The Regional Municipality of Peel

Supply Capacity Increase for Palgrave Well # 4

Class Environmental Assessment

FINAL Environmental Study Report

Thursday, November 23, 2023

T001508A

CIMA+

500-5935 Airport Road
Mississauga, ON L4V 1W5
T 905 695 1005 **F** 905 695 0525
cima.ca

Contact

Sandra Rodriguez, M.Eng., P.Eng.
sandra.rodriguez@cima.ca
T 905 695 1005, 6718

Engineering for **people**

Region of Peel
working with you

FINAL Environmental Study Report

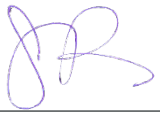
Class Environmental Assessment for Palgrave No. 4 Supply Well
Project No T001508A

PREPARED BY:

Emily Snoei, EIT, ENV SP

Cristina Lugo, P. Eng., PhD.

Maham Azam, M.Sc., EIT



VERIFIED BY: Sandra Rodriguez, M.Eng., P.Eng.

Executive Summary

I. Introduction and Background

The Region of Peel is responsible for several municipal drinking water systems within its municipal boundaries, which includes the City of Mississauga, City of Brampton, and the Town of Caledon. Within the Town of Caledon, the Region operates four (4) independent groundwater systems; namely, Alton/Caledon Village, Palgrave/Caledon East, Cheltenham, and Inglewood, which service ten (10) villages, hamlets, and rural service centres across the Town of Caledon The Palgrave/Caledon East Drinking Water System supplies drinking water to the communities of Caledon East, Palgrave, Palgrave Estates, Mono Road, Albion, Centreville, and Cedar Mills, drawing from six municipal groundwater sources in Palgrave and Caledon East.

A comprehensive review of the municipal water and wastewater systems in the Town, carried out in June 2020 by the Region identified the need to enhance security of supply in the Palgrave/Caledon East Drinking Water System. To address this, a hydrogeological investigation was completed, in advance of the Class Environmental Assessment (Class EA) Study, to assess the feasibility of increasing the water taking capacity of one of the existing municipal production wells in the system, the Palgrave Well #4. The investigation concluded that the water taking capacity can be increased from 30 to 60 L/s with minimal impact to the environment or production aquifer.

Accordingly, the Region undertook a Schedule C Class EA study to determine the preferred long-term solution to ensure a secure and reliable source of supply for the Palgrave/Caledon East Drinking Water System. CIMA+ was retained by the Region to complete the Class EA study. This report outlines the planning and decision-making process followed in the Class EA study to arrive at the preferred recommended solution.

II. Municipal Class Environmental Assessment Process

All municipal infrastructure projects in Ontario are subject to the Municipal Class EA process (Municipal Engineers Association, March 2023) to meet the requirements of the Environmental Assessment Act (EA Act).

The Municipal Class EA process is an approved decision-making and planning process that covers all aspects of the environment that should be considered during the planning and construction phases of a project. The Municipal Class EA process includes various phases that are completed subsequently to ensure that the best approach is identified to address a specific problem, requiring the evaluation of possible solutions/design concepts, and recommending the best solution based on a comprehensive evaluation of environmental effects and identification of mitigation measures.

The supply capacity increase of Palgrave Supply Well #4 has been conducted as a Schedule C undertaking under the Municipal Class EA Process. Completion of this report, referred to as the Environmental Study Report (ESR), fulfills the requirements of the Schedule C Class EA study process. The ESR will be placed on the public record for at least 30 calendar days for public review. Notification to the public and review agencies will be through the issuance of a Notice of Study Completion.

Interested persons may provide written comments to the project team within the review period and all comments and concerns should be sent directly to the Region. In addition, if there are outstanding concerns that the project may have a potential adverse impact on constitutionally protected Indigenous and treaty rights and that an Order may prevent, mitigate, or remedy this impact, Section 16 Order requests on those matters should be addressed in writing to the Minister of Environment, Conservation and Parks (MECP), the Director of Environmental Assessment Branch and the Region.

If no significant issues arise during the review period which cannot be resolved in consultation with the Region, and no Section 16 Order requests are received, the project will be considered approved and may proceed directly to implementation, as outlined in this report.

