health-based treatment goal of a minimum 4-log removal and/or inactivation of enteric viruses, but also indicates a greater log reduction may be required, depending on the source water quality. The consultation period ended in December 2017. The Procedure for the Disinfection of Drinking Water in Ontario (2006) is currently undergoing revisions through the MECP. New treatment requirements will be reflected in the updated procedure document, but these are anticipated to align with the recommendations of the Health Canada document. An early interpretation of the proposed guideline suggests 4-log virus removal and/or inactivation is recommended, which brings potential financial implications for drinking water systems in terms of additional treatment requirements and water source monitoring. The Mount Albert wells (Well 1, 2 and 3) are currently permitted and approved as non-GUDI, and the treatment processes can be modified with minor operational adjustments to meet the requirement of 4-log virus inactivation.

Drinking Water Quality Standards	Considerations
Terms of Reference for Groundwater Under the Direct Influence of surface water, currently being updated by MECP, working draft issued in January 2019 by MECP, and implementation is expected by the end of 2020	The MECP is undertaking a review to update the 2001 Terms of Reference for GUDI, so well water is treated appropriately, to reduce pathogen risk by determining whether a communal well requires additional treatment beyond a minimum level of primary disinfection. The new Terms of Reference: Determination of Minimum Treatment for Municipal Residential Drinking Water Systems using Subsurface Raw Water Supplies shifted the focus from eliminating risks by characterizing microbial threats in the source water to determine the minimum treatment required for groundwater. Considering the new MECP Terms of Reference (which is not yet released), the existing Mount Albert wells may be subject to a reassessment of minimum treatment required through the license renewal process, based on the historical microbiological water quality monitoring. Actual treatment and monitoring requirements would need to be confirmed once the new provincial documents were released.

⩽ = less than or equal to

GUDI = Groundwater Under the Direct Influence of surface water

O. Reg. = Ontario Regulation

OG = operational goal

2.1.2 Planning and Servicing Context

The Study Area falls within the Greenbelt Plan, Oak Ridges Moraine Conservation Plan, Lake Simcoe Region Protection Plan, and Golden Horseshoe Plan jurisdiction area. The provincial, regional and local planning policy documents that may be applicable to this Class EA study were reviewed and are documented in Table 2-2 to Table 2-4.

Table 2-2. Provincial Planning

Context	Considerations
Provincial Policy Statement (2020) The Provincial Policy Statement is a consolidated statement of the government's policies on land use planning, under the *Planning Act*. It gives provincial policy direction on key land use planning issues that affect communities.	Key points from the document that are relevant to this study are noted as follows: "Water and sewage infrastructure shall be provided in efficient manner for the impacts of climate change while accommodating projected needs" (Section 1.6.6). Protect, improve and restore quality and quantity of water" (Section 2.2).

Context	Considerations
Growth Plan for the Greater Golden Horseshoe (2020) Under the *Places to Grow Act*, 2005, the Ministry of Municipal Affairs and Housing developed A Place to Grow: Growth Plan for the Greater Golden Horseshoe (2020). This document is a provincial growth plan and guides government investments and municipalities on their own long-term growth plans.	The following guiding principles are relevant to this study: • Improve the integration of land use planning with planning and investment in infrastructure and public service facilities, including integrated service delivery through community hubs, by all levels of government. • Protect and enhance natural heritage, hydrologic, and landform systems, features, and functions. • Support and enhance the long-term viability and productivity of agriculture by protecting prime agricultural areas and the agri-food network. • Conserve and promote cultural heritage resources to support the social, economic, and cultural well-being of all communities, including First Nations and Métis communities. • Integrate climate change considerations into planning and managing growth such as planning for more resilient communities and infrastructure that are adaptive to the impacts of a changing climate and moving towards low-carbon communities, with the long-term goal of net-zero communities, by incorporating approaches to reduce greenhouse gas emissions. Key points from the document that are relevant to this study are noted as follows: • "Opportunities for optimization and improved efficiency within existing water and wastewater systems will be prioritized and supported by strategies for energy and water conservation and water demand management" (Section 3.2.6.2.a). • "For settlement areas that are serviced by rivers, inland lakes, or groundwater, municipalities will not be permitted to extend water or wastewater services from a Great Lakes source unless: the extension is required for reasons of public health and safety, in which case, the capacity of the water or wastewater services provided in these circumstances will be limited to that required to service the affected settlement area, including the capacity for planned development within the approved settlement area boundary" (Section 3.2.6.3.a).
Greenbelt Plan (2017) The Greenbelt Plan was prepared by the Ministry of Municipal Affairs and Housing and approved under the *Greenbelt Act*, 2005 and took effect on December 16, 2006, to protect 1.8 million acres of agricultural land and environmentally sensitive areas in the Greater Golden Horseshoe from urban development and sprawl. The Greenbelt Plan was amended in 2017.	Most of the Study Area is within the greenbelt, with land designation of "Protected Countryside." Section 4.2.1 of the Greenbelt Plan outlines the policies for locating infrastructure within the Protected Countryside, as follows: "existing, expanded or new infrastructure, approved under the *Environmental Assessment Act* or receives other similar environmental approval, is permitted within the Protected Countryside." Section 4.2.2 outlines "the extension of municipal or private communal sewage or water services outside of a settlement area boundary shall only be permitted in the case of health issues or to service existing uses and the expansion thereof adjacent to the settlement area," which should be considered in the alternatives evaluation.
Oak Ridges Moraine Conservation Plan (2017) The ORMCP was prepared and approved under the *Oak Ridges Moraine Conservation Act*, 2001 and was amended on July 1, 2017. The ORMCP was prepared to protect the ecological and hydrological integrity and regulate development and infrastructure within the ORMCP Area.	The ORMCP divides the moraine into four land designations: (1) Natural Core Areas, (2) Natural Linkage Areas, (3) Countryside Areas, and (4) Settlement Areas (a component of Countryside Area). A small portion on the western side of the Study Area falls within "Settlement Areas" and "Countryside Areas," and a small piece of land is designated as "Natural Core Area." Section 41 of the ORMCP outlines the policies for infrastructure within the ORMCP area. Settlement areas focus and contain urban growth to existing communities planned by municipalities. In general, application for infrastructure development in Natural Core Area is not permitted. This should be considered in the evaluation of alternatives, specifically potential development in wellhead protection areas and areas of high aquifer vulnerability.

Context	Considerations
O. Reg. 179/06: LSRCA, Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses (2013) O. Reg. 179/06, approved under the *Conservation Authority Act*, 1990, ensures development proposals have regard for natural hazard features and the natural environment, while conforming with the Lake Simcoe Watershed development policies.	The study area is within the LSRCA jurisdiction, with some portions of land considered as regulated areas, including shorelines, wetlands, river and stream valleys, hazardous land, and other areas that could interfere with the hydrological function of a subwatershed within the Lake Simcoe watershed. Development in regulated areas requires permission from LSRCA with or without conditions.
Lake Simcoe Protection Plan (2008) The Lake Simcoe Protection Plan, approved under the *Lake Simcoe Protection Act*, 2008, addresses long term environmental issues in Lake Simcoe and its watershed by promoting immediate action to address threats to the ecosystem, such as excessive phosphorus, targeting new and emerging causes of stress such as invasive species and climate change, protecting and restoring important natural areas such as shorelines and wetlands and restoring the health of the fish and other aquatic life.	The designated policies on Chapter 4 impose requirements and restrictions on both phosphorous loading to the Lake Simcoe and the establishment of sewage treatment plants and stormwater management structures. Chapter 5 outlines strategic actions to maintain a healthy aquatic ecosystem in the Lake Simcoe watershed, such as streamflow targets and implementation of water conservation and efficiency plans. To contribute to the ecological health of the watershed, designated policies in Chapter 6 prohibit development and site alteration within key natural heritage areas within 30 m of lakes, permanent or intermittent stream, or wetland outside of settlement areas and the greenbelt area and Oak Ridges Moraine area.

LSRCA = Lake Simcoe Region Conservation Authority

ORMCP = Oak Ridges Moraine Conservation Plan

Table 2-3. Regional Planning and Servicing

Context	Considerations
York Region Official Plan (2010) and Its Amendments The York Region Official Plan describes how York Region plans to accommodate future growth and development while meeting the needs of existing residents and businesses in York Region. It provides directions and policies that guide economic, environmental, and community planning decisions.	York Region is expected to grow to approximately 1.8 million people and 900,000 jobs by 2041. The York Region Official Plan relies on a sustainability framework composed of three main sections: (1) Towards a Sustainable Design, (2) Growth Management, and (3) Implementation. The evaluation of alternatives will consider their contributions to the York Region Official Plan's goal of creating high-quality, sustainable communities.
2016 York Region Water and Wastewater Master Plan Update The 2016 Water WWWMP Update is composed of a Regionwide review, evaluation and development of water and wastewater servicing strategies to accommodate population and employment growth within serviced areas of York Region from 2016 to 2041. The 2016 WWWMP is currently undergoing review, and it is anticipated that the updated plan will be presented to York Region Council for endorsement in 2021.	The 2016 WWWMP Update presented a One Water Approach based on new, innovative, and sustainable approaches to meet its future growth need, including initiatives such as the Long-Term Water Conservation Strategy. These initiatives have had a tangible impact on York Region's infrastructure planning process, and the per-capita water demand has been decreasing steadily over the last decade and will continue to have a positive effect on the future projected water consumption rates. A water servicing strategy for each serviced area in York Region was identified and reviewed based on the performance of the existing water systems, an assessment of future servicing needs, as well as York Region's water efficiency program and design criteria. The 2016 WWWMP identified that the Mount Albert Water Supply System has sufficient groundwater supply capacity to meet the projected growth in its service area to the year 2041 and beyond.
York Region Energy Conservation and Demand Management Plan (2019) The York Region Energy Conservation and Demand Management Plan, mandated under the *Electricity Act*, 1998, focuses exclusively on corporate-wide energy consumption and greenhouse gas emissions resulting from York Region's service delivery to residents, including water and wastewater. Conservation initiatives and emissions goals set in York Region Energy Conservation and Demand Management Plan are driven to achieve net-zero carbon by 2051.	Proposed Initiatives for the water and wastewater treatment, pumping, and storage systems include water conservation programs, sanitary sewer inflow and infiltration reduction programs, and efficiency measures leading to reduced energy consumption at these facilities.

Context	Considerations
York Region By-Law No. 2011-56 The York Region By-Law No. 2011-56 regulates the discharge of sewage, stormwater and land drainage at York Region.	This by-law aims to protect the public, the environment and Regional infrastructure by setting strict limits on what can be discharged into the sewers system and natural watercourses. Some substances are completely prohibited, where others are restricted to defined safe limits.
York Region Groundwater Treatment Strategy Study (2020) In anticipation of the recently issued guideline and possible regulatory changes in the values for manganese in drinking water and to address water quality challenges with discoloured water, York Region initiated the Groundwater Treatment Strategy Study to develop a region-wide strategy for groundwater treatment; particularly for systems using sequestration to control iron and manganese.	The outputs of the study and strategy will address Region-wide, as well as system-specific water quality challenges such as chlorine residuals and aesthetic parameters, including iron and manganese (that is, discoloured water). The study includes an analysis of Mount Albert's local distribution system and provides information that will inform the proposed water servicing alternatives for this Class EA. Among the overall groundwater treatment strategies, the following alternatives had the highest score for Mount Albert Water Supply System: • Alternative 1 – Baseline Condition: Continue sequestration and implement treatment optimization and distribution system maintenance best practices. • Alternative 4 – Iron and manganese removal through the use of oxidation-filtration and distribution system maintenance best practices. The recommendations and strategies identified under the Groundwater Treatment Strategy Study are part of this Class EA study.
Mount Albert Groundwater Exploration Study (2019) To support the identification and evaluation of water supply alternatives as part of the Mount Albert Water Supply System Class EA, a preliminary hydrogeological investigation was undertaken by York Region to investigate the feasibility of a new groundwater supply well with improved water quality (with respect to iron and manganese) to be incorporated into the existing Mount Albert Water Supply System.	The area of study for this hydrogeological investigation is the existing Mount Albert Well 3 site. The test well MW18 designed to produce 38 L/s was constructed in the deep aquifer unit known as the TAC. Pumping tests were performed up to 47.2 L/s. Results showed that MW18 is non-GUDI and capable of producing 38 L/s on a long-term basis. Water quality sampling results performed during the pumping test were compared to the Ontario Drinking Water Standards and provincial guidelines and found that all parameters met the corresponding criteria limit/range, with the notable exceptions of hardness and manganese.
Current Projects at Mount Albert Water Supply Facilities York Region is currently undertaking various studies and construction projects at Mount Albert water supply facilities, summarized under separate covers.	The following list provides an overview of the current and planned projects this Class EA study has considered: • 2019/2020 Wells 1 and 2 Standby Power Generator Replacement • 2019/2020 Condition Assessments of the Mount Albert North and South Elevated Tanks • 2016/2017 Pump Maintenance and Well Rehabilitation Program

L/s = litre(s) per second

TAC = Thorncliffe Aquifer Complex

WWWMP = Water and Wastewater Master Plan

Table 2-4. Local Planning and Servicing

Context	Considerations
Town of East Gwillimbury Official Plan (2010) and 2018 Consolidation The Town of East Gwillimbury's Official Plan, adopted in 2010 and consolidated in 2018, provides direction and a policy framework for managing growth and land-use decisions over the planning period to 2031.	The policy framework ensures appropriate growth toward a sustainable community. This plan also provides for long-term protection of the Town of East Gwillimbury's environmental areas, cultural heritage features, historic community identity, and rural countryside.
East Gwillimbury Water & Wastewater Master Plan (2009) The Town of East Gwillimbury's Water & Wastewater Master Plan identifies the water distribution and the wastewater collection systems, which are the town's responsibility, and will be necessary to accommodate the projected ultimate buildout population.	This master plan has been developed, including the requirement that all town areas, excepting rural areas, must be provided with full municipal services by 2031. This master plan is currently under review.

2.2 Overview of Existing Water Supply and Distribution System

The Mount Albert Water Supply System consists of three municipal supply wells, located at two treatment facilities and two elevated storage tanks, all owned and operated by York Region. The groundwater from these wells contains elevated levels of iron and manganese, which is sequestered using sodium silicate to minimize solids deposition in the distribution system and to mitigate water discolouration. Chlorine is added to support sequestration, as well as to provide primary and secondary disinfection.

Figure 2-1 provides a schematic of the Mount Albert Water Supply System. A detailed description of the Mount Albert Water Supply System is provided in *System Capacity Optimization Study* (Jacobs, 2020c) in **Appendix B**.

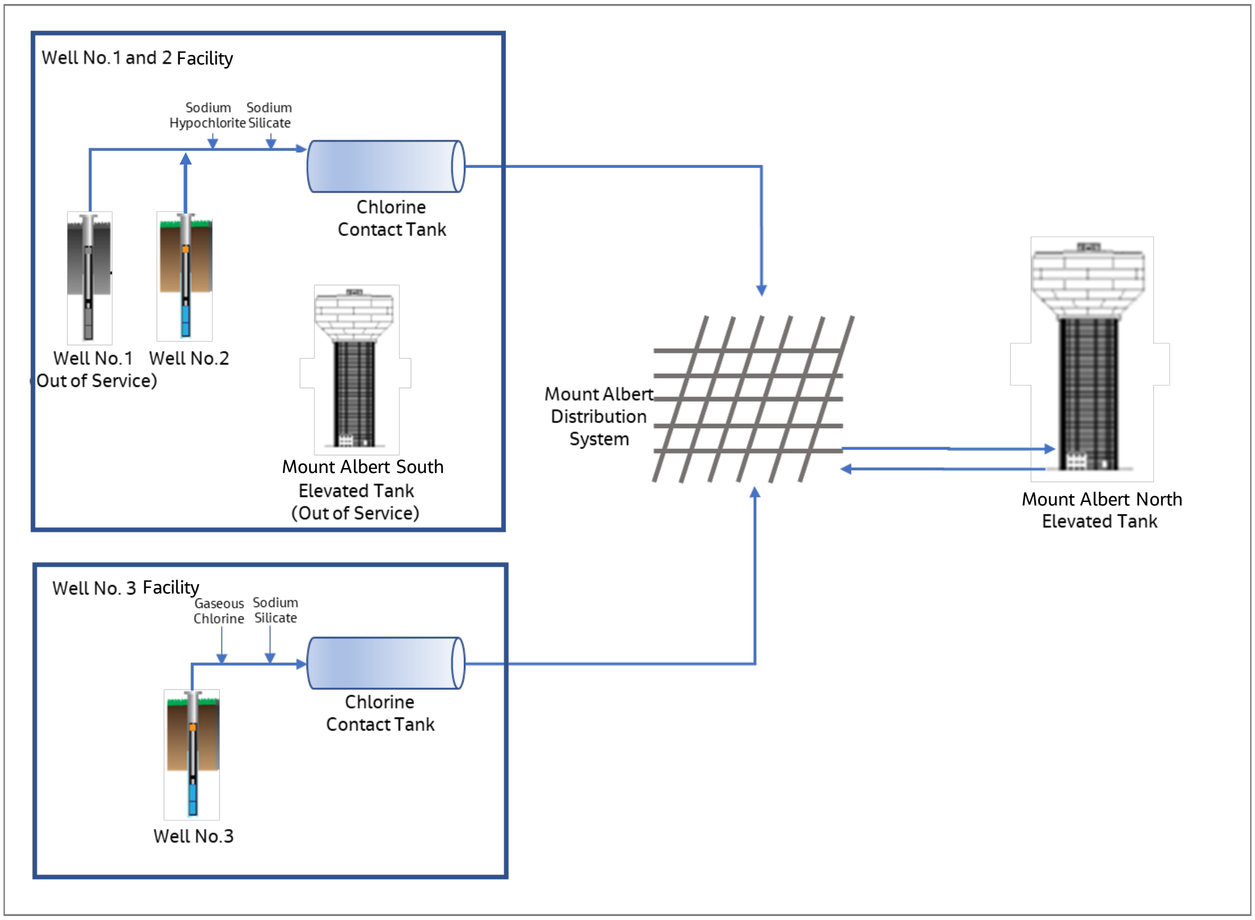

Figure 2-1. Overview of Mount Albert Water Supply System

2.2.1 Wells, Treatment and Storage Facilities

Mount Albert Wells 1 and 2 are combined and treated at the Wells 1&2 Treatment Facility. Well 1 is located inside the pumphouse, and Well 2 is located outside on the property, approximately 50 m southwest of the facility. Mount Albert Well 3 is housed at the Well 3 Treatment Facility, where treatment is provided for this well. An overview of the wells is provided in Table 2-5. Well 1 was removed from duty service in June 2017 due to the elevated manganese concentration in this well water. The three wells are interpreted to draw water from the TAC and are considered to be "true" groundwater (non-GUDI). The existing permit to take water (PTTW) No. 1312-AVKKZM defines the maximum water taking allowed from the three wells in this system, as a combined daily taking from any combination of Wells 1 to 3 of 4,990 m^3/d (57.8 L/s) with a maximum taking per minute per well of 2,273 L/min (37.88 L/s).