III. Problem/Opportunity Statement

The problem/opportunity statement for the Palgrave Well No 4 Supply Well Class EA Study was defined as follows:

Infrastructure improvements to the Palgrave/Caledon East Drinking Water System are required to:

- Increase the well supply capacity and enhance the security of water supply;
- Minimize potential risks associated with declined well efficiency;
- Provide an appropriate level of service while meeting the long-term water needs of the serviced area.

IV. Identification and Evaluation of Alternative Solutions

A broad range of alternative solutions was developed during the early stages – Phase 2 of the Class EA Study. Preliminary screening of these alternative solutions was completed based on defined screening criteria, which included contribution to water supply security, compliance with the project objectives and applicable drinking water regulations and standards, and technical and financial feasibility to provide the required capacity and contribute to the overall operability and efficiency of the system. The

results of the preliminary screening provided the basis for the selection of the preferred alternative solution – **Expand / Retrofit Existing PAL4 Water Treatment Plant.**

The preferred alternative solution involves increasing the treatment capacity of the existing PAL4 Water Treatment Plant to support the water taking increase from 30 to 60 L/s. As such, upgrades to the existing iron removal and disinfection processes were necessary, as well as modifications to the existing emergency standby power and process wastewater management.

The list of potential alternative solutions and the results of the preliminary screening were presented to the public and agencies for feedback via an online Public Information Centre (PIC) held on the Region's website on February 14, 2022, for approximately three (3) weeks, until March 4, 2022.

V. Identification and Evaluation of Alternative Design Concepts

As part of Phase 3 of the Class EA study, the preferred alternative solution – Expand / Retrofit Existing PAL4 Water Treatment Plant, was further developed into alternative design concepts to reflect alternative treatment configuration options to achieve the proposed supply capacity increase to 60 L/s.

Available treatment technologies for iron removal and disinfection were reviewed and screened so that only feasible technologies were used in the establishment of treatment trains. The short-listed technologies / upgrade options recommended for further analysis in the Class EA study included:

- Iron removal – Replacement of the existing filters with three (3) larger units using the same fundamental technology: pre-oxidation of iron with sodium hypochlorite followed by catalytic media for iron filtration. This option mimics the existing filter treatment technology and reduces operational and construction complexity.
- Disinfection – Chlorination (alone) or combination UV irradiation and chlorination. The current system uses sodium hypochlorite injection for disinfection. Chlorination alone involved twinning the existing chorine contact pipe, while the combination of UV/chlorination required a new UV reactor and additional contact pipe volume.
- Emergency Stand-by Power – Replacement of the existing indoor generator with a new larger unit within the existing building or with a new outdoor generator
- Process Wastewater Management – Continuing using the existing decanting tank without any physical alterations or increasing its volume to settle backwash water.

The shortlisted technologies / upgrade options were further conceptualized into four (4) treatment train options for further evaluation:

- Option 1A: Three (3) Larger Filters + Chlorination (alone) + Indoor Genset
- Option 1B: Three (3) Larger Filters + UV / Chlorination + Indoor Genset
- Option 2A: Three (3) Larger Filters + Chlorination (alone) + Outdoor Genset
- Option 2B: Three (3) Larger Filters + UV / Chlorination + Outdoor Genset

In terms of wastewater management, the following alternative design concepts were developed and evaluated in detail:

- Option WM1: Existing Process Wastewater Decanting Tank
- Option WM2: Additional Volume of Wastewater Decanting Tank

A thorough comparative evaluation of alternative design concepts was conducted considering evaluation criteria such as natural/environmental, socio-cultural, technical/operational, and financial/economics. Opinion of probable capital, operating and maintenance costs, and lifecycle costs were developed for each design concept to support the financial evaluation of the options.

Each design concept was assessed and given a score based on its potential net impact after mitigation measures. The individual scores were reviewed and confirmed during a workshop with the Region on August 9, 2022. A sensitivity analysis was also performed to verify the robustness and defensibility of the evaluation results.

The alternative design concepts, results of the selection process for the preliminary preferred design concept and the potential impacts and mitigation measures were presented to the public and agencies for feedback via a second Public Information Centre (PIC 2) held in-person at Palgrave Equestrian Facility – Palgrave Community Room on October 27, 2022, from 4:00 pm to 7:00 pm.

After PIC 2, the Region identified a preference to have all the equipment associated with the emergency standby power, including both genset unit and fuel source, indoors to reduce operational challenges, especially during the winter months. As such, an additional option of a natural gas generator, which eliminated the need for a fuel tank, was explored further and selected instead of the diesel emergency standby power. This change was not formally presented to the public since it was considered a minor modification to the preferred design treatment concept, and in general, is deemed to have lesser short- and long-term impacts to the neighbouring residents since all equipment will be confined within the existing building footprint. A diesel fuel tank is no longer required for a natural gas generator. The newly proposed natural gas generator will comply with all TSSA and ESA requirements.

VI. Preferred Recommended Alternative Design Concept

Based on the results of the evaluation process and feedback obtained from the public throughout the Class EA study, the recommended design concept is to Expand / Retrofit Existing PAL4 Water Treatment Plant through:

- Installation of three (3) larger greensand filters. Existing filter units to be decommissioned and replaced with newer larger units
- Construction of an additional chlorine contact pipe to provide the necessary disinfection requirements. Disinfection to be provided only through chlorination
- Replacement of existing diesel generator with a new larger indoor genset (Natural Gas Emergency Standby Power)
- No physical retrofits to the existing process wastewater decanting tank. Operational modifications to the backwash procedures will be required.

The schematic of the preferred water treatment design concept to Expand / Retrofit Palgrave Well No. 4 Water Treatment Plant is shown in **Figure (i).** The key advantages of the preferred recommended design concept are its compatibility with existing processes which reduces overall complexity and minimal long term nuisance impacts on adjacent neighbours since the standby generator will be located indoors.

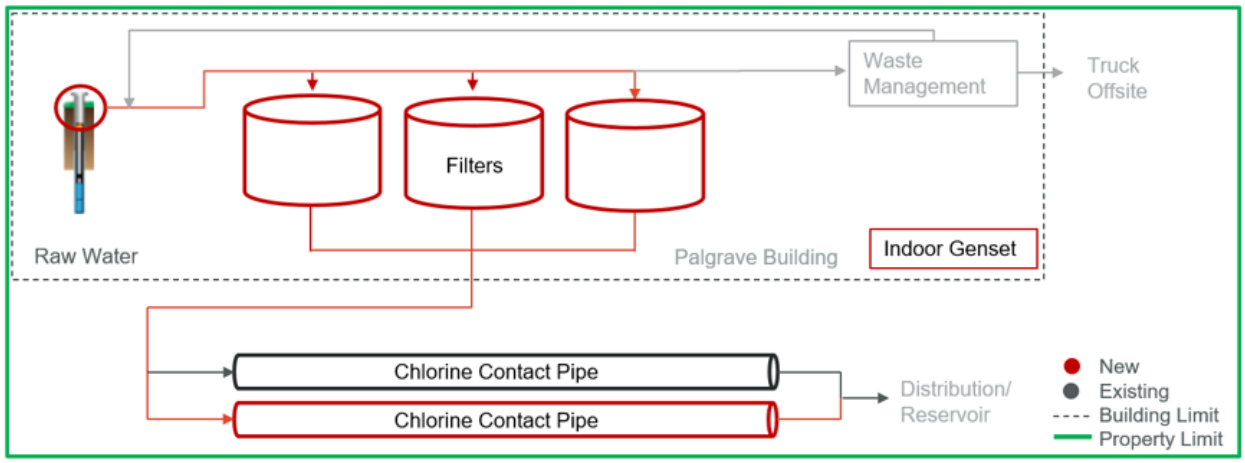


Figure (i): Preferred Water Treatment Design Concept (Option 1A)

The schematic of the preferred design concept for residuals treatment to Expand / Retrofit Palgrave Well No. 4 Water Treatment Plant is given in **Figure (ii)**. The key advantages of this design concept are that it maximizes the existing infrastructure. In addition, it can be easily implemented through operational modifications only without the need for physical modifications to the existing tank.