Table 2-5. Overview of Mount Albert Wells

Item	Well 1 (MTA PW 1)	Well 2 (MTA PW 2)	Well 3 (MTA PW 3)
Well Pump Capacity	2,265 L/min (37.8 L/s) at 100 m TDH (VFD)	2,265 L/min (37.8 L/s) at 100 m TDH (VFD)	2,280 L/min (38 L/s) at 79 m TDH (VFD)
Well Pump Type	Vertical turbine pump	Submersed pump	Vertical turbine pump
Permitted Capacity	3,273 m^3/d (37.88 L/s)	3,273 m^3/d (37.88 L/s)	3,273 m^3/d (37.88 L/s)
Date Well Drilled	October 24, 1977	November 1, 1993 (rehabilitated in 2011 and 2012)	October 25, 2005
Well Depth	64 m	64 m	85.5 m

Notes:

TDH = total dynamic head

VFD = variable-frequency drive

The treatment provided at each treatment facility includes the addition of chlorine and sodium silicate to the water in order to sequester the iron and manganese. The addition of sodium hypochlorite at the Wells 1 and 2 Facility and chlorine gas at the Well 3 Facility provides for the disinfection of the water supply. The chemicals are added to the raw water at the individual well discharge headers (one from each well) and flow through an in-ground, pressurized, chlorine contact tank at each facility that provides the required chlorine contact time for primary disinfection. The treated water then enters the distribution system via a single watermain.

Under normal operations, Mount Albert Well 3 operates as the duty well, with Mount Albert Well 2 starting and stopping to meet system demand based on level setpoints in the North ET. The system operation is monitored, controlled, and recorded through York Region's supervisory control and data acquisition (SCADA) system.

The North ET has a design capacity of 2,727 m^3. The tank is a composite elevated tank, commissioned in 2005. The South ET is located at the Wells 1 and 2 Facility and has a design capacity of 910 m^3. The tank was constructed in 1979 as the first composite elevated tank built in North America. The elevations of the key design points are provided in Table 2-6.

Table 2-6. Mt. Albert Elevated Tanks Key Design Parameters

Parameter	North ET	South ET
Total Volume	2,727 m^3	910 m^3
Overflow	El. 314.29 m	El. 314.92 m
High Water Level (Elevation)	El. 313.94 m	El. 313.94 m
Finished Floor Elevation	El. 277.80 m	El. 280.42 m

All of the wells, the Wells 1 and 2 Facility, Well 3 Facility, and North ET are considered to be in good physical condition, requiring routine maintenance and minor upgrades to achieve an extended lifespan of service. The South ET is reported to be in "Very Poor" condition and is not currently considered fit for use so it has been removed from service.

2.2.2 Water Distribution

The water distribution system is composed of a single pressure zone with an elevation range of 37 m (245 to 282 m). The system includes approximately 32 km of distribution watermain, owned and operated by the Town of East Gwillimbury. The pipes in the distribution system are less than 50 years old, and more than half of the pipes were installed after the year 2000. As a result, few watermain breaks have been reported.

A *Hydraulic Analysis Study* (Jacobs, 2020b), provided in **Appendix A,** was undertaken to establish the baseline conditions and identify system constraints and issues for further investigation. Modelled system pressures ranged between 328 and 742 kiloPascals, which equate to 47.6 and 107.6 pounds per square inch) under average day demand (ADD) conditions. Under maximum day demand (MDD) conditions, water pressure can drop as low as 242 kiloPascals (35.1 pounds per square inch), when there are low water levels in the elevated tank and well pumps are off.

The hydraulic model reported the desired hydrant flow is achieved at 73 percent of modelled locations in the system. Developing fire flow targets is a useful planning exercise for sizing water system equipment, but meeting fire flow at all locations is not regulated for distribution systems. Overall, the Mount Albert distribution system appears to meet requirements for fire flow, though there are some areas where fire flow could be improved.

The modelled water age near the North ET is predicted by the model to be the highest. The ADD water age in the North ET stabilizes at an average of about 113 hours (4.7 days), with a maximum of 129 hours (5.4 days). The MDD water age in the elevated tank stabilizes at an average of about 60 hours (2.5 days), with a maximum of 66 hours (2.75 days). The ADD water age in the distribution system ranges from 10 to 222 hours (9.2 days), with an average of 146 hours (6.1 days). Water age was found to be the lowest near the well facilities. In addition, average water age at dead-end pipes is higher than within looped mains because dead ends have lower water demands and less flow.

2.2.3 Water Quality

Five years of raw water quality for the three production wells and treated water quality from both facilities were reviewed in *System Capacity Optimization Study* (Jacobs, 2020c) in **Appendix B**.

The raw water quality for the three production wells and the treated water from both facilities meet most of the Ontario Drinking Water Quality Standards or Guidelines, with the exception of the following parameters: iron, manganese, ammonia, and hardness, as detailed here.

Iron and Manganese

Iron and manganese in the raw water from the existing wells and treated water regularly exceeds the current provincial aesthetic objective of 0.3 mg/L for iron and 0.02 mg/L for manganese. While concentrations for manganese approach the Health Canada MAC of 0.12 mg/L only for Well 1, the aesthetic objective of 0.02 mg/L is exceeded for all wells. Sampling of iron and manganese (total and dissolved) in the distribution system showed that iron and manganese deposition was occurring across the system, independent of correlation to water age, pipe material, pipe age, or pipe diameter. The current treatment practice of sequestration does not provide consistent control, resulting in particulate deposition in the distribution system and customer complaints associated with discoloured water. More importantly, iron and manganese deposition occurred regardless of the amount of iron and manganese in the dissolved form, suggesting changes to the silicate dosing would not substantially improve sequestration in the drinking water system.

Ammonia

For Wells 1 and 2, the average ammonia concentration exceeds 0.1 mg/L of nitrogen recommended by Health Canada to prevent nitrification in treated water; however, the slighted elevated ammonia concentration is dealt with through breakpoint chlorination.

Hardness

The values for hardness found in all three production wells exceed the provincial operational guideline of 80 to 100 mg/L as calcium carbonate, but the values are less than the unacceptable threshold of 500 mg/L as defined in Section 17.10 of the *Region Design Guidelines* (York Region, 2017) and provincial guidelines.

Free Chlorine

The main concern for distribution system water quality is the maintenance of consistent free chlorine residual for secondary disinfection. An assessment of free chlorine residuals through both sampling and modelling shows stable free chlorine residuals in the distribution system, consistently above the minimum operating target of 0.4 mg/L. Further, there was little variation between the free chlorine residual and total chlorine residual measurements and there were no obvious trends, indicating consistent biostability in the distribution system.

2.2.4 Water Supply and Storage Requirements

The historical data from the Mount Albert SCADA was analyzed to determine the historical and current water demands. Table 2-7 summarizes the values obtained during this analysis. A review of data indicates that current system demand can be met by any of the wells operating without exceeding the individual wells permitted capacity of 3,273 m^3/d (3.27 MLD). The reported well pump capacities are slightly less at 3,262 m^3/d (3.26 MLD) and, while minor declines have been reported in well efficiencies, the supply remains more than sufficient to meet current demands of the system.

Table 2-7. Historical Water Demands

Year	Total Water Demand (ML)	ADD (MLD)	MDD (MLD)	MDD (99th Percentile)[a] (MLD)	Max. Day Factor[b]
2014	352	0.96	2.16	1.72	1.78
2015	381	1.05	2.43	1.98	1.89
2016	423	1.16	2.56	2.39	2.06
2017	384	1.05	3.33	2.53	2.41
2018	400	1.09	3.02	2.78	2.54
Average	388	1.06	Not Applicable	Not Applicable	Not Applicable
Maximum	423	1.16	3.33	2.78	2.54

[a] The 99th percentile was used instead of the absolute maximum value to remove atypical maximum day demands that may be caused by watermain breaks, fire flows, or flushing programs.

[b] The MDD peaking factors are calculated using the ADD and the MDD (99th Percentile) values.

York Region's 2016 WWWMP established the population and water demand for the Community of Mount Albert for major milestone years to 2041 and beyond. Table 2-8 summarizes the population forecast, projected water demands, and projected water storage.

Table 2-8. Projected Population, Future Water Demands, and Water Storage by 2041

Parameter	Unit	2016	2021	2026	2031	2036	2041
Residential Population[a]	persons	5,434[a]	5,904	5,927	5,953	5,968	5,975
Residential Average Day Demand	L/cap/d	233	218	211	201	195	189
Residential Average Day Demand	MLD	1.27	1.29	1.25	1.20	1.16	1.13
Employment Population	persons	745	1,125	1,197	1270	1,328	1,337
Employment Average Day Demand	L/cap/d	182	164	160	155	149	144
Employment Average Day Demand	MLD	0.14	0.18	0.19	0.20	0.20	0.19
Total Average Day Demand	MLD	1.4	1.5	1.4	1.4	1.4	1.3
	L/s	16.2	17.4	16.2	16.2	16.2	16.2

Parameter	Unit	2016	2021	2026	2031	2036	2041
Total Maximum Day Demand (Max. Day Factor=2.3)	MLD	3.3	3.4	3.3	3.2	3.1	3.1
	L/s	38.2	39.4	38.2	37.0	35.9	35.9
A = Fire Storage[b]	m^3	1,200	1,200	1,200	1,200	1,200	1,200
B = Equalization Storage[b]	m^3	824	846	829	801	783	777
C = Emergency Storage[b]	m^3	506	512	507	500	496	494
Total storage Requirement (A + B + C)[b]	m^3	2,529	2,558	2,537	2,502	2,479	2,471

[a] Forecasted population per 2016 WWWMP, it may differ from the 2016 census.

[b] Storage requirements were determined, in accordance with MECP Design Guidelines for Drinking Water Systems and York Region Design Guidelines, where:

A = Fire Storage: The fire flow requirement has been reviewed during the establishment of hydraulic modelling as well as in the System Capacity Optimization Study, based on York Region, Town of East Gwillimbury and Fire Underwriter Survey guidelines and standards. The fire flow targets established for the water storage in Mount Albert Water Supply System is 10,000 litres per minute (167 L/s) for 2 hours (1,200 m^3 of fire storage).

B = Equalization Storage will be provided for Mount Albert at 25% of maximum day demand throughout the planning horizon of 2041.

C = Emergency Storage will be provided for emergencies other than fire-fighting, such as power outages, watermain breaks, and pump mechanical failures. C=25% of (A+B)

Notes:

L/cap/d = litre(s) per capita per day

Max = maximum

It is important to note that the demands projected for 2021 are greater than those for subsequent years, including 2041, due to a forecasted decline in per capita consumption.

The available water storage volume in the North ET is estimated to be 2,585 m^3, which is sufficient to meet the project water storage requirement beyond the year 2041. The South ET has a design storage capacity of 910 m^3 but is currently offline due to its poor structural condition. There is, therefore, no alternate storage available to allow maintenance or rehabilitation of the North ET. If the North ET is out of service, the identified fire flow volume of 10,000 litres per minute (167 L/s) could not be adequately supplied from the existing wells even if the maximum permitted taking flow condition could be waived during an emergency situation. Alternatives sources of water for fire flow would, therefore, have to be developed as a contingency for when North ET is taken out of service.

The Mount Albert Water Supply System has sufficient storage capacity to meet the total water storage requirements, and as a result, the well pumps are required to only provide maximum day demand. The future projected MDD needs of the system of 3.4 MLD (39.4 L/s) only slightly exceeds the permitted capacity of 3.27 MLD (37.88 L/s) for a single well supply. The future demand can therefore be met within the current firm capacity of the system, which is defined as the capacity with two of the three wells in operation and the permitted maximum combined daily taking from wells of 4,990 m^3/d (4.99 MLD). This demand assessment allows for potential decline in well pump capacity or well efficiency as the system continues to age but requires that Well 1 supply is available.

2.3 Problem/Opportunity Statement

The Mount Albert Water Supply System has sufficient supply capacity and storage to service current and future water demands beyond 2041, with Well 1 in service. In general, the facilities are in good condition and provided with sufficient redundant equipment to avoid service interruptions in the event of component failure.

The assessment of existing conditions, as detailed in the *System Capacity Optimization Study* (Jacobs, 2020c) in **Appendix B** has identified a number of opportunities to address system constraints and improve the existing system's operations and maintenance, which would not require major capital investment. These opportunities included improving silicate dosing systems, inspecting and cleaning the contact chambers and the North ET, and collaborating with the Town of East Gwillimbury on monitoring, cleaning, and flushing programs for the distribution system.

While silicate dosage improvements at the wells may allow for more effective sequestration, the raw water quality exceeds the recommended targets for effective sequestration at Wells 1 and 2. As the raw water quality at Well 3 is comparatively better, dosage improvements may provide more satisfactory results. For each well, the interference of the identified factors of hardness, alkalinity, and potentially phosphate on the treatment process cannot be easily avoided, and the potential of water quality issues remains.

Even if sequestration in Well 3 could be improved, the supply is insufficient on its own to meet the long-term needs of the community, and more extensive capital investments to Wells 1 and 2 Facility beyond the scope of system optimization would be required to provide redundancy.

Additional upgrade solutions are therefore required to be identified to address water quality concerns and resolve distribution system issues and associated discoloured water complaints from residents.

To guide the identification and investigation of alternative solutions, the following Problem / Opportunity Statement has been developed, in accordance with the Class EA process (Jacobs, 2020d; see **Appendix C**):

> *"Mount Albert is currently supplied solely by groundwater that contains elevated levels of naturally-occurring iron and manganese above the aesthetic objectives. The current practice of sequestration does not provide effective control of these constituents, as evidenced by significant particulate deposition throughout the distribution system and frequent customer complaints associated with discoloured water. Additionally, the Mount Albert North Elevated Tank cannot be taken out of service for any prolonged period without creating significant constraints for the operation of the system. Optimization of existing water infrastructure can improve these issues but may not provide a complete resolution. To mitigate aesthetic water quality issues and comply with future manganese regulation, a preferred solution to upgrade the Mount Albert Water Supply System that is socially, environmentally and financially sustainable will be identified, with consideration given to treatment methodologies and improvement of overall system redundancy and reliability."*

3. Identification of Alternative Solutions

Alternative solutions have been identified and evaluated to systematically assess the different water servicing alternatives, related to social, environmental, technical, and economic criteria (Figure 3-1), described in this section.

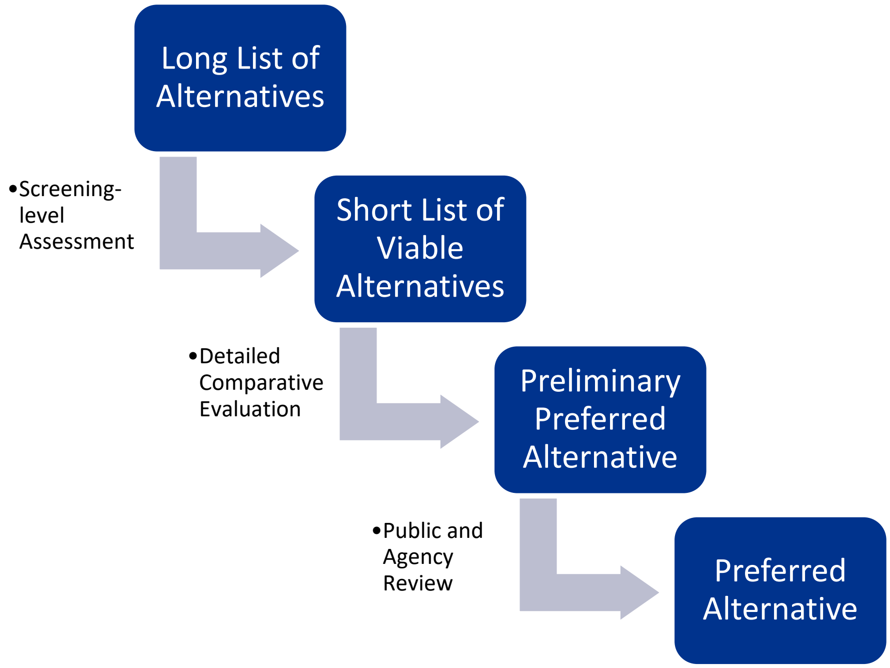

Figure 3-1. Phase 2 – Alternative Solutions Planning Process

The details of the development of the alternative solutions are provided in *Technical Memorandum No. 2: Identification and Assessment of Alternative Solution* in **Appendix D** (Jacobs 2020e) and are summarized in this section.

3.1 Development of Long List of Alternatives

The long list of alternatives (Table 3-1 and Table 3-2) were identified in consultation with York Region to address the problem statement for the Mount Albert Water Supply System. The alternatives were divided into two categories:

A. **Improve water quality** – which will focus on the iron and manganese particulate deposition across the distribution system and frequent customer complaints associated with discoloured water.

B. **Improve feasibility of storage maintenance –** which will focus on improvements to facilitate removing the North ET from service for maintenance.

Table 3-1. Long List of Alternatives to Improve Water Quality

Alternatives	Description
A1: Do Nothing	Maintain existing water supply system and reinvest in existing infrastructure, as necessary, to extend their service life
A2: Limit Community Growth	Limit community growth to the capacity of the existing water supply system
A3: Implement Water Conservation and Efficiency Measures	Defer capital investments in the new water supply system by reducing demand

Alternatives	Description
A4: Continue Sequestration at Wells 1 and 2 Facility and Well 3 Facility, and Upgrade Systems to Optimize Operations and Maintenance	Continue current treatment (sequestration) while implementing upgrades and optimization strategies for more effective treatment
A5: Provide Iron and Manganese Removal Technology for All Wells	Provide iron and manganese removal technology for all wells to minimize iron and manganese reaching the distribution system and the customers
A6: Provide Iron and Manganese Removal Technology at Wells 1 and 2 Facility and Continue Sequestration at Well 3 Facility	Provide iron and manganese removal technology for Wells 1 and 2 and continue current treatment (sequestration) for Well 3 while implementing upgrades and optimization strategies for more effective treatment
A7: Connect New Well (MW18) to Mount Albert Water Supply System and Remove Wells 1 and/or 2	Connect a new well with better water quality at an existing well site to the system to replace one or two existing wells, continue existing treatment (sequestration) where feasible and provide iron and manganese removal technology on remaining wells
8A: Connect to Existing Alternative Water Supply Source	Connect Mount Albert Water Supply System to another water supply system within a close community and retire all wells at Mount Albert
9A: Develop New Water Supply Sources	Search for a new groundwater source with less iron and manganese

Table 3-2. Long List of Alternatives to Improve Feasibility of Storage Maintenance

Alternatives	Description
B1: Do Nothing	Maintain existing water storage system and reinvest in existing storage facilities, as necessary, to extend the service life
B2: Rehabilitate Mount Albert South Elevated Tank and Return it to Service	Refurbish South Elevated Tank for a temporary return to service while North Elevated Tank is maintained
B3: Operate the Distribution System in Pressure Mode By-passing the North Elevated Tank	Minor upgrades to maintain the drinking water system supply while the North Elevated Tank is out of service for maintenance
B4: Provide New Storage	Construct a new storage tank to allow for North Elevated Tank to be taken out of service for maintenance

3.2 Screening of Shortlisted Alternative Solutions

Each identified alternative was evaluated based on its ability to address the Problem/Opportunity Statement using the screening criteria presented in Table 3-3 and Table 3-4. Alternatives that met all of the screening criteria were considered viable and were carried forward for more detailed evaluation and comparison in subsequent sections of this report.

Table 3-3. Screening Criteria for the Long List of Alternatives to Improve Water Quality

Alternatives	Description
Does the alternative provide sufficient system capacity to meet projected water demands?	The Mount Albert Water Supply System has sufficient supply capacity and storage to service current and future water demands beyond 2041 with appropriate redundancy. MDD of 3.4 MLD in 2021 and 3.1 MLD in 2041 and storage volume of (2,558 m^3) in 2021.
Can the alternative provide consistently reliable water quality that meets current and pending regulations?	The Mount Albert Water Supply System can meet current regulations, including the AO of 0.3 mg/L for total iron in drinking water and the potential implementation of the new manganese guidelines, which are the MAC of 0.12 mg/L and the AO of 0.02 mg/L for total manganese in drinking water. Deposition in Mount Albert's distribution system and associated cleaning/flushing are minimized. Negative aesthetic events associated with iron and manganese are controlled in Mount Albert Water Supply System, indicated by reaching ≤2.5 total annual complaints per 1,000 customer accounts (AWWA Partnership for Safe Water, 2014) and apparent colour in the distribution system ≤25 units from sampling stations samples and ≤40 units from hydrant samples (AWWA M58).
Does the alternative work with alternatives to improve the North ET maintenance?	This alternative does not preclude implementation of alternatives considered to improve the feasibility of storage maintenance of the Mount Albert Water Supply System.

Table 3-4. Screening Criteria for the Long List of Alternatives to Improve Feasibility of Storage Maintenance

Alternatives	Description
Does the alternative allow the maintenance of the North ET?	The North ET can be taken out of service for inspection, cleaning, and proper maintenance, allowing the infrastructure to reach an extended life span and minimizing the potential impact of sediments present in the bottom of the tank on water quality.
Does the alternative work with alternatives to improve water quality?	This alternative does not preclude implementation of alternatives considered to improve the water quality of the Mount Albert Water Supply System.

Table 3-5 and Table 3-6 summarize the results of the screening process for each category to identify the viable alternative solutions.

Table 3-5. Screening Assessment to Improve Water Quality

Alternatives	Sufficient Capacity to Meet Demands	Reliable Water Quality	North ET Maintenance Alternatives	Recommendation
A1: Do Nothing	Yes [a]	No	Yes	Not Viable
A2: Limit Community Growth	Yes [a]	No	Yes	Not Viable
A3: Water Conservation and Efficiency Measures	Yes	No	Yes	Recommended as part of any solution
A4: Continue Sequestration at Wells 1 and 2 Facility and Well 3 Facility, and Upgrade Systems to Optimize Operations and Maintenance	Yes [a]	Yes [b]	Yes	Viable Option for Evaluation
A5: Provide Iron and Manganese Removal Technology for All Wells				
Sub-option A5a: Centralized Removal Technology at Wells 1 and 2 Facility	Yes	Yes	Yes	Viable Option for Evaluation
Sub-option A5b: Decentralized Removal Technology at both Facilities	Yes	Yes	Yes	Viable Option for Evaluation
A6: Provide Iron and Manganese Removal Technology at Wells 1 and 2 Facility and Continue Sequestration at Well 3 Facility	Yes	Yes [b]	Yes	Viable Option for Evaluation
A7: Connect New Well (MW18) to Mount Albert Water Supply System and Remove Wells 1 and/or 2				
Sub-option A7a: Replace Well 1 with Well MW18 and Continue Sequestration for all Wells	Yes	Yes [b]	Yes	Viable Option for Evaluation
Sub-option A7b: Replace Wells 1 and 2 with Well MW18, Re-rate Wells 3 and MW18, and Continue Sequestration	Yes	Yes [b]	Yes	Viable Option for Evaluation
Sub-option A7c: Replace Well 1 with Well MW18, Continue Sequestration at Well 3 Facility, and provide iron and manganese removal technology at Wells 1 and 2 Facility	Yes	Yes [b]	Yes	Viable Option for Evaluation
8A: Connect to Existing Alternate Water Supply Source	No	No	Yes	Not Viable
9A: Develop New Water Supply Sources	Yes	No	Yes	Not Viable

[a] Provided Well 1 remains in service.

[b] Provided optimization strategies and infrastructure improvements address issues, potential interference of the identified factors of hardness, alkalinity and potentially phosphate on the treatment process are not limiting, and potential blending issues can be mitigated, when applicable.

Table 3-6. Screening Assessment to Improve Feasibility of Storage Maintenance

Alternatives	Maintenance of the Mount Albert North Elevated Tank	Improve Water Quality Alternatives	Recommendation
B1: Do Nothing	No	Yes	Not Viable
B2: Rehabilitation of Mount Albert South Elevated Tank and Return it to Service	Yes	Yes	Viable Option for Evaluation
B3: Operate the Distribution System in Pressure Mode By-passing the North Elevated Tank	Yes	Yes	Viable Option for Evaluation
B4: Provide New Storage	Yes	No	Not Viable

Based on the screening evaluation presented, the following alternatives were considered viable options for further evaluation:

A) Improve Water Quality

- **Alternative A4:** Continue Sequestration at Wells 1 and 2 Facility and Well 3 Facility, and Upgrade Systems to Optimize Operations and Maintenance
- **Alternative A5:** Provide Iron and Manganese Removal Technology for All Wells
  - Sub-option A5a: Centralized removal technology at Wells 1 and 2 Facility
  - Sub-option A5b: Decentralized removal technology at both facilities
- **Alternative A6:** Provide Iron and Manganese Removal Technology at Wells 1 and 2 Facility and Continue Sequestration at Well 3 Facility
- **Alternative A7:** Connect New Well (MW18) to Mount Albert Water Supply System and Remove Wells 1 and/or 2
  - Sub-option A7a: Replace Well 1 with Well MW18 and continue sequestration at both facilities
  - Sub-option A7b: Replace Wells 1 and 2 with Well MW18, re-rate Wells 3 and MW18, and continue sequestration
  - Sub-option A7c: Replace Well 1 with Well MW18, continue sequestration at Well 3 Facility, and provide iron and manganese removal technology at Wells 1 and 2 Facility

B) Improve Feasibility of Storage Maintenance

- **Alternative B2:** Rehabilitation of Mount Albert South Elevated Tank and Return it to Service
- **Alternative B3:** Operate the Distribution System in Pressure Mode

The following enhancements were identified for inclusion with each alternative to improve the overall system redundancy, reliability, and performance:

- Clean and inspect chlorine contact chambers at Wells 1 and 2 Facility and Well 3 Facility
- Clean and inspect the North ET
- Collaborate with Town of East Gwillimbury to develop and implement a tailored monitoring program for the distribution system to assess and track water quality and maintenance needs of the distribution system
- Collaborate with Town of East Gwillimbury to refine a unidirectional flushing program to identify optimal flushing conditions and frequency and implement a swabbing program to address accumulated deposits; the goal would be to achieve ≤2.5 total annual complaints per 1,000 customer accounts (AWWA Partnership for Safe Water, 2014) and apparent colour in distribution system ≤25 units from sampling stations samples and ≤40 units from hydrant samples (AWWA M58).
- Validate low pressure detected by the hydraulic model is occurring in the distribution system, then determine operational adjustments required to address the low-pressure issues in the distribution system without compromising water quality

4. Natural, Social, Cultural, and Economic Environments

A number of supporting investigations and comprehensive studies were completed under this Class EA study to allow for the assessment of potential impact and the required mitigating measures.

- Subsurface Utility Engineering Report
- Geotechnical Study
- Hydrogeological Study
- Surface Water Study
- Stage 1 Archeological Assessment
- Cultural Heritage Resource Assessment

The findings, conclusions, and recommendations of each study were documented in individual reports appended to the *Technical Memorandum No. 2: Identification and Assessment of Alternative Solution* in **Appendix D** (Jacobs 2020e), with the Cultural Heritage Resource Assessment provided in in **Appendix E** of this report).

This section provides a high-level description of the established baseline condition, based on the key findings of each investigation or study, which will be used as the foundation for the development of alternative water servicing alternatives.

4.1 Socio-economic Environment

4.1.1 Town of East-Gwillimbury, including Mount Albert Community

In 2016, the population of Mount Albert Community was recorded as 4,925, an increase of 21.8 percent from the 4,044 recorded in 2011. It is expected that the build-out of the community will result in an overall residential population of approximately 6,000 people. Under the Village Core provisions of the Town's Official Plan, Centre Street remains an area for potential redevelopment opportunities. Figure 4-1 provides an overview of the current community boundary and proposed development areas in Mount Albert.

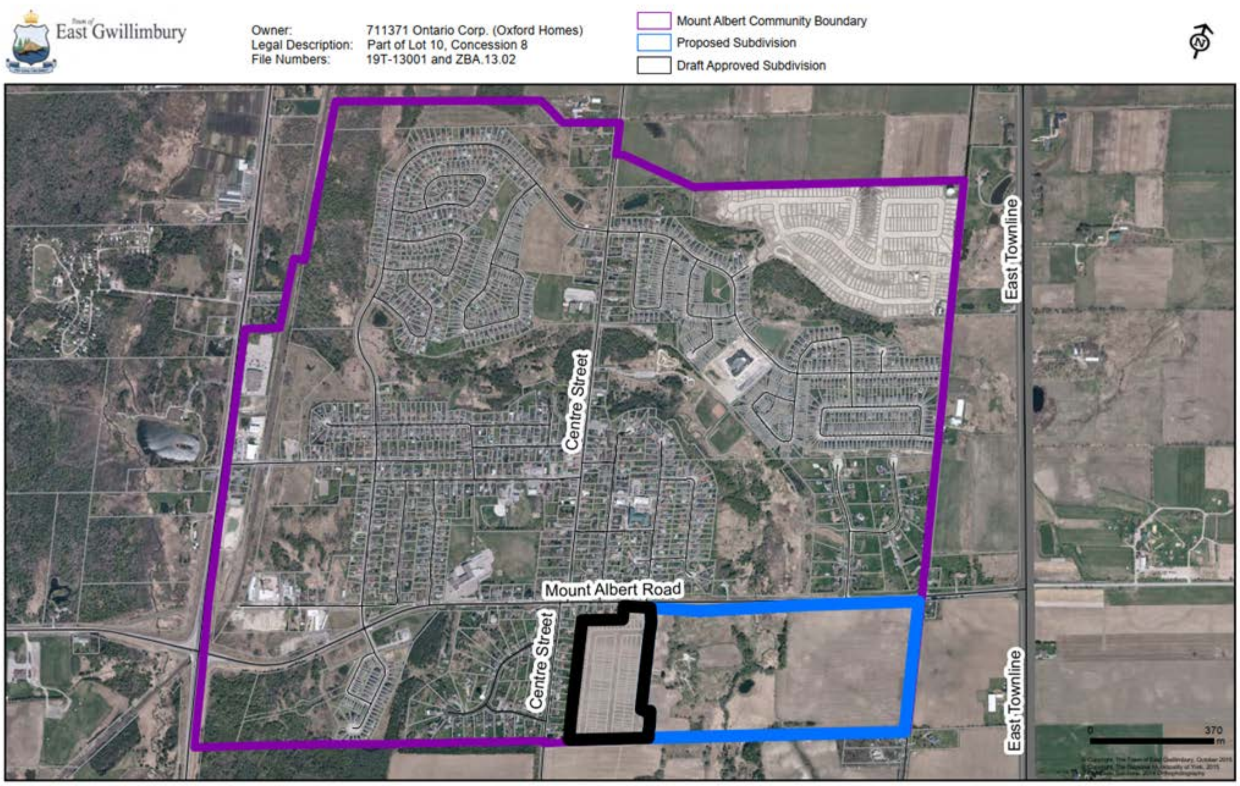

Figure 4-1. Mount Albert Development Plans - Current Community Boundary and Proposed Development

4.1.2 Land Use

Located on the eastern border of East Gwillimbury, the Community of Mount Albert is primarily a residential community, with a commercial, institutional and retail support area, surrounded by farms, regional forests and conservation areas. The urban area occupies the northern portion of the Study Area, while agricultural/rural land is located in the southern portion. Most of the Study Area is within the Greenbelt Plan and is designated "Protected Countryside" (92 percent of the study area), and a small portion of the land to the west is within the ORMCP area (8 percent of the Study Area).

Most of the Study Area is within Recharge Management Area (WHPA-Q). The south-central area of the Study Area, which includes a portion of Well 3 Facility, contains significant groundwater recharge areas per the LSRCA. The west-central area includes areas of highly vulnerable aquifers, according to ORMCP and LSRCA. The southeastern portion of the Study Area also includes wellhead protection areas for Wells 1, 2 and 3. The land-use activities in these areas may impact the groundwater quality and quantity, and proposed developments or change in activity must comply with the local source water protection plan according to the *Clean Water Act* (Province of Ontario, 2006).

Underground utilities located within the Study Area include the following.

- Local watermains, sanitary sewers, and storm sewers (owned and operated by the Town of East Gwillimbury)
- Hydro One Networks Inc.
- Enbridge Gas Distribution
- Bell Canada
- Rogers Cable Communications Inc

4.2 Natural Features Assessment

4.2.1 Geotechnical and Hydrogeology

Ground surface topography in the study area ranges from a high of approximately 309 m above sea level at the southern extent of the Study Area to a low of 228 m above sea level in the northwestern portion of the Study Area. The topography at both Well 1 & 2 Facility and Well No. 3 Facility is undulating and sloped.

The geology in the Study Area typically consists of post-glacial deposits (recent deposits) over the Oak Ridges Moraine Aquifer Complex (ORAC). The ORAC is comprised of interlobate glacial deposits whose texture ranges from silt to gravelly sand, but that typically consists of sand and gravel sediments. The ORAC is discontinuous and absent at each of the facilities but is present as a shallow discontinuous layer nearby each of the three sites. In the direct vicinity of the Wells 1 and 2 Facility, Well 3 Facility, and the North ET, the regional geology is characterized by post-glacial deposits over Newmarket Till, comprised of dense sand to silty sand diamicton sediments

The physiographic landforms characterizing the Study Area are predominantly drumlins, till plains, sand plains, and peat and muck. The surficial soils vary across the Study Area. Wells 1& 2, Wells 3 and North ET facilities are all located in regions characterized by till material consisting of stone-poor, sandy silt to silty sand on Paleozoic Terrain. Fine and coarse-textured glaciolacustrine deposits, alluvial deposits and organic deposits can also be expected at the surface across the Study Area.

The Study Area hydrogeological setting is dominated by the Oak Ridges Moraine Aquifer Complex (ORAC), a shallow aquifer only used by private water wells in Mount Albert. Approximately 400 well records were identified in the Study Area as being associated with domestic use, livestock, and commercial use. The ORAC is discontinuous and absent at the wells' production sites but present near these locations. The Mount Albert production wells are interpreted to draw water from the TAC. The TAC aquifer unit is deep and well-protected from anthropogenic contaminant sources because it is confined by overlying till units. There is no apparent hydraulic connection between the TAC or Inter-Newmarket Sediments aquifer units and the ORAC aquifer unit near the production wells. However, there is some degree of hydraulic connection between the Inter-Newmarket Sediments and TAC near Well 3.