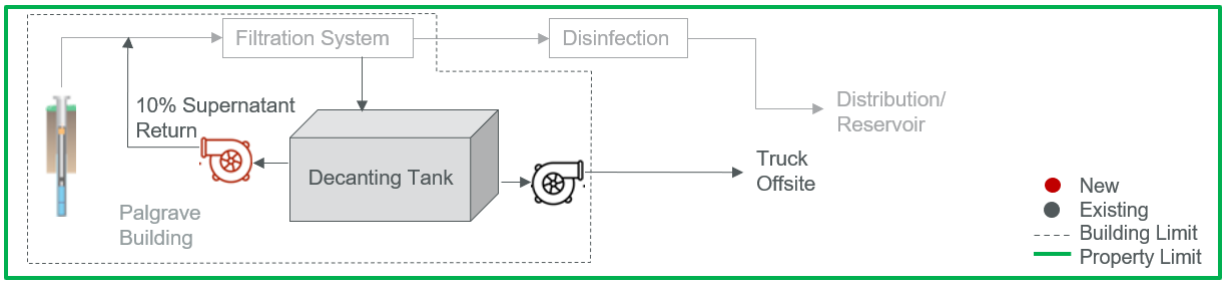


Figure (ii): Preferred Residuals Treatment Design Concept (Option WM1)

VII. Proposed Mitigation Measures of Potential Impacts

Potential impacts associated with the implementation of the preferred alternative design concept were identified as well as available mitigation measures. As with any other construction project, some inevitable effects in terms of noise, vibration, dust, and truck traffic will be experienced around the construction areas; however, no residual negative impacts are expected with the implementation of mitigation measures outlined in this report. Specific mitigation measures, as summarized below, are recommended for implementation to reduce anticipated potential impacts.

Natural Environment

The proposed improvements to Palgrave Well #4 are expected to have minimal impacts on natural heritage features. Groundwater assessment carried out by Geo Kamp Limited (Appendix G) indicate that the proposed well improvements would double extraction rates without affecting nearby wells or surface water. No negative effects on fisheries resources or base flow reductions were found. Aquatic habitats are unaffected due to the absence of watercourses within 120m of the site.

The project area is a manicured lawn, avoiding disruption to adjacent vegetation. No vegetation removals are planned for the cultural meadow or nearby plantations, and tree protection measures focus on preserving key trees on premises. No species at risk or their habitats were detected, and no sensitive wildlife functions or habitats were found in the areas designated for construction.

Standard best management practices and recommended mitigation measures include:

- Implement erosion and sediment control measures along the southwest border to prevent sediment migration.
- Conduct proposed works exclusively within the manicured lawn area to avoid disturbing adjacent vegetation communities.
- Employ tree protection measures to conserve significant trees in the southeast corner of the Subject Property.

- Ensure construction activities remain within the boundaries of the existing chain link fence to prevent any adverse impacts.
- Adhere to the Migratory Birds Convention Act when conducting vegetation clearing to prevent disturbance during breeding periods.
- Minimize machinery-related soil contamination through regular maintenance and proper cleaning.
- Perform vehicle refueling and maintenance on designated spill collection pads to prevent soil and water contamination.
- Develop and follow a comprehensive spill response plan, including staff training and emergency spill kits.
- Erect tree protection fencing to safeguard trees during construction activities.
- Limit construction activities to the manicured lands to minimize disturbance to wildlife habitats.
- Use fencing to isolate construction activities from neighboring lands, reducing potential external impacts.