Near the Wells 1 and 2 Facility and Well 3 Facility, the water table is estimated to be between 12 m and 14 m below ground surface, and 7 m and 10 m below ground surface, respectively. Construction dewatering is not anticipated to be significant at these facilities. Near the North ET, the water table is estimated to be between less than 1 m and 22 m below ground surface, and substantial construction dewatering volumes are anticipated in that area.

4.2.2 Aquatic and Terrestrial Environment

The Study Area is in the Black River Subwatershed, within the Lake Simcoe Watershed. The Study Area supports a number of significant natural environmental features as summarized here, but does not contain the following significant ecological areas:

- Areas of Natural and Scientific Interest
- Environmental Sensitive Area
- Habitat of endangered, rare, or threatened species per ORMCP

The Mount Albert Wells 1 and 2 Facility and Well 3 Facility are in the vicinity of Vivian Creek, a tributary to Mount Albert Creek and the Black River and considered a cool water habitat. None of the fish species found in Vivian Creek are endangered, threatened, or special concern, per O. Reg. 230/08: Species at Risk in Ontario List (Province of Ontario, 2008).

The Mount Albert Wetland Complex in the northwestern portion of the Study Area is considered a Provincially Significant Wetland. The wetlands adjacent to the Wells 1 and 2 Facility, Well 3 Facility and proposed works have not yet been evaluated under the Ontario Wetland Evaluation System, and construction in their vicinity would need to consider their current designation.

Mature trees and dense vegetation border the western and northern perimeter of the Wells 1 and 2 Facility with a relatively steep slope that tapers into the adjacent residential properties. The immediate area around Well 3 Facility is relatively clear of mature trees or dense vegetation; however, a forested area with treed swamps and marsh is located near the northeast corner of the property. The North ET property area includes a few mature trees and vegetation along the northern perimeter.

4.3 Surface Water Study

As several of the viable alternatives will result in the generation of backwash wastewater that will require disposal, a surface water study was undertaken to provide an initial assessment of potential impacts on surface water. The study reviewed potential discharge of backwash wastewater to the Mount Albert sanitary sewer collection system for treatment at the Mount Albert WRRF or treatment on-site at the well facilities and disposal of the treated wastewater to the nearby Vivian Creek, with an option to haul collected sludge to the Duffin Creek WPCP. On-site treatment for this assessment was assumed to be the use of the gravity settling process, which can typically remove 90% percent of suspended solids, along with iron and manganese.

Based on the capacity assessment of the Mount Albert WRRF (Blue Sky, 2018) and operational data from 2015 to 2017, the Mount Albert WRRF has sufficient capacity to collect, treat, and discharge the backwash wastewater under its current Environmental Compliance Approval. Considering the iron and manganese loads and the performance of existing secondary clarifier and tertiary treatment processes, there are no concerns about achieving the required iron and manganese levels before water enters the ultraviolet reactors.

The impacts of discharge of the supernatant from on-site treatment to Vivian Creek were investigated in terms of stream flow and quality, acknowledging that there is limited data available for a complete assessment. However, based on available information, the preliminary assessment identified that likely required effluent limits for chlorine, iron, manganese, and total suspended solids could not be achieved through gravity settling alone. The viability of discharge to Vivian Creek would require confirmation of effluent limits and associated treatment requirements through more detailed investigation of stream flow and water quality to more accurately assess impacts.

4.4 Cultural Environment

4.4.1 Archeological

A Stage 1 Archeological Assessment (AA) was completed to establish the archaeological potential of the areas that could be impacted by alternative solutions. The following heritage and archeological features were identified in the Study Area:

- Two designated heritage resources: Mount Albert Wesleyan Methodist Pioneer Cemetery at 19015 Centre Street and the George Haigh House at 5716 Mount Albert Road
- Four early cemeteries: Franklin Pioneer Cemetery at 5548 Herald Road; Mount Albert Cemetery at 19675 Centre Street; the Mount Albert Wesleyan Methodist Pioneer Cemetery; and Birchard Family Burying Grounds at 5590 Mount Albert Road
- Five registered archeological sites

Only the Mount Albert Wesleyan Methodist Pioneer Cemetery and the Birchard Family Burying Grounds would be in the vicinity of the identified viable alternatives. The swaths of land adjacent to these features identified as having moderate or high potential for the recovery of unmarked burials, and additional archaeological/cemetery investigations are required if construction activities occur in this area. Lands beyond 20 m of the cemetery were identified as having low potential for unmarked burials and are considered free of further investigations.

Although the majority of the Wells 1 and 2 Facility property has been previously disturbed through construction activities; the northwestern and southern portions of the property were identified to retain archaeological potential. At the Well 3 Facility property, the forested area, a portion of the property near the northeastern corner and the immediate area were identified to retain archaeological potential. These areas require further archaeological investigation and would be subject to a Stage 2 AA if construction activities or other soil-disturbing activities were to occur within these areas, including the development of construction laydown areas.

4.4.2 Cultural Heritage

A Cultural Heritage Resource Assessment was completed to establish the existing conditions of the Study Area, present an inventory of aboveground built heritage resources and cultural heritage landscapes, assess potential impacts of the proposed undertaking, and propose appropriate mitigation measures and recommendations to minimize and avoid impacts to identified cultural heritage resources. During the background review and field work, 12 cultural heritage resources were identified within and adjacent to the area potentially impacted by the works, including nine built heritage resources (BHRs) and three cultural heritage landscapes (CHLs):

- 19014 Centre Street (BHR 1)
- 19031 Centre Street (BHR 2)
- 5623 Mount Albert Road (BHR 3)
- 5631 Mount Albert Road (BHR 4)
- 5664 Mount Albert Road (BHR 5)
- 18855 Centre Street (BHR 6)
- 6 Alice Street (BHR 7)
- 10 Alice Street (BHR 8)
- 5639 Mount Albert Road (BHR 9)
- 19015 Centre Street (CHL 1)
- 18784 Centre Street (CHL 2)
- 5590 Mount Albert Road (CHL 3)

No direct impacts are anticipated to identified cultural heritage resources as the proposed works are contained within the property at Wells 1 and 2 Facility and Well 3 Facility and the existing rights-of-ways. Indirect impacts to seven cultural heritage resources (BHR 1 to BHR 4, BHR 6, CHL 1, and CHL 3) may occur as a result of their proximity to the proposed works in the right-of-way. To prevent these seven identified cultural heritage resources from being impacted during construction, baseline vibration monitoring should be undertaken during detailed design. If this advance monitoring assessment determines the structures or landscape features within the cultural heritage resources will be subject to vibrations, a vibration monitoring plan should be prepared and implemented to lessen vibration impacts related to construction.

5. Evaluation Framework and Criteria

To determine the most appropriate solution for the Mount Albert Water Supply System, an evaluation framework was developed to allow a comparative assessment of the short-listed alternatives. Table 5-1 summarizes the evaluation criteria, which reflect four overarching categories of the environment (Natural, Socio-cultural, Technical, and Economic). These criteria are based on the triple-bottom-line approach described in the Class EA process and were established through consultation with York Region, and with the following considerations:

- The existing conditions of the Study Area
- The alternative solutions being considered
- The Problem/ Opportunity Statement

Table 5-1 also presents the main considerations for each criterion to achieve the following guidelines.

- **Mutually Exclusive and Collectively Exhaustive** – to avoid double-counting possible consequence and to prevent important considerations from being neglected
- **Concise** – to focus the analysis only on the objectives necessary to make a decision
- **Operational** – to confirm the information necessary to measure objectives can be obtained with reasonable time and effort
- **Measurable** – to define objectives precisely and to specify the degree to which objectives may be achieved
- **Understandable** – to facilitate the communication of insights from the decision-making process

Table 5-1. Comparative Evaluation Criteria

Comparative Criteria	Description
Natural Environment	Not Applicable
Aquatic Vegetation and Wildlife	Potential impact on local aquatic species and habitats, aquatic species at risk, and locally significant aquatic species
Terrestrial Vegetation and Wildlife	Potential impact on local terrestrial species and habitats, designated areas, species at risk, and locally significant species
Surface water	Potential impact on the quantity and quality of surface water
Soil and Geology	Geology, hydrogeology, and contamination considerations
Socio-cultural Environment	Not Applicable
Archaeological Sites	Potential impact on registered/known archaeological features during construction or ongoing operations
Cultural/Heritage Features	Potential impact on known cultural landscapes and built heritage features during construction or ongoing operations
Impacts During Construction	Potential construction impacts due to noise, dust, odour or traffic and duration of adverse effects
Long-term Community Impact	Long-term impact on local community and business including land-use compatibility
Planning Policy Compliance	Compliance with Local and Regional Planning Policies
Technical Considerations	Not Applicable
Ease of Implementation	Ease of implementation in terms of available space, accessibility, new infrastructure, constructability, easements, and land acquisition needs
System Redundancy	Improvement in redundancy of supply/service to allow continuous water supply and proper maintenance
Reliability of Supply	Ability to provide reliable water quality on a consistence basis

Comparative Criteria	Description
Operations	Requirement for additional and new Operations resources at regional and municipal level. The complexity and operability of new assets
Maintenance	Requirement for additional and new maintenance resources at regional and municipal level; the complexity and maintainability of new assets
Alignment with Other Infrastructure	Potential impacts on functions or performance of other infrastructure, such as wastewater, conveyance, transportation, and utility projects
Flexibility	Flexibility in being able to meet future demands/expansion requirements; or future regulatory requirements
Permits and Approvals	Ease of receiving permits and approvals, including the agency approvals necessary
Economic Evaluation	Not Applicable
Lifecycle Cost	Net present value whole-life cost

For each comparative criterion, the alternatives are assigned a ranking of least preferred, moderately preferred, and most preferred (Figure 5-1). This preference is established based on the alternative solutions' levels of impacts and benefits. Next, these rankings are summed, so each criterion is equally weighted, to provide an overall recommended solution.

Figure 5-1. Evaluation Scoring

The evaluation criteria were presented to the public at the Public Consultation Centre (PCC) No. 1 for review and comment. The responses did not provide additional criteria to include for assessing alternatives, but comments were collected regarding the relative importance of each criterion. The responses generally ranked the evaluation categories and criteria within each category equally, apart from the Reliability of Supply, which 91 percent of participants scored as Extremely Important. As consistency among the criteria was observed in general, it is considered appropriate to apply equal weighting to each criterion for evaluation.

6. Comparative Evaluation of Shortlisted Alternative Solutions

The following section describes further shortlisted alternatives and summarizes the comparative evaluation to identify the preferred alternative. The concept designs were developed to establish the level of effort related to each alternative, to allow the comparative evaluation. The design concept for the preferred alternative will be confirmed, refined, and detailed during Phase 5 of the Class EA Study. Detailed descriptions of short-listed alternatives and comparative evaluation with scoring rationale is presented in *Technical Memorandum No. 2: Identification and Assessment of Alternative Solution* in **Appendix D** (Jacobs 2020e).

6.1 Alternative Solutions to Improve Water Quality

6.1.1 Alternative A4: Continue Sequestration at Wells 1 and 2 Facility and Well 3 Facility, and Upgrade Systems to Optimize Operations and Maintenance

Alternative A4 involves the continuation of sequestration to control iron and manganese, but with the following optimization strategies recommended in the System Capacity Optimization Study (Jacobs, 2020c) in **Appendix B**.

- Complete the following improvements for the silicate dosing systems:
  - Implement improvements undertaken at Wells 1 and 2 Facility at Well 3 Facility to allow for the calibration columns and injection points to undergo tempered flushing and cleaning.
  - Supply a pressure or flow switch to provide a more positive indication of silicate application at both facilities.
  - Increase regular mixing and changeover in the sodium silicate tanks to maintain good-quality silicate at both facilities.
  - Continue to monitor and validate dosage accuracy for continuous process improvements.
  - Review of the impact of raw water chemistry on sequestration effectiveness, as infrastructure issues are addressed.
- Clean and inspect chlorine contact chambers at the Wells 1 and 2 Facility and the Well 3 Facility.
- Clean and inspect the North ET.
- Collaborate with the Town of East Gwillimbury to develop and implement a tailored monitoring program for the distribution system, to assess and track iron and manganese sequestration effectiveness and distribution system maintenance needs.
- Collaborate with the Town of East Gwillimbury to refine a unidirectional flushing program to identify optimal flushing conditions and frequency and implement a swabbing program to address accumulated deposits.
- Validate the low pressure detected by the hydraulic model is occurring in the distribution system, then investigate operational adjustments to address the low-pressure issues in the distribution system without compromising the water quality.

Table 6-1 presents the key considerations of Alternative A4.

Table 6-1. Alternative A4: Key Considerations

Criterion	A4: Continue Sequestration at Wells 1 and 2 Facility and Well 3 Facility, and Upgrade Systems to Optimize Operations and Maintenance
Natural Environment	No anticipated impacts on natural environment, as works are undertaken within existing buildings and no anticipated additional groundwater pumping rates from TAC aquifer
Socio-cultural Environment	No anticipated impacts on archeological/cultural/heritage features and minor anticipated impacts during construction, as works are undertaken within existing buildings Potential for heavy iron and manganese deposition continues resulting in customer complaints due to staining of fixtures and fouling of POU devices, which may contribute to low pressures
Technical Considerations	While proposed capital improvements may improve existing operation, significant focused operations and maintenance efforts would be required to monitor the sequestration effectiveness across the distribution system and to minimize deposition at the chlorine contact chambers, North ET, and distribution system Iron and manganese deposition in the distribution system is considered potentially heavy (>10 g/m/year), requiring frequent cleaning and flushing of the system to address the deposition of solids and associated negative aesthetic events to reduce customer complaints Presents challenges in accommodating the new Health Canada manganese guidelines, if it is implemented by MECP, as maintaining Well 1 in operation is required to provide adequate redundancy throughout the planning horizon No need for property acquisition as works are undertaken within existing buildings

Notes:

g/m/year = gram(s) per metre of pipe per year

POU = point of use

6.1.2 Alternative A5: Provide Iron and Manganese Removal Technology for All Wells

Alternative A5 involves providing iron and manganese removal technology for all wells. A review of available treatment technologies undertaken through the recent Groundwater Treatment Strategy Study (Jacobs, 2020a) identified adsorptive filtration using a continuously regenerated adsorptive media for removal. The well supply is pre-oxidated with chlorine to oxidize iron, which then precipitates and is removed through a series of pressure filters. Manganese is removed via adsorption onto the filter media surface. Solids collected through filtration are removed through periodic backwashing for either disposal to the sanitary sewer collection system or onsite residual management, which provides solids concentration onsite, supernatant discharge to a local receiver, and sludge disposal offsite or to the sanitary sewer collection system. A multifilter design approach has been applied to minimize equipment, footprint, and backwash volume requirements. Section 6.1.5 discusses the residual management system and its viable strategies.

Both treatment facilities sites have the potential to accommodate the identified building footprint for the removal technology. For the Wells 1 and 2 Facility, a new building housing the removal technology and the associated equipment is considered north of the existing building for this Class EA study, space is also available south or west of the existing building... For the Well 3 Facility, a building extension northeast of the existing building would house treatment equipment. While there is sufficient space at both sites for treatment facilities, as there are no sanitary sewer collection facilities near Well 3 consideration was given to centralizing treatment to avoid minimize additional sanitary sewer construction. The following sub-options were considered:

- Sub-option A5a: Centralized removal technology at Wells 1 and 2 Facility
- Sub-option A5b: Decentralized removal technology at both facilities

For Alternative A5a, the existing transmission main from Well 3 would be repurposed and extended to convey raw water to a new treatment facility at the Wells 1 and 2 Facility.

Table 6-2 presents the key considerations of Alternative A5.

Table 6-2. Alternative A5: Key Considerations

Criterion	A5a: Centralized Removal Technology at Wells 1 and 2 Facility	A5b: Decentralized Removal Technology at both Facilities
Natural Environment	Minor anticipated impacts on natural environment as works are undertaken within existing properties and along existing roads and streets without waterbody crossing Additional groundwater pumping from TAC aquifer for backwashing (5.3%), but no anticipated impact since within PTTW No anticipated impact on private well users during construction due to dewatering since no groundwater taking requirements	Minor anticipated impacts on natural environment as works are undertaken within existing properties and along existing roads and streets without waterbody crossing Additional groundwater pumping from TAC aquifer for backwashing (6.7%), but no anticipated impact since within PTTW No anticipated impact on private well users during construction due to dewatering since no groundwater taking requirements
Socio-cultural Environment	Preliminary layout of alternative can be limited to areas without archeological potential; no impact on cultural/heritage features Moderate anticipated impacts during construction as works are undertaken within existing properties and along existing roads Significant reduction of POU softeners fouling by iron and manganese with removal technology and staining of fixtures	Preliminary layout of alternative can be limited to areas without archeological potential. No impact on cultural/heritage features Moderate anticipated impacts during construction as works are undertaken within existing properties Significant reduction of POU softeners fouling by iron and manganese with removal technology and staining of fixtures Works at Well 3 Facility partially within Greenbelt natural heritage area
Technical Considerations	Removal technology would allow for aesthetic objectives and treatment goals to be achieved consistently This strategy considerably reduces the levels of iron and manganese in the treated water and the deposition in the chlorine contact chambers, North ET, and distribution system, which reduces customer complaints related to discoloured water, the need for monitoring, and the frequency of cleaning and flushing infrastructure There is little potential concern that the particulate iron and manganese will accumulate along the raw water transmission main, requiring frequent cleaning and flushing of the system to address the deposition of solids Removal technology would reduce manganese levels less than the Health Canada manganese guidelines and Well 1 can be returned to service to provide sufficient supply capacity to meet current and future water demands beyond 2041 The existing transmission main has sufficient capacity to deliver water from Well 3 and Well MW18, if Well MW18 is required as part of the system in the future All water supply is routed through a single contact tank and a single facility Consideration can be given to maintain the sequestration and chlorination systems at Well 3 Facility, in case of emergency to increase the security of supply No need for property acquisition as works can be accommodated within existing properties and right-of-way	Removal technology would allow for aesthetic objectives and treatment goals to be achieved consistently This strategy considerably reduces the levels of iron and manganese in the treated water and the deposition in the chlorine contact chambers, North ET, and distribution system, which reduces customer complaints related to discoloured water, the need for monitoring, and the frequency of cleaning and flushing infrastructure Removal technology would reduce manganese levels less than the Health Canada manganese guidelines and Well 1 can be returned to service to provide sufficient supply capacity to meet current and future water demands beyond 2041 Alternative A5b provides a higher level of redundancy and operational flexibility than Alternative A5a since it includes multiple wells being treated at different locations No need for property acquisition as works can be accommodated within existing properties

6.1.3 Alternative A6: Provide Iron and Manganese Removal Technology at Wells 1 and 2 Facility and Continue Sequestration at Well 3 Facility

Alternative A6 combines Alternatives A4 and A5. Given the improved raw water quality of Well 3, sequestration would continue for iron and manganese control method at Well 3, after the optimization strategies as detailed in Alternative A4. The Wells 1 and 2 Facility is upgraded with iron and manganese removal technology. Similar to Alternative A5, the removal technology was considered to be adsorptive filtration and chlorine as an oxidant. A multifilter design approach has been applied to minimize equipment, footprint, and backwash volume requirements. Section 6.1.5 discusses the residual management system and its viable strategies. For the Wells 1 and 2 Facility, a new building housing the removal technology and the associated equipment could be located north of the existing building, and the existing Well 3 facility has sufficient space for the identified upgrades. Table 6-3 presents the key considerations of Alternative A6.

Table 6-3. Alternative A6: Key Considerations

Criterion	A6: Provide Iron and Manganese Removal Technology at Wells 1 and 2 Facility and Continue Sequestration at Well 3 Facility
Natural Environment	Minor anticipated impacts on natural environment as works are undertaken within existing properties and along existing roads and streets without waterbody crossing Additional groundwater pumping from TAC aquifer for backwashing (5.3%), but no anticipated impact since within PTTW No anticipated impact on private well users during construction due to dewatering since no groundwater taking requirements
Socio-cultural Environment	Preliminary layout of alternative can be limited to areas without archeological potential. No impact on cultural/heritage features Moderate anticipated impacts during construction as works are undertaken within existing properties Potential for moderate iron and manganese deposition continues resulting in customer complaints due to staining of fixtures and fouling of POU devices, which may contribute to low pressures
Technical Considerations	The addition of removal technology would allow for the aesthetic objectives and treatment goals to be achieved consistently at Wells 1 and 2 Facility Well 3 raw water quality is comparatively better, but the interference of the identified factors of hardness, alkalinity, and potentially phosphate on the treatment process cannot be easily avoided, so the potential of water quality issues remains Focused operations and maintenance efforts would be required to monitor the sequestration effectiveness throughout the distribution system and maintain the chlorine contact chamber at Well 3 Facility, North ET, and distribution system free of deposition to minimize the release of legacy manganese and resulting customer complaints As the quality of treated water from each facility will be considerably different, the blending of the supplies may generate water quality issues, which can result in deposition across the distribution system The alternative can accommodate the potential implementation of the new manganese guidelines; however, careful consideration needs to be given to the potential for the accumulation and subsequent release of manganese in the distribution system As Well 1 would be returned to service, sufficient supply capacity would be available to meet current and future water demands beyond 2041 This alternative provides flexibility to incorporate Well MW18, if Well MW18 is required as part of the system in the future If sequestration cannot be implemented effectively at Well 3, the opportunity also exists to either implement iron and manganese removal technology at Well 3 Facility or to connect to treatment at Wells 1 and 2 Facility No need for property acquisition, as works can be accommodated within existing properties

6.1.4 Alternative A7: Connect New Well (MW18) to Mount Albert Water Supply System and Remove Wells 1 and/or 2

Alternative A7 involves expanding the Well 3 Facility to connect Well MW18 to the water supply system and decommissioning Wells 1 or 2, or both. With this alternative, sequestration continues to control iron and manganese, at least for Well 3 and the new well MW18. Therefore, the optimization strategies must be implemented as detailed in Alternative A4. This alternative is divided into three sub-options:

- Sub-option A7a: Replace Well 1 with Well MW18 and continue sequestration for all wells.

- Sub-option A7b: Replace Wells 1 and 2 with Well MW18, and re-rate Wells 3 and MW18 for a maximum taking per minute of 39.4 L/s (3.40 MLD) to match the forecasted MDD and continue sequestration.
- Sub-option A7c: Replace Well 1 with Well MW18, continue sequestration at the Well 3 Facility, and provide iron and manganese removal technology for Well 2 at the Wells 1 and 2 Facility.

Alternatives A7a and A7c are based on the current capacity of 37.88 L/s (3.27 MLD) for Wells 2 and 3 and the development of Well MW18 to that same capacity. With Alternative A7b, the Wells 3 and MW18 maximum taking per minute is increased to 39.4 L/s (3.4 MLD) to match the forecasted MDD without Wells 1 and 2 in service.

Similar to Alternative A5, Alternative A7c assumed the removal technology to be adsorptive filtration and chlorine as an oxidant, and a multifilter design approach was assumed. Section 6.1.5 discusses the residual management system and its viable strategies. Both treatment facilities sites have the potential for building expansion. For the Wells 1 and 2 Facility, a new building housing the removal technology and the associated equipment is considered north of the existing building for this Class EA study, space is also available south or west of the existing building. For the Well 3 Facility, an extension northeast of the existing building is considered to house the equipment associated with Well MW18. For the Well 3 Facility, it is necessary to expand the chlorine dosing system, sodium silicate dosing system, and chlorine contact tank. Table 6-4 presents the key considerations of Alternative A7.

Table 6-4. Alternative A7: Key Considerations

Criterion	A7a: Replace Well 1 with Well MW18 and continue sequestration for all wells	A7b: Replace Wells 1 and 2 with Well MW18, re-rate Wells 3 and MW18, and continue sequestration	A7c: Replace Well 1 with Well MW18, continue sequestration at Well 3 Facility, and provide iron and manganese removal technology at Wells 1 and 2 Facility
Natural Environment	Minor anticipated impacts on natural environment as works are undertaken within existing properties No anticipated additional groundwater pumping rates from TAC aquifer, but the zone of influence may change with new well pumping and potentially impact well users	Minor anticipated impacts on natural environment as works are undertaken within existing properties No anticipated additional groundwater pumping rates from TAC aquifer, but the zone of influence may change with new well pumping and potentially impact well users	Minor anticipated impacts on natural environment as works are undertaken within existing properties Additional groundwater pumping from TAC aquifer for backwashing (4.3%), but no anticipated impact since within PTTW; however, the zone of influence may change with new well pumping and potentially impact well users
Socio-cultural Environment	Preliminary layout of alternative can be limited to areas without archeological potential; no impact on cultural/heritage features Moderate anticipated impacts during construction as works are undertaken within existing properties Potential for moderate iron and manganese deposition continues resulting in customer complaints due to staining of fixtures and fouling of POU devices, which may contribute to low pressures	Preliminary layout of alternative can be limited to areas without archeological potential; no impact on cultural/heritage features Moderate anticipated impacts during construction as works are undertaken within existing properties Potential for moderate iron and manganese deposition continues resulting in customer complaints due to staining of fixtures and fouling of POU devices, which may contribute to low pressures	Preliminary layout of alternative can be limited to areas without archeological potential; no impact on cultural/heritage features Moderate anticipated impacts during construction as works are undertaken within existing properties Potential for moderate iron and manganese deposition continues resulting in customer complaints due to staining of fixtures and fouling of POU devices, which may contribute to low pressures
Technical Considerations	Wells 3 and MW18 raw water quality is comparatively better, but the interference of the identified factors of hardness, alkalinity and potentially phosphate on the treatment process cannot be easily avoided, so the potential of water quality issues remains Focused operations and maintenance efforts would be required to monitor the sequestration effectiveness throughout the distribution system and maintain the chlorine contact chamber at Well 3 Facility, North ET, and distribution system free of deposition to minimize the release of legacy manganese and resulting customer complaint. The alternative can accommodate the potential implementation of the new manganese guidelines; however, careful consideration needs to be given to the potential for the accumulation and subsequent release of manganese in the distribution system As Well MW18 testing indicates sufficient quantity of supply, it is considered that the sub-options that replace Well 1 with MW18 would meet the criteria of sufficient supply for the long-term needs No need for property acquisition as works can be accommodated within existing properties	If both Wells 1 and 2 are replaced, it is considered that additional hydrogeological study would confirm the viability of increasing the maximum taking per minute required, as there would be no net increase in daily water taking from the aquifer Reconstruction of Well 3 would be required for the increased rate. Wells 3 and MW18 raw water quality is comparatively better, but the interference of the identified factors of hardness, alkalinity and potentially phosphate on the treatment process cannot be easily avoided, so the potential of water quality issues remains Focused operation and maintenance efforts would be required to monitor the sequestration effectiveness throughout the distribution system and maintain the chlorine contact chamber at Well 3 Facility, North ET, and distribution system free of deposition to minimize the release of legacy manganese and resulting customer complaints The alternative can accommodate the potential implementation of the new manganese guidelines. However, careful consideration needs to be given to the potential for the accumulation and subsequent release of manganese in the distribution system As Well MW18 testing indicates sufficient quantity of supply and the marginal increase of Well 3 maximum taking per minute, it is considered that the sub-options that replace Well 1 with MW18 would meet the criteria of sufficient supply for the long-term needs The security of supply becomes entirely dependent on a single facility and a long-run single transmission main with the decommissioning of Wells 1 and 2 More detailed hydraulic modelling validation during design is required to assess the impacts on system pressures No need for property acquisition, as works can be accommodated within existing properties	The addition of removal technology would allow for the aesthetic objectives and treatment goals to be achieved consistently at Wells 1 and 2 Facility Wells 3 and MW18 raw water quality is comparatively better, but the interference of the identified factors of hardness, alkalinity and potentially phosphate on the treatment process cannot be easily avoided, so the potential of water quality issues remains As the quality of treated water from each facility will be considerably different, the blending of the supplies may generate water quality issues, which can result in deposition across the distribution system Focused operation and maintenance efforts would be required to monitor the sequestration effectiveness throughout the distribution system and maintain the chlorine contact chamber at Well 3 Facility, North ET, and distribution system free of deposition to minimize the release of legacy manganese and resulting customer complaints The alternative can accommodate the potential implementation of the new manganese guidelines. However, careful consideration needs to be given to the potential for the accumulation and subsequent release of manganese in the distribution system As Well MW18 testing indicates sufficient quantity of supply, it is considered that the sub-options that replace Well 1 with MW18 would meet the criteria of sufficient supply for the long-term needs Alternative A7c allows for a phased approach by implementing removal technology for Wells 3 and MW18 in the future in the event continued sequestration does not yield satisfactory results No need for property acquisition as works can be accommodated within existing properties

6.1.5 Residual Management for Alternatives with Iron and Manganese Removal Technology

The adsorptive filtration technology generates residuals from backwashing the filters, which contain elevated levels of iron and manganese oxides. Iron concentration can reach up to 50 mg/L, and manganese concentration can reach up to 5.6 mg/L in the backwash wastewater. Other constituents of the source water are not expected to become more concentrated and do not influence the selection of the residual management strategy. Additional details regarding the backwash wastewater characteristics are presented in the *Surface Water Study* (Appendix D of **Appendix D** provided in this report).

Neither of the treatment facilities currently have a direct connection to the sanitary sewer collection system or stormwater system. The sanitary sewer collection system at Centre Street, north of Mount Albert Road, is 400 m from the Wells 1 and 2 Facility and 2,000 m from the Wells 3 Facility. The closest local receiving body is Vivian Creek, which is 800 m from the Wells 1 and 2 Facility and 400 m from Wells 3 Facility. The Wells 1 and 2 Facility is 420 m from the closest sub-district stormwater system, which discharges to Vivian Creek. The following residual management alternatives were considered viable and have been carried forward for further evaluation.

- **Alternative R1:** Direct connection to sanitary sewer collection system.

  This alternative involves discharging backwash wastewater to an onsite equalization tank, where it is pumped through a new forcemain to a connection to the existing local sanitary sewer collection system for treatment at the Mount Albert WRRF.

- **Alternative R2:** Onsite treatment, with supernatant discharged to Vivian Creek and sludge discharged to sanitary sewer collection system.

  This alternative involves the installation of onsite treatment to treat the backwash wastewater. Treated backwash wastewater (supernatant) would be discharged to Vivian Creek, either directly or via the nearest sub-district stormwater system. The gravity settling process and dechlorination are both considered to be part of the onsite treatment. The sludge generated would be pumped to the sanitary sewer and treated at the Mount Albert WRRF.

- **Alternative R3:** Onsite treatment, with supernatant discharged to Vivian Creek and sludge hauled offsite.

  This alternative involves the installation of a gravity settling tank to treat the backwash wastewater, similar to Alternative R2; however, the sludge is discharged to tanker trucks and hauled to the Duffin Creek WPCP for further treatment and disposal.

Given the depth of the wells, in accordance with O. Reg. 372, the siting of the residual management system assumes a separation distance of at least 15 m from the production wells. For the Wells 1 and 2 Facility, the available space for the residual management facility is very limited: it could be located in the southern portion of the existing building and north of the South ET to minimize modification of live yard piping, or the South ET could be demolished to create additional space. At the Well 3 Facility, the residual management system could be in the northeastern corner of the property. Table 6-5 presents the key considerations of the residual management alternatives, to be considered along with Alternatives A5a, A5b, A6, and A7c.

Table 6-5. Residual Management Alternatives: Key Considerations

Criterion	R1: Direct connection to sanitary sewer collection system	R2: Onsite treatment with supernatant discharged to Vivian Creek and sludge discharged to sanitary sewer collection system	R3: Onsite treatment with supernatant discharged to Vivian Creek and sludge hauled offsite
Natural Environment	Minor anticipated impacts on natural environment during construction as works are undertaken within existing properties and along existing roads and streets without waterbody crossing Negligible associated long-term impacts on aquatic vegetation and species, as well as on surface water	Significant anticipated impacts on terrestrial vegetation and wildlife during construction of the Well 3 Facility outfall (open-cut method); mitigation measures would be required to offset the impact through the wetland area Limited data to assess the impacts of iron and manganese discharge to Vivian Creek and aquatic ecology at the moment, but there is potential that Vivian Creek could assimilate these constituents, given the low volume of the supernatant with the anticipated degree of treatment Further investigation and assessments would be required to assess the treatment requirements for the backwash wastewater and effluent discharge limits Enhanced residuals on-site treatment may be required to avoid long-term impacts on aquatic vegetation and species and surface water with the discharge of supernatant of on-site treatment to Vivian Creek	Significant anticipated impacts on terrestrial vegetation and wildlife during construction of the Well 3 Facility outfall (open-cut method); mitigation measures would be required to offset the impact through the wetland area Limited data to assess the impacts of iron and manganese discharge to Vivian Creek and aquatic ecology at the moment, but there is potential that Vivian Creek could assimilate these constituents, given the low volume of the supernatant with the anticipated degree of treatment Further investigation and assessments would be required to assess the treatment requirements for the backwash wastewater and effluent discharge limits Enhanced residuals onsite treatment may be required to avoid long-term impacts on aquatic vegetation and species and surface water with the discharge of supernatant of on-site treatment to Vivian Creek
Socio-cultural Environment	Planned works near designated heritage resources and areas with potential of unmarked burials are within highly disturbed right-of-way, and no impact is anticipated Moderate anticipated impacts during construction, as works are undertaken within existing properties and along existing roads and streets Works at Well 3 Facility partially within Greenbelt natural heritage area	Planned works near designated heritage resources and areas with potential of unmarked burials are within highly disturbed right-of-way and no impact is anticipated Stage 2 archeological assessment required along for Well 3 Facility outfall to Vivian Creek Moderate anticipated impacts during construction, as works are undertaken within existing properties and along existing roads and streets Works at Well 3 Facility partially within Greenbelt natural heritage area; construction of the Well 3 Facility outfall within LSRCA-regulated area Sludge residuals are within By-Law No. 2011-56 sewer discharge limits, except for manganese Supernatant is within By-Law No. 2011-56 stormwater discharge limits, except for manganese	Stage 2 archeological assessment required along Well 3 Facility outfall alignment to Vivian Creek Additional traffic, noise, dust and greenhouse gas emissions due to sludge haulage Works at Well 3 Facility partially within Greenbelt natural heritage area Supernatant is within By-Law No. 2011-56 stormwater discharge limits, except for manganese
Technical Considerations	The existing sanitary sewer collection system, Mount Albert SPS and Mount Albert WRRF have sufficient capacity to collect and treat the backwash wastewater The discharge to the sanitary sewer may be programmed for off-peak hours if required, and the interlock with the SPS SCADA is recommended in order to avoid surcharging the sanitary sewer collection system and SPS during high flow events Negligible impact on the Mount Albert WRRF hydraulic capacity, treatment performance, and operations No need for property acquisition as works are undertaken within existing sites and rights of way	The Mount Albert stormwater system has sufficient hydraulic capacity to collect and discharge the supernatant from Wells 1 and 2 Facility The existing sanitary sewer collection system, Mount Albert SPS and Mount Albert WRRF have sufficient capacity to collect the sludge Property acquisition required for construction of Well 3 Facility outfall	The Mount Albert stormwater system has sufficient hydraulic capacity to collect and discharge the supernatant from Wells 1 and 2 Facility The Duffin Creek WPCP has sufficient capacity to and treat the anticipated sludge volumes Property acquisition required for construction of Well 3 Facility outfall

Notes:

SPS = sewage pumping station

6.2 Alternative Solutions to Improve Feasibility of Storage Maintenance

6.2.1 Alternative B2: Rehabilitation of Mount Albert South Elevated Tank and Return it to Service

Alternative B2 involves returning the South ET back to service temporarily during the North ET maintenance. The South ET, which has a design storage capacity of 910 m^3, is currently offline due to its poor asset condition, and a major rehabilitation is required to bring this tank back into service. The recent condition assessment (Landmark, 2020) noted the following repairs as necessary for the South ET to return when the North ET requires maintenance:

- Interior lining replacement
- Tank roof reinforcement
- Access and safety equipment reinforcement or replacement

These repairs would be considered temporary in nature and would not significantly extend the useful life of the tank. The South ET has enough storage to provide equalization storage which provides a cushion between production and demand to meet the diurnal variation of water demand when the North ET is out of service. However, it does not have enough capacity to provide the required fire storage of 1200 m^3. Table 6-6 presents the key considerations of Alternative B2.