Source Water Protection

Impacts on Existing Groundwater Users and Surface Water Features

A hydrogeological investigation of PAL4 was completed in 2019 (Watermark Environmental and Well Initiatives) to assess the feasibility of increasing the pumping rate of PAL4 from its current maximum water taking of 30.3 L/s to 60.6 L/s. A review of the cumulative impacts to groundwater and surface water resources from both the existing and the proposed increased water takings at PAL4 was carried out as part of the 2019 hydrogeological investigation. The impact assessment included the following key activities:

- A 72-hour constant rate pumping test to assess feasibility of water taking increase and to evaluate the sustainability of this rate over the long-term. Monitoring of PAL4 and surrounding observation wells, piezometers, and streamflow stations for groundwater and surface water elevations, respectively.
- Identification of potential groundwater receptors including domestic or permitted water supplies in the area that could reasonably be impact by water takings of all Palgrave wells, inclusive of PAL4. Groundwater usage was obtained through the MECP Water Well Information Systems Query and identifying permitted water takers, within 500m radius of each production well. The search results identified a

total of 24 drilled or dug wells within the search radius. A breakdown of the local private groundwater usage within 500 m radius of PAL4 is show in the table below.

Table (i): Water Well Records within 500 m radius of PAL4

Primary Well Use	Number of Wells within 500 m radius	Percentage of Total
Water Supply – Domestic	7	29.2
Water Supply – Municipal	2	8.3
Water Supply – Industrial	1	4.2
Monitoring/Observation/Test Hole	8	33.3
Abandoned/Unknown	6	25.0
Total	**24**	**100%**

Key findings and recommendations of the impact assessment included:

- At a sustained pumping rate of 60.6 L/s at PAL4, the stabilized Radius of Influence (ROI) is approximately 1 km for PAL4. Within the 1 km ROI, pumping of PAL4 was observed to result in only minor drawdowns in wells screened at a depth of 40 m and no attributable drawdowns in wells screened above a depth of 30m. In addition, the measured drawdowns are believed to be confined to the immediate area of PAL4. Based on the conceptual understanding of the shallow and semi-confined groundwater system, long-term impacts to existing groundwater users from an increase in water taking of PAL4 to 60.6 L/s are not expected.
- Water takings at PAL4 have not been the cause for any private well complaints in the area related to either quality or quantity of groundwater.
- The results of water level monitoring in a piezometer and surface water monitoring station (located approximately 365 m to the southwest of PAL4 along the east bank of the Humber River) during the pumping test of PAL4, suggest that pumping at PAL4 has no influence on the surface water features (Humber River) where the stations were instrumented. Additionally, based on the conceptual hydrogeological model for PAL4, all surface water features within the estimated ROI of PAL4 are believed to be hydraulically disconnected from the production aquifer by more than 50 m of fine-grained soils.
- Considering the presence of a significant depth of confining material and no observed drawdown at the surface water monitoring stations during the pumping period of PAL4, it was concluded that long-term impacts to surface water from an increase in water taking of PAL4 to 60.6 L/s are not expected.

- The study also recommended that the current monitoring program for the Palgrave Drinking Water System be maintained. The current monitoring program managed and executed by the Region has been effective in identifying potential impacts related to water takings in the area and therefore no changes are recommended at this time.
- As noted above, long-term impacts to other groundwater and surface water features are not expected under the proposed pumping conditions for PAL4. However, if an unacceptable impact is reported and believed to be caused directly from municipal water takings, a contingency plan, including the following key actions are recommended:
    - Temporarily stall water takings at the well until it is proven that the unacceptable impact is unrelated to the operation of the well.
    - Prepare a detailed report on the unacceptable impact, including information on the reporter, location and damages incurred.
    - Validate the claims against the operation of the well using historical pumping test evaluations to assess the likelihood of the impact being a direct result of the well.
    - If the impact is confirmed as a direct result of the well operation and affects groundwater quantity or quality in a private well, implement a plan to mitigate damages and prevent future occurrences.
    - If the impact is confirmed and affects the natural functions of the surrounding ecosystem, establish a plan to mitigate further impacts to the ecosystem.
    - If the impact is determined to be unrelated to the well's operation, reinstate the well, and resume pumping. Maintain a record of the impact report for three (3) years.

Wellhead Protection Areas and Groundwater Vulnerability Assessment

An increase in water taking from an existing municipal supply well results in new Wellhead Protection Areas (WHPAs). The delineation of these new WHPAs was carried out as a separate assignment in parallel to this Class EA project. DRAFT limits of WHPAs have been delineated, as shown in **Figure (iii)** below, to reflect the proposed water taking increase to 60.6 L/s. The WHPA delineations will remain in draft form until the next stage of consultation process with the public, stakeholders and Source Protection Committee prior to submission and final approval by the MECP.