Table 6-6. Alternative B2: Key Considerations

Criteria	B2: Rehabilitation of Mount Albert South Elevated Tank and Return it to Service
Natural Environment	No anticipated impacts on natural environment and no anticipated changes on groundwater pumping rates and private well users during construction due to dewatering, as works are undertaken within existing infrastructure
Socio-cultural Environment	No anticipated impacts on archeological/cultural/heritage features and minor anticipated impacts during construction as works are undertaken within existing infrastructure Partial fire storage available and fire flow could not be adequately supplied when North ET is off-service, requiring the implementation of fire contingency plan
Technical Considerations	The South ET has sufficient storage capacity to provide equalization storage for the water supply system but does not provide sufficient fire flow storage A contingency plan would need to be developed for operation during the maintenance period, to bring on additional wells on an emergency basis and investigate alternate means to meet fire flow demands with Fire Protection Services South ET requires major structural rehabilitation in order to return the tank to service, even on a limited basis Given the degree of structural rehabilitation identified, there is some potential that the tank cannot be successfully rehabilitated and will need to be demolished Increase the water age in the distribution system with the return of South ET to service, which may contribute to water quality issues related to chlorine residual decay Returning the South ET temporarily to service will allow for temporary increased pressures in the elevated areas of the distribution network near the Wells 1 and 2 Facility caused by hydraulic limitations of the distribution system There is additional maintenance effort required for maintaining South ET No need of property acquisition, as works are undertaken within existing infrastructure

6.2.2 Alternative B3: Operate the Distribution System in Pressure Mode

Alternative B3 involves operating the distribution system in pressure mode when the North ET is bypassed during inspection and maintenance activities. The well pumps are equipped with VFDs, which can be controlled for pressure mode operation. However, the minimum pumping capacity is identified at 12 L/s for efficient operations, while the demand during nighttime can be as low as 3 L/s. Since the minimal flow supplied by the well pumps exceeds the current minimum demand, the distribution system can become over pressurized when flow exceeds demand. Solutions to avoid over pressurization include increasing nighttime demand, typically through irrigation and other outdoor water uses or by wasting excess water through auto flushers and pressure relief valves. The temporary installation of smaller well pump or a pressure tank system may assist if a prolonged shutdown period is required for the North ET during major rehabilitation. This alternative includes the implementation of equipment and controls to facilitate the pressure operations of facilities that would not require major capital investment. Table 6-7 presents the key considerations of Alternative B3.

Table 6-7. Alternative B3: Key Considerations

Criterion	B3: Operate the Distribution System in Pressure Mode
Natural Environment	No anticipated impacts on natural environment and no anticipated changes on groundwater pumping rates and private well users during construction due to dewatering, as works are undertaken within existing infrastructure Significant operational water usage to avoid over pressurization during pressure mode operation and low demand periods The discharge of excess of water could cause localized erosion if the stormwater system was overloaded
Socio-cultural Environment	No anticipated impacts on archeological/cultural/heritage features and no anticipated impacts during construction as works are undertaken within existing infrastructure No fire storage available and fire flow could not be adequately supplied when North ET is off-service, requiring the implementation of fire contingency plan
Technical Considerations	Hydraulic modelling and field validation is required to assess the operational protocols necessary to avoid over pressurization of the system and the availability of fire flow protection during this scenario, as well as potential testing of all three well pumps in operation to assess their ability to increase the permitted taking requirement During the maintenance period, additional efforts required to modify operations and increase the demand in the system, either through community communication programs to increase water usage during low flow periods or by discharging excess flows through the system A contingency plan would need to be developed for operation during the maintenance period, to bring on additional wells on an emergency basis and investigate alternate means to meet fire flow demands with Fire Protection Services Operation in pressure mode will temporarily benefit areas with low pressure in the distribution network near the Wells 1 and 2 Facility No need of property acquisition as works are undertaken within existing infrastructure

6.3 Whole-life Cost

The whole-life costs were estimated for each alternative (Table 6-8 and Table 6-9). A 20-year planning period from 2021 to 2040 was used, and the following assumptions were applied:

- On capital projects, an allowance of 20 percent for design/engineering and contract administration/site inspection, and a 30 percent construction contingency based on the construction costs were included in calculating the total capital investments.
- An allowance of 5 percent of capital projects or studies was used for York Region's project management activities.
- A Harmonized Sales Tax rate of 1.76 percent was used as the non-recoverable portion.
- An interest rate of 5 percent and an inflation rate of 3 percent were used.
- The capital costs were distributed along the 20 years, according to the planning horizon for the required infrastructure investments.
- Costs associated with the renewal of new or existing infrastructure were not considered.
- Revenue from the Town of East Gwillimbury is considered equal for all alternatives (related to the demand); therefore, it was not included in the analysis.
- Operations and maintenance expenditures included chemical consumption, power consumption related to additional building footprint, sludge haulage, additional operations and maintenance labour effort required, water and sewer fees, cleaning of storage and contact tanks, and distribution system cleaning program and monitoring, where applicable.
- Any costs related to cleaning of the local distribution system will be assumed by the Town of East Gwillimbury and were not considered.
- Costs related to the risks of each alternative are not being considered.

It is important to note that in this analysis, the common works between the alternatives are not included, including the works related to current operations and maintenance of the wells, the North ET, and the water distribution system.

Table 6-8. Whole Life Costs for Alternative Solutions to Improve Water Quality

Alternatives	Capital Investment (Discounted)	Operations and Maintenance Expenditures (Discounted)	Total Whole-life Cost
A4: Continue Sequestration at Wells 1 and 2 Facility and Well 3 Facility, and Upgrade Systems to Optimize Operations and Maintenance	$454,000	$3,215,000	**$3,669,000**
A5: Provide Iron and Manganese Removal Technology for All Wells	Not Applicable	Not Applicable	Not Applicable
A5a: Centralized Removal Technology at Wells 1 and 2 Facility			
R1: Direct connection to sanitary sewer collection system	$5,380,000	$ 2,864,000	**$ 8,244,000**
R2: Onsite treatment with supernatant discharged to Vivian Creek and sludge discharged to sanitary sewer collection system	$6,884, 000	$2,396,000	**$9,280,000**
R3: Onsite treatment with supernatant discharged to Vivian Creek and sludge hauled offsite	$6,413,000	$3,192,000	**$9,605,000**
A5b: Decentralized Removal Technology at both Facilities			
R1: Direct connections to sanitary sewer collection system	$9,977,000	$3,203,000	**$13,180,000**
R2: Onsite treatment with supernatant discharged to Vivian Creek and sludge discharged to sanitary sewer collection system	$12,970,000	$2,788,000	**$15,758,000**
R3: Onsite treatment with supernatant discharged to Vivian Creek and sludge hauled offsite	$10,709,000	$3,584,000	**$14,293,000**
A6: Provide Iron and Manganese Removal Technology at Wells 1 and 2 Facility and Continue Sequestration at Well 3 Facility			
R1: Direct connection to sanitary sewer collection system	$4,983,000	$3,215,000	**$8,198,000**
R2: Onsite treatment with supernatant discharged to Vivian Creek and sludge discharged to sanitary sewer collection system	$6,487,000	$2,897,000	**$9,384,000**
R3: Onsite treatment with supernatant discharged to Vivian Creek and sludge hauled offsite	$6,016,000	$3,428,000	**$9,444,000**
A7: Connect New Well (MW18) to Mount Albert Water Supply System and Remove Wells 1 and/or 2			
A7a: Replace Well 1 with Well MW18 and Continue Sequestration for all Wells	$3,518,000	$1,976,000	**$5,494,000**
A7b: Replace Wells 1 and 2 with Well MW18, Re-rate Wells 3 and MW18, and Continue Sequestration	$5,693,000	$1,976,000	**$7,669,000**
A7c: Replace Well 1 with Well MW18, Continue Sequestration at Well 3 Facility, and provide iron and manganese removal technology at Wells 1 and 2 Facility			
R1: Direct connection to sanitary sewer collection system	$8,056,000	$2,954,000	**$11,010,000**
R2: Onsite treatment with supernatant discharged to Vivian Creek and sludge discharged to sanitary sewer collection system	$9,508,000	$2,850,000	**$12,358,000**
R3: Onsite treatment with supernatant discharged to Vivian Creek and sludge hauled offsite	$8,979,000	$3,137,000	**$12,116,000**

Table 6-9. Whole Life Costs for Alternative Solutions to Improve Feasibility of Storage Maintenance

Alternatives	Capital Investment (Discounted)	Operation & Maintenance Expenditures (Discounted)	Total Whole-life Cost
B2: Rehabilitation of Mount Albert South Elevated Tank and Return it to Service	$888,000	$138,000	**$1,026,000**
B3: Operate the Distribution System in Pressure Mode By-passing the North Elevated Tank	$246,000	$94,000	**$340,000**

6.4 Summary of Comparative Evaluation

Table 6-10 and Table 6-11 summarize the comparative evaluation of the alternatives. The shortlisted alternatives were evaluated using the criteria provided in **Table 5-1**.

Table 6-10. Comparative Evaluation Summary of Alternative Solutions to Improve Water Quality

Alternatives	A4	A5a-R1	A5a-R2	A5a-R3	A5b-R1	A5b-R2	A5b-R3	A6-R1	A6-R2	A6-R3	A7a	A7b	A7c-R1	A7c-R2	A7c-R3
Natural	Most Preferred	Most Preferred	Moderately Preferred	Moderately Preferred	Most Preferred	Least Preferred	Least Preferred	Most Preferred	Moderately Preferred	Moderately Preferred	Most Preferred	Most Preferred	Most Preferred	Moderately Preferred	Moderately Preferred
Socio-cultural	Most Preferred	Moderately Preferred	Moderately Preferred	Moderately Preferred	Moderately Preferred	Least Preferred	Least Preferred	Moderately Preferred	Least Preferred	Moderately Preferred	Moderately Preferred	Moderately Preferred	Least Preferred	Least Preferred	Least Preferred
Technical	Least Preferred	Most Preferred	Moderately Preferred	Moderately Preferred	Most Preferred	Moderately Preferred	Moderately Preferred	Moderately Preferred	Least Preferred	Moderately Preferred	Moderately Preferred	Least Preferred	Least Preferred	Least Preferred	Least Preferred
Economic	Most Preferred	Moderately Preferred	Moderately Preferred	Moderately Preferred	Least Preferred	Least Preferred	Least Preferred	Moderately Preferred	Moderately Preferred	Moderately Preferred	Moderately Preferred	Moderately Preferred	Least Preferred	Least Preferred	Least Preferred
Overall Results	Most Preferred	Most Preferred	Moderately Preferred	Moderately Preferred	Moderately Preferred	Least Preferred	Least Preferred	Moderately Preferred	Least Preferred	Moderately Preferred	Moderately Preferred	Moderately Preferred	Least Preferred	Least Preferred	Least Preferred

Table 6-11. Comparative Evaluation Summary of Alternative Solutions to Improve Feasibility of Storage Maintenance

Alternatives	B2	B3
Natural	Most Preferred	Moderately Preferred
Socio-cultural	Most Preferred	Most Preferred
Technical	Least Preferred	Most Preferred
Economic	Least Preferred	Most Preferred
Overall Results	Least Preferred	Most Preferred

6.5 Recommended Preferred Solution

The **Alternative A5a-R1: Provide Iron and Manganese Removal Technology for All Wells, with Centralized removal technology at Wells 1 and 2 Facility and Direct connection to sanitary sewer collection system** was identified as the preliminary preferred alternative to improve water quality in Mount Albert Water Supply System; this provides the greatest benefit with the fewest impacts based on the currently available information. Although Alternatives A4, A5a, andA5b scored similarly, A5a offers the following benefits:

- Removal technology achieves the AOs and treatment goals, providing consistently reliable water quality that meets current and anticipated upcoming regulations
- Low deposition in the distribution system will reduce distribution system operations and maintenance requirements, minimize POU softener fouling, and reduce customer concerns
- Alternative can accommodate potential future development as firm capacity (4.91 MLD) exceeds projected MDD (3.4 MLD)
- Alternative allows future connection of Well MW18 if existing well replacement is required in future due to its age or condition
- Additional linear construction is required to connect Well 3 to the Wells 1 and 2 Facility, but this is offset by the savings of centralizing treatment at one facility
- Ability to connect directly to the sanitary sewer system for disposal of backwash wastewater reduces the impact on the natural environment, as impacts to Vivian Creek are avoided
- Low risk of impact on the cultural environment since construction adjacent to the burial/cemetery lands and cultural heritage resources is within previously disturbed right-of-way
- Short-term disruption to the community during construction of the sanitary forcemain, watermain, and treatment facility at the Wells 1 and 2 Facility; however, the new linear infrastructure length will be minimized, and the anticipated routing avoids impacts on the natural environment

- Alternative increases security of supply and redundancy by having multiple well sites and allows for continuation of disinfected supply from Well 3 in emergency conditions, if the Well 1 and 2 Facility is offline
- While it represents a higher capital cost than A4, alternative provides for more consistent and stable operations, reducing requirements for operator intervention and system monitoring

The **Alternative B3: Operate the Distribution System in Pressure Mode** was selected as the preliminary preferred alternative for operation during periods when the North Elevated Tank is out of service for cleaning and maintenance. as it provides the greatest benefit with the fewest impacts. This alternative was selected as the preliminary solution for the following reasons:

- The significant operational water usage to avoid over pressurization during pressure mode operation and low demand periods is expected to happen only on an infrequent basis, while returning the South ET to service would require recurrent maintenance efforts.
- Additional operations and maintenance efforts are restricted to the infrequent periods when the North ET is out of service.
- There are no anticipated impacts to natural environment or the cultural environment.
- It provides a better cost-benefit than Alternative B2.

As Section 1 mentioned, this Class EA study was initiated as a Schedule B activity. Upon a review of the preliminary alternative solutions, the Mount Albert Water Supply Upgrades Class EA study should continue to proceed under Schedule B.

7. Consultation with Public and Stakeholders

York Region and the project team have maintained continuous communication with stakeholders through the planning process and will continue this dialogue throughout the project's lifecycle. Stakeholders included the Town of East Gwillimbury, regulatory agencies and authorities (such as the MECP and LSRCA) and interested members of the public.

7.1 Consultation and Communication Program

A Public Engagement and Communication Plan (PECP), which can be found in **Appendix F.1**, was created to facilitate timely, effective, and consistent communication with stakeholders during the study. The plan was used throughout the study to guide the communications strategy, to engage both internal and external stakeholders, and will be updated as required throughout the process. It also identifies points of consultation and the methodology to be used during these points to provide clarity on the timing and transfer of information to and from interested parties. The Stakeholder Contact List was developed at the outset of the study to send out the Notice of Commencement, through both mail and email correspondence, and was updated as comments or requests are made from the public and stakeholders.

Consultation with the public, regulatory agencies, and other stakeholders is a vital component of the study. Pre-consultation was identified in the PECP and is described further in Section 7.1.1. To align with the Municipal Class EA requirements, a Schedule B project requires a minimum of one Public Contact to update the public and stakeholders on the development and selection of alternatives at the end of Phase 2. York Region also held an additional Public Contact in July 2020 to present the public and the stakeholders with the preliminary findings, the Problem and/or Opportunity Statement, and alternative solutions and evaluation criteria for their input. The Notice of Study Completion will be published at the end of Phase 2, before the Project File is published and filed. All notices are issued through direct mailing to those in the Stakeholder Contact List and posted on the project webpage. Copies of the notices are provided in **Appendix F.2**, along with the respective Stakeholder Contact List.

7.1.1 Stakeholder Pre-consultations

Given the Study Area location and nature of the Mount Albert Water Supply Upgrades project, the Town of East Gwillimbury, LSRCA, and MECP were identified as key stakeholders for pre-consultation:

- Town of East Gwillimbury: The Town of East Gwillimbury Official Plan and Water & Wastewater Master Plan are integral to the planning of future development in the area and will inform potential future servicing capacity that may need to be accommodated. The Town of East Gwillimbury representatives are considered part of the project team, and their input is solicited in all major deliverables. In addition, some alternatives impacted municipally owned infrastructure, and the Town of East Gwillimbury was contacted to provide information and confirm feasibility of these alternatives.
- Lake Simcoe Region Conservation Authority: The Study Area is in the Lake Simcoe Watershed, within the Black River Subwatershed, and is within the LSRCA's jurisdiction. Some alternatives affected the LSRCA-regulated area, and LSRCA was contacted to provide input and review approval requirements.
- Ministry of the Environment, Conservation and Parks: To follow the MECP process, the project team reached out early to the MECP. The MECP was contacted through email on July 4, 2019, to confirm the appropriate MECP representative for the area, and to confirm the consultation correspondence was directed to the appropriate person. As the regulatory approval body for EAs, MECP Environmental Assessment Branch was informed and kept updated throughout the study. In addition, the MECP Environmental Permissions Branch was contacted to provide input and review approval requirements.

7.2 Public Contact Activities

7.2.1 Project Website

York Region created and maintains a project-specific webpage, at the following link: www.york.ca/ea[1], under the East Gwillimbury dropdown. The web-page includes all public contact activities and frequently asked question documents regarding the study. The webpage also provides the opportunity for the public to register for the Project Contact Distribution List to receive project updates.

7.2.2 Notice of Commencement

A formal Notice of Commencement was published on July 4, 2019 and sent to stakeholders in the Study Contact List on July 4, 2019. It was also posted on York Region's project webpage. The purpose of the notice was to announce the commencement of the EA and to briefly describe the study. The MECP was also provided with a completed Project Information Form during the mailout. A copy of the Notice of Commencement is provided in **Appendix F.2**.

7.2.3 Public Consultation Centre No. 1

The first PCC was an online consultation held from July 2 to July 15, 2020. The purpose of this PCC was to update the community, including details on the development of the Problem Statement, and to seek feedback on the evaluation framework to be used for alternative solutions. The presentation included the following topics:

- Class EA study introduction
- Study Area
- Project status
- Information on the current water supply system
- Shortlisted alternatives
- Evaluation criteria
- Next steps of the project

The Notice of Community Update and Survey was emailed to the Project Contact Distribution List and the Stakeholder Contact List, posted in social media, and advertised in local newspaper and through a roadside sign located at Mount Albert Road and Woodbine Avenue. A copy of the Notice is provided in **Appendix F.3**.

A total of 276 respondents answered the survey, with 194 fully completed responses. York Region released a frequently asked questions document to address the most common concerns raised by the respondents.

Written comments were received by the following stakeholders, and are presented in Sections 7.3 and 7.4:

- The MECP
- The Ontario Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI)
- The Nation Huronne-Wendat

One resident provided written comments, which York Region responded to.

A copy of the PCC No. 1 information is provided in **Appendix F.3**, including the notice, open house presentation, survey questionnaire, summary of survey responses, and frequently asked question.

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[1] https://www.york.ca/wps/portal/yorkhome/transportation/yr/environmentalassessmentstudy/!ut/p/z1/jY_NCoMwEISfpQ9QsgZ_chX7k8SKQim1uZRA1QY0ikmF9ulrpddq9zQL387MIoFyJLQcVCWtarWsx_0i_CsL94zSGHjqkghCSEOOAwLbzEPnCYAfEwIS_9zPAGLeni8FjB_gPomSColO2vta6bJFeaEH1be6KbSVtTSmMOajjX3cnmMnMbli7PrUiYADTQmwXZB5G0IdwMECEOMvMFO8a07561AeWbVavQH7mZzD/dz/d5/L2dBISEvZ0FBIS9nQSEh/#.X75lP-mSmHs

7.2.4 Public Consultation Centre No. 2

The second PCC was held online from October 30 to November 13, 2020. The purpose of this PCC was to review the project information and seek feedback on the preliminary preferred alternative solutions. The presentation included the following topics:

- Problem Statement
- Study Area
- Class EA study introduction
- Alternative solutions development
- Alternatives evaluation
- Preferred alternative solution recommendation.

The Notice of Online Open House was emailed to the Project Contact Distribution List and the Stakeholder Contact List, posted on social media platforms, and advertised twice in local newspaper.

A total of 10 respondents answered the survey. Written comments were received by MECP and Nation Huronne-Wendat and are presented in Sections 7.3. and 7.4. One resident provided written comments, which were responded to by York Region.

A copy of the PCC No. 2 information is provided in **Appendix F.4**, including the notice, open house presentation, survey, questionnaire, survey responses and post-open house notice.

7.2.5 Notice of Completion

A formal Notice of Completion was published on January 14, 2021 and sent to stakeholders in the Study Contact List on January 14, 2021. It was also posted on York Region's project webpage. The purpose of the notice was to advise of the completion of this study, and the opportunities to review the Project File report. A copy of the Notice of Completion is provided in **Appendix F.2**.

7.3 Review Agency Consultation

As part of the PECP, a Stakeholder Contact List was created, including the relevant review agencies and potentially interested stakeholders. The list was updated throughout the study and used to notify agencies and stakeholders of the Class EA milestones and public contact activities. The following agencies and ministries were included:

- Indigenous and Northern Affairs Canada
- Ministry of Indigenous Affairs
- Ministry of Agriculture, Food and Rural Affairs
- Ministry of Municipal Affairs and Housing
- Ministry of Economic Development, Job Creation and Trade
- Ministry of Community Safety and Correctional Services
- Ministry of Energy, Northern Development and Mines
- Ministry of Transportation
- Ministry of Natural Resources and Forestry
- Ministry of Heritage, Sport, Tourism and Culture Industries
- Ministry of Environment, Conservation and Parks

Table 7-1 and Table 7-3 summarize comments received from review agencies and York Region's responses, as well the pre-consultation process. The complete project correspondence with review agencies is available in **Appendix F.5**.

Table 7-1. Summary of Agency Comments

Stakeholder	Date	Type	Comment	Response
Ministry of Environment, Conservation and Parks	July 31, 2019	Letter	MECP provided its formal response to the Notice of Commencement and provided a list of Indigenous Communities who should be consulted.	MECP's recommended Indigenous Communities were added to the Stakeholder Contact List.
Ministry of Environment, Conservation and Parks	July 20, 2020	Email	MECP reiterated the guideline to source water protection as part of the Class EA Process and provided the contact for the Project Manager for Drinking Water Source Protection (LSRCA) for additional information.	Region confirmed vulnerable areas for source water protection were delineated and the preliminary assessment identified no threats to sources of drinking water. Region's Source Water Protection, Risk Management Office confirms compliance with the policies of the York Region Source Protection Area. Contact provided was added to Stakeholder Contact List.
Ministry of Environment, Conservation and Parks	October 2, 2020	Email	MECP informed updates were made to Areas of Interest document found in the response to the Notice of Commencement for this project, including the Provincial Policy Statement (2020), the Growth Plan for the Greater Golden Horseshoe (2020), On-Site and Excess Soil Management" (O. Reg. 406/19), Environmental Assessment Act through Bill 197, Covid-19 Economic Recovery Act, 2020. MECP provide information on the Class EA Process.	Region confirmed receipt. Project documentation was updated.
Ministry of Environment, Conservation and Parks	November 2, 2020	Email	MECP advised of the new notification process, which requires that Notices of Commencement, Completion and Addendum, at a minimum, be submitted to the regional email address and other notices (such as Notice of Open Houses etc.) and also to be sent to the regional email address for consistency or provided directly to the Regional Environmental Assessment Coordinator.	Region confirmed receipt. The Stakeholder Contact List was updated.
Ministry of Heritage, Sport, Tourism and Culture Industries	July 14, 2020	Letter	MHSTCI reiterated the need to determine the potential impact on cultural heritage resources as part of the Class EA process and requested a copy of the cultural heritage assessment being completed for this EA.	Region confirmed Stage 1 AA was conducted, and Stage 2 AA will be undertaken to assess impact if required. A copy of the draft Stage 1 AA was provided.
Ministry of Heritage, Sport, Tourism and Culture Industries	October 7, 2020	Email	MHSTCI acknowledged the commitment to undertaking additional AA where recommended and re-iterated the archeological assessments should be submitted to MHSTCI by a licensed archeologist. MHSTCI requested that a Cultural Heritage Evaluation Report be completed to address known and potential built and cultural heritage resources and cultural heritage landscapes the study area as part of the Class EA Process.	Region confirmed the final Stage 1 AA will be submitted officially by licensed archeologist. Region informed MHSTCI that Cultural Heritage Evaluation Report study was initiated, and a copy will be submitted when available and it will be documented in the Project File.

Stakeholder	Date	Type	Comment	Response
Lake Simcoe Region Conservation Authority	March 10, 2020	Email	LSRCA confirmed interested if the regulated area is affected, but no specific details were given at this moment.	Informed LSRCA would be contacted during Phase 2 once the alternatives are developed, and the impact on regulated areas are identified.
Town of East Gwillimbury	August 17, 2020	Email	Region request authorization to discharge the backwash wastewater to the sanitary sewer system.	Town confirmed there is no objections if it becomes the preferred alternative

Table 7-2. Summary of Agency Pre-consultation Meetings

Stakeholder	Date	Type	Summary
Ministry of Environment, Conservation and Parks	June 29, 2020	Meeting	Meeting to introduce the project to the MECP Environmental Permissions Branch, and review approval requirements, primarily related to iron and manganese removal technology, for consideration in the evaluation of alternatives
Lake Simcoe Region Conservation Authority	July 2, 2020	Meeting	Meeting to review approval requirements, primarily related to iron and manganese removal technology and its residual management, for consideration in the evaluation of alternatives
Ministry of Environment, Conservation and Parks, Lake Simcoe Region Conservation Authority	October 15, 2020	Meeting	Joint meeting with MECP Environmental Permissions Branch and LSRCA review approval requirements, especially the Environmental Discharge Parameters related residual management of iron and manganese removal technology, for consideration in the evaluation of alternatives.

7.4 Indigenous Consultation

In addition to engaging the public and agencies, the Class EA study offered Indigenous Communities the opportunity to identify their interest in the Study Area, to provide their input, and to address their concerns. The following Indigenous Communities received the project notifications:

- Chippewas of Georgina Island
- Chippewas of Rama First Nation
- Beausoleil First Nation
- Nation Huronne-Wendat
- Georgian Bay Métis Council
- Métis Nation of Ontario

York Region initially identified Indigenous stakeholders in the PECP, then completed this list with recommendations from the MECP. Table 7-3 summarizes comments received from each Indigenous Community and York Region’s responses. The complete project correspondence with the Indigenous Community is available in **Appendix F.6**.

Table 7-3. Summary of Indigenous Community Comments

Stakeholder	Date	Type	Comment	Response
Nation Huronne-Wendat	July 10, 2020	Email	Nation Huronne-Wendat requested a copy of the AA being completed for this EA.	Region confirmed Stage 1 AA was conducted, and Stage 2 AA will be undertaken if required to assess any impact. A copy of the draft Stage 1 AA was provided.
Nation Huronne-Wendat	October 5, 2020	Email	Nation Huronne-Wendat requested to be representation on field in case a Stage 2 AA is undertaken.	Region informed that Stage 2 AA will not be required for the implementation of the preferred alternative. A copy of the final Stage 1 AA was provided.
Nation Huronne-Wendat	November 2, 2020	Email	Nation Huronne-Wendat requested a copy of the archeological assessment being completed for this EA.	Region confirmed that Stage 1 AA report provided is only archeological assessment completed for the EA..

8. Project Description

Based on the multicriteria evaluation, and confirmed by feedback provided during PCC No. 2, the following options were identified as preferred alternatives for the Mount Albert Water Supply System:

- Alternative A5a-R1: Provide Iron and Manganese Removal Technology for All Wells, with Centralized removal technology at Wells 1 and 2 Facility and Direct connection to sanitary sewer collection system
- Alternative B3: Operate the Distribution System in Pressure Mode

Together, these alternatives will allow York Region to mitigate the aesthetic water quality issues and to comply with future manganese regulations, while improving the overall system redundancy and reliability with the least possible overall impact.

8.1 Description

8.1.1 Conceptual Design

The preferred alternative to improve water quality involves a centralized iron and manganese removal technology for the wells at Wells 1 and 2 Facility. As discussed, adsorptive filtration with a continuously regenerated adsorptive media for removal and a multifilter design have been considered. The residual management system involves the discharge of backwash wastewater to an on-site equalization tank, where it is pumped through a new forcemain to a connection to the existing local sanitary sewer collection system for treatment at the Mount Albert WRRF.

It is estimated that iron levels in the treated water will be ≤ 0.01 mg/L, and the manganese levels will be ≤ 0.005 mg/L, which would comply with potential manganese guidelines. The iron and manganese deposition in the distribution system is considered low (<1 g/m/year). Well 1 can be returned to service to provide sufficient supply capacity to meet current and future water demands beyond 2041. There is little concern that the particulate iron and manganese will accumulate along the raw water transmission main, which would require the system to undergo frequent cleaning and flushing to address solids deposition.

The existing 400-millimetre concrete pressure pipe transmission main will be repurposed as a raw watermain between the Well 3 Facility and the corner of Centre Street and Cupples Farm Lane. A new raw watermain will be extended 350 m along Cleverdon Boulevard to reach the Wells 1 and 2 Facility. The new building housing the removal technology and the associated equipment has been identified for north of the existing building at the Wells 1 and 2 Facility. There is also sufficient space to the south and west and the final location of the new building will be determined during detailed design, pending geotechnical,constructability considerations and future expansion of the facility. York Region is planning to replace the sodium hypochlorite system with a chlorine gas system at the Wells 1 and 2 Facility. The preliminary design will review whether the existing sodium hypochlorite room can be modified to accommodate the new chlorine system.

It is recommended that pilot testing of the selected iron and manganese removal technology be undertaken to confirm preferred media, efficiency, and design guidelines. Impact of raw water quality on the effectiveness of the removal technology has considered that although the wells have elevated water hardness, the hardness concentrations are typical of groundwater sources in Ontario and do not approach levels that would impact the selected removal technology but are an important consideration for system maintenance. The design will consider the need to include measures to clean media with phosphoric acid. The wells currently have low phosphate levels, and phosphate complexation is not considered a concern at this time. Bench-scale tests performed as part of the Groundwater Treatment Strategy study (Jacobs, 2020a) suggested that organic complexation and colloidal formation are also not expected to be of concern.

The removal technology will likely increase the headloss of each well facility by 69 kiloPascals (10 pounds per square inch); however, this will not impact the well pumps' abilities to meet the top water level (TWL) of the North ET, and is not anticipated to impact distribution system pressures significantly.

The equalization tank for collection of backwash wastewater will be a multicell design to facilitate operations and maintenance activities and be provided with appropriate personnel access. Consideration will be given to measures to schedule discharge to the sanitary sewer during off-peak hours as required to avoid surcharging the sanitary sewer collection system and SPS during high-flow events. Truck haulage facilities can also be included to provide the flexibility to haul the backwash wastewater to the Aurora Pumping Station or Duffin Creek WPCP, in case of emergency.

Table 8-1 presents the key features for the concept design. Figure 8-1 presents the schematic diagram and Figure 8-2 presents the conceptual site layout for the preferred alternative.

Table 8-1. Preferred Alternative: Key Concept Design Features

Wells 1 and 2 Facility	Preferred Alternative
Iron and Manganese Removal	
Design Capacity (ML/d) [(a)]	4.99 [(b)]
Filtration System [(c)]	10 filters of 1.2-m diameter (4 feet)
Residual Volume (m^3/d) [(d)]	60 to 100
Building Footprint Required [(e)]	9 m by 5.5 m (50 m^2)
Total Firm Capacity (MLD) [(f)]	4.91
Residual Management	
Equalization Tank Volume (m^3) [(g)]	16
Sewage Pumping System (L/s) [(g)]	4.3
Sanitary Sewage Connection	400 m, 75 mm diam. forcemain
Footprint Required on Site [(h)]	6 m by 10 m (60 m^2)

[(a)] Maximum water taking of 4.99 MLD (57.8 L/s) with a maximum taking per minute per well of 3.27 MLD (37.88 L/s) per current PTTW.

[(b)] Any combination of Wells 1 to 3.

[(c)] Maximum design filtration flowrate of 18 m/h will all filters in service and 20 m/h with one filter out of service.

[(d)] Each filter in operation is backwashed once daily.

[(e)] Building housing the removal technology and the associated equipment, including oxidant dosing systems. Residual management requirements identified separately.

[(f)] Considering the loss of backwash volume without air scour.

[(g)] Volume of one backwash pumped to sanitary sewer over a 1-hour period.

[(h)] Considering tankage depth of 4 m, excavation slope of 3:1 and including valve chamber and yard piping.

Notes:

m^2 – square metre(s)

m/h = metre(s) per hour

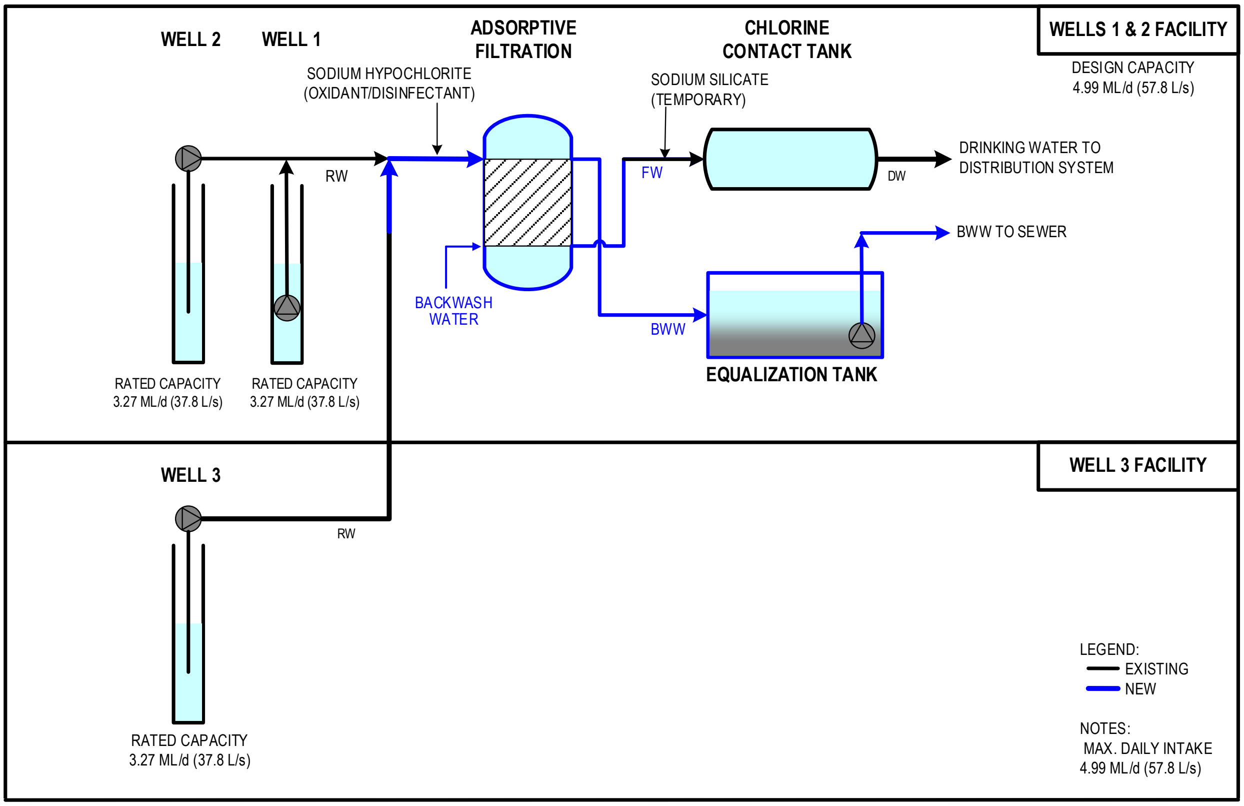


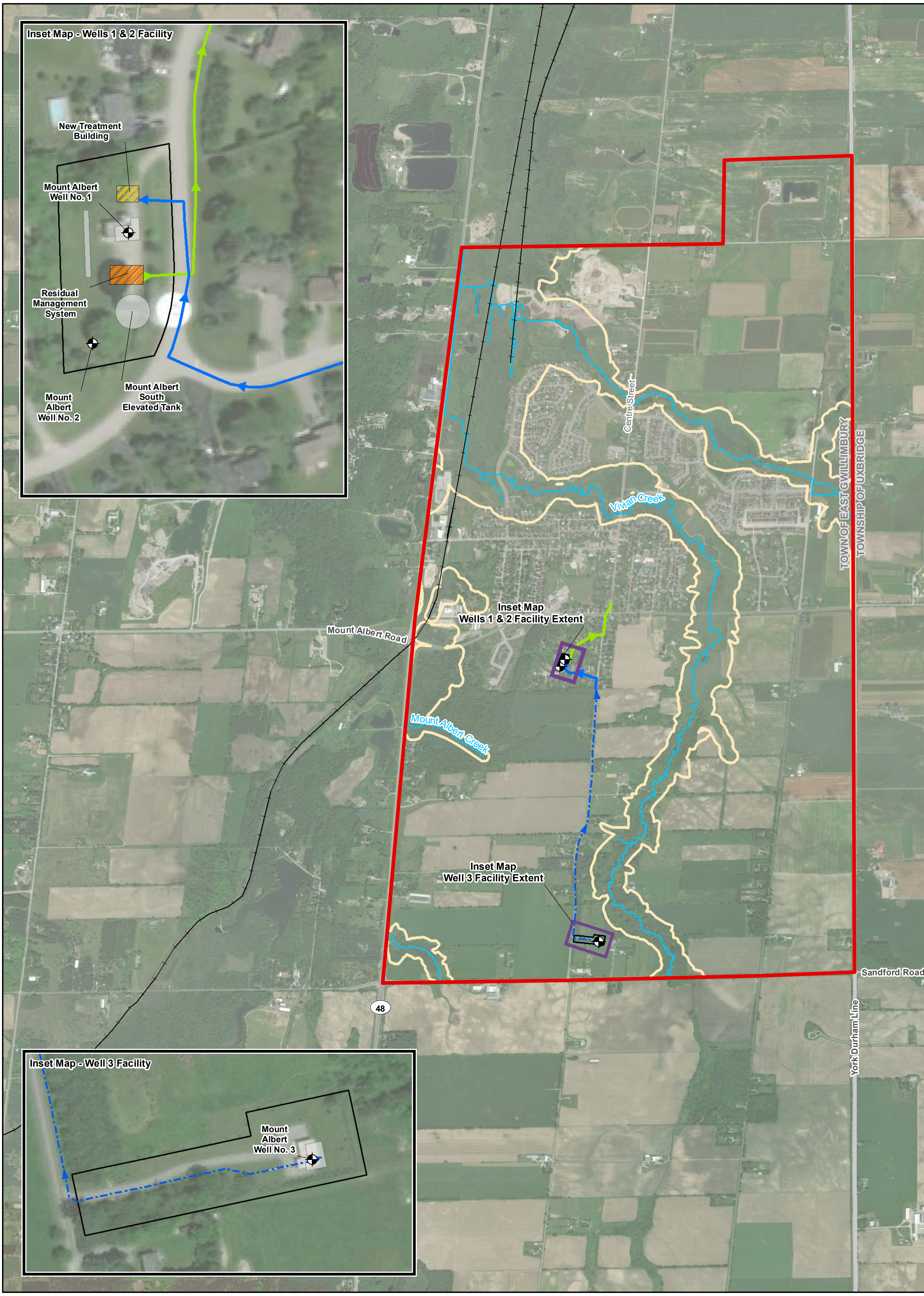
Figure 8-1. Schematic Diagram

The preferred alternative to improve the feasibility of storage maintenance involves operating the distribution system in pressure mode when the North ET is bypassed during inspection and maintenance activities.

Solutions to avoid over pressurization during periods when the minimum pump flow exceeds demand include increasing nighttime demand, typically through irrigation and other outdoor water uses; or directing excess water to waste through auto flushers and pressure relief valves. There are currently four auto flushers in the distribution system sized for discharge up to 12 L/s, and some of them discharge to the stormwater system. They are equipped with a digital controller that allows the flushing cycles to be adjusted for different flowrates and frequency. Based on available documentation, the Well 3 Facility surge anticipator valve (Tag V732-WEL-SRV1) has an integrated pressure relief function and could also be used in an emergency. Consideration can also be given to replacing one of the well pumps with a smaller pump during prolonged outages of the North ET's for major rehabilitation, to more closely match low demand; however, this will impact fire flow protection.

In November 2020, York Region and the Town of East Gwillimbury successfully operated the Mount Albert distribution system in pressure mode in order to isolate the North ET for cleaning and inspection. The distribution system demands were satisfied by operating one well pump continuously to maintain a targeted pressure setpoint.

As the water demand at night was lower than the minimum well pumping flows, one auto flusher was manually opened overnight to increase the water demand by approximately 12 L/s and avoid over-pressurization of the distribution system. The surge anticipator valve at the Well 3 Facility and an additional hydrant pressure relief valve in the distribution system were also set to limit the maximum system pressure to within typical conditions. The North ET was isolated for approximately 4 days for draining, cleaning, inspection, disinfection and bacteriological testing prior to being returned to service. Fire protection during the North ET maintenance was provided by the three well pumps and supplemented by two bulk water tankers, the Fire Department's pumper and tanker trucks. The Mount Albert Water Supply System was continuously monitored by York Region staff during the North ET maintenance period.



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Alternative A5a
- New Treatment Building
- Residual Management System
- Sanitary Forcemain
- New Raw Watermain
- Re-purposed Watermain

- Production Well
- Watercourse
- Railway

- LSRCA Regulated Area
- Municipal Boundary
- Property Boundary
- Facility Footprint
- Study Area

Note:
1. Aerial Source: Vivid-Canada, 2013.

Figure 8-2
Conceptual Site Layout
Project File
Region of York
Mount Albert, Ontario

Jacobs

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8.1.2 Whole-life Cost

To implement the preferred alternative, the following key infrastructure upgrades and operations and maintenance initiatives are proposed. The whole-life cost analysis was estimated using net present value. Table 8-2 summarizes the capital investment costs, operations and maintenance expenditures, and net present.

- 350 m of 400-mm-diameter watermain from the corner of Centre Street and Cupples Farm Lane to Wells 1 and 2 Facility and associated valve chambers
- New building housing removal technology at Wells 1 and 2 Facility for all wells
- Onsite residual management system at Wells 1 and 2 Facility, including equalization tank, sewage pumping system, and yard piping
- Connection to sanitary sewer collection system
- Implementation of equipment and controls to facilitate pressure operation (provision)
- Cleaning and inspection of chlorine contact chambers at Wells 1 and 2 Facility and Well 3 Facility
- Cleaning and inspection of the Mount Albert North ET
- Tailored monitoring program for the distribution system
- Unidirectional flushing and swabbing program

Table 8-2. Preferred Alternative: Capital Investment and Operations & Maintenance Expenditures, and Whole-life Costs

Component	Preliminary Cost [(a)]
Capital Investment	
Raw Watermain [(b)]	$455,000
New Treatment Building at Wells 1 and 2 Facility [(b)]	$2,250,000
Onsite residual management system [(b)]	$450,000
Connection to sanitary sewer collection system [(b)]	$270,000
Improvements to Facilitate Pressure Mode Operation (provision) [(c)]	$150,000
Design & Construction Administration (20%)	$716,000
Contingency (30%)	$1,290,000
Region Project Management (5%)	$281,000
Harmonized Sales Tax (1.76%)	$106,000
Total Capital Costs	**$5,968,000**
Operations and Maintenance Expenditures [(d)]	
Sodium Silicate for Sequestration	$32,800
Chlorine Gas for Oxidation	$30,300
Operations and Maintenance Labour	$624,000
Power Consumption	$49,500
Cleaning and Inspection of Chlorine Contact Chambers (every 5 years)[(e)]	$480,000
Cleaning and inspection of the Mount Albert North Elevated Tank (every 5 years)[(e)]	$160,000
Unidirectional flushing program of raw water transmission main (every year)[(f)]	$36,000
Swabbing program of raw water transmission main (every 5 years)[(f)]	$16,500
Unidirectional flushing program of distribution system (every 5 years)[(e)]	$307,200

Component	Preliminary Cost [a]
Swabbing program of distribution system (every 20 years)[e]	$154,000
Tailored Monitoring Program for the distribution system[e]	$325,000
Sanitary Sewer Discharge	$1,022,400
Wasted Water[g]	$115,600
Total O&M Costs	**$3,353,300**
Net Present Value	
Capital Investment (Discounted)	$5,615,329
Operations and Maintenance Expenditures (Discounted)	$2,834,117
Total Whole Life Cost	**$8,449,445**

[a] Prices are 2019/2020 based, in CAD.

[b] Implementation timeline of the alternative (and capital investment) between 2021 to 2025.

[c] Implementation timeline of the alternative (and capital investment) between 2021 to 2023.

[d] Additional O&M costs produced by the alternative, including chemicals, electricity and labour.

[e] Considering low accumulation of deposits in the distribution system.

[f] Considering heavy accumulation of deposits in the raw water transmission main.

[g] Considering moderate accumulation of deposits in the distribution system, which means cleaning of North ET every 2 years, and 9 L/s of water wasted for 8 h/day during 15 days of North ET out of service, and York Region 2020 water rate.

8.1.3 Additional Field Investigations

The following additional field investigations will be completed to support the development of the design:

- Geotechnical and Hydrogeological investigations
- Phase 1 Environmental Site Assessment (ongoing)
- Designated Substances Survey at Well 3 Facility
- Pilot test of the selected iron and manganese removal technology to confirm preferred media, its efficiency, backwash wastewater characteristics and settleability, and design guidelines

8.2 Environmental Impacts and Mitigation Measures

Mitigation measures will be required during the construction of the preferred solutions and subsequent long-term operations. Table 8-3 presents the preliminary mitigation strategies identified based on information obtained during this study. These strategies will be further refined once information from the additional field investigations (Section 8.1.3) is available and as design progresses.

Table 8-3. Preliminary Mitigation Strategies for the Preferred Alternative

Impact Type	Mitigation During Design and Construction	Mitigation for Long-term Operation
Vegetation and Wildlife	• Prepare tree preservation plan, as required to protect mature and mid-aged trees along the edge of construction. • Restore disturbed areas/habitat to existing or better conditions.	• Impact to wildlife by removal of vegetation has primarily been avoided by the preferred alternative.
Surface Water	• Implement a sediment and erosion control plan to include requirements for sampling of discharge water, as required to meet local sewage by-laws to ensure existing surface water features are not impacted.	• Impact to surface water has primarily been avoided by the preferred alternative.
Water Conservation	Not Applicable	• Implementation of iron and manganese removal will reduce distribution system flushing requirements over the long term. • Some water wastage may be required when pressure mode operation is required for elevated tank maintenance during low-demand periods. • During extended periods of pressure-mode operation due to major rehabilitation activities, consideration can also be given to replacing one of the well pumps on a temporary basis with a smaller pump to more closely match low demand.
Groundwater	• No threats to sources of drinking water were identified with the construction of the preferred alternative.	• No threats to sources of drinking water identified with the preferred alternative.
Erosion and Sedimentation	• The layout of construction on the Well 1 & 2 Facility will need to consider the stability of the bank in the northwestern portion of the property.	• Provisions to avoid localized erosion will be required if autoflushers that discharge to local ditches are used during pressure-mode operation.
Excess Soil Management	• Construction will be completed in accordance with O. Reg. 406/19: On-Site and Excess Soil Management" and the MECP's current guidance document titled "Management of Excess Soil – A Guide for Best Management Practices" (2014).	Not Applicable
Contaminated Soils and Waste, Spills and Leaks	• Disposal of soil and waste generated during construction will be disposed of in accordance with applicable provincial regulations. • Contamination of soils through spills and leaks can be avoided by ensuring that fuel storage, refueling, and construction equipment maintenance are handled properly and not allowed in or adjacent to watercourses. • Contingency plans will be prepared before construction begins for the control and cleanup of a spill, should one occur. • The MECP Spills Action Centre must be contacted if a spill occurs.	Not Applicable

Impact Type	Mitigation During Design and Construction	Mitigation for Long-term Operation
Cultural Features	• Baseline vibration monitoring should be conducted for: 19014 Centre Street (B.H.R. 1), 19031 Centre Street (B.H.R. 2), 5623 Mount Albert Road (B.H.R. 3), 5631 Mount Albert Road (B.H.R. 4), 18855 Centre Street (B.H.R. 6), 19015 Centre Street (C.H.L. 1), and 5590 Mount Albert Road (C.H.L. 3) during detailed design and a vibration monitoring plan developed as required..	Not Applicable
Traffic and Access	• A Construction Traffic Management Plan will be prepared as part of detailed design to maintain access to properties at all times. • Project updates will be provided to advise the community of traffic impacts and any affected property owners will be individually notified in advance.	Not Applicable
Noise, Vibration, and Dust	• A Construction Noise and Vibration Mitigation Plan will be prepared at detailed design, considering site fencing and dust control measures both for onsite activities and construction accesses. • Construction operations will be scheduled for daytime hours to the extent feasible, with the contractor required to adhere to local noise by-laws. • To address construction related vibration impacts on nearby buildings, pre-construction surveys will be completed before construction. The surveys will document existing building conditions, as well as identify sensitive structures to be considered during construction.	Not Applicable
Fire Protection	Not Applicable	• Develop Fire Contingency Plan with Fire Services during tank maintenance activities.
System Redundancy and Operational Flexibility	Not Applicable	• Include flexibility for the future expansion of treatment and residual management system, as well as the connection of a new well (MW18) from the Well 3 Facility in design concepts. • Maintain the existing treatment at the Well 3 Facility and provide appropriate valving for redundancy purposes, in case of emergency event or maintenance at the Wells 1 and 2 Facility. • Consider redundancy for the single contact tank at the Wells 1 and 2 Facility. • Develop Water Supply Contingency Plan for emergency events, such as prolonged power loss, watermain breaks, since no storage is available during the maintenance of North ET. • Develop site layout to consider future addition of gravity settling system, should more effective utilization of existing wastewater infrastructure be required.
Alignment with Other Infrastructure	• Interlock the new system with the SPS SCADA to avoid surcharging the sanitary sewer collection system and SPS during high-flow events and allow the possibility of backwashes to be performed during off-peak hours.	• Develop a monitoring plan and collect additional data for Vivian Creek that allow future consideration of discharge of supernatant to Vivian Creek, should more effective utilization of existing wastewater infrastructure be required.

8.3 Permits and Approvals

The following permits and approvals have been identified and will be obtained before the project is tendered, following York Region's internal protocols:

- Amendment of the Municipal Drinking Water Licence and Drinking Water Works by MECP to include the removal technology and the residual management system
- Approval for emergency relief of the PTTW permitted taking from MECP to allow operation of all wells at the same time in the event of an emergency while North ET is being maintained
- Environmental Activity and Sector Registry Approval (Dewatering) by MECP if identified through subsequent geotechnical and hydrogeological investigations
- Approvals by York Region (Source Water Protection Permit, Road Use and Road Signs Construction Permit)
- Approvals and exemptions by Town of East Gwillimbury (service connection permit, building permit, site plan, road occupancy, noise, temporary discharge to stormwater system during construction)
- Encroachment permit by local utilities if any conflict with utility lines

8.4 Timing of Implementation

The timeline to implement centralized iron and manganese removal technology for the Wells 1 and 2 Facility is approximately 4 years (between 2021 and 2025) with the following considerations:

- 3 months for detailed design procurement
- 18 months to design the centralized iron and manganese removal technology for the Wells 1 and 2 Facility and its residual management system
- 3 months for construction procurement
- 2 years to construct the centralized iron and manganese removal technology for the Wells 1 and 2 Facility and its residual management system

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