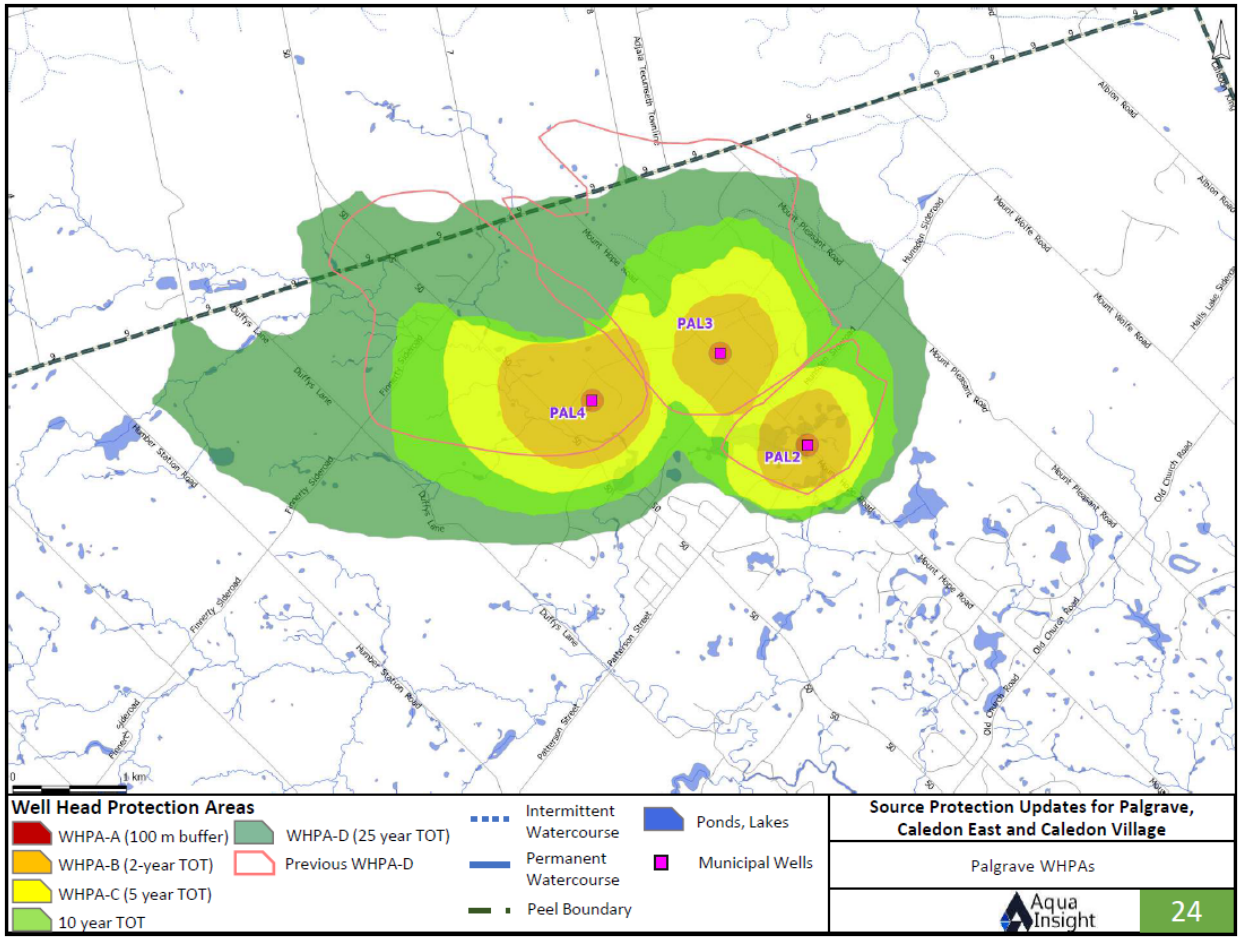


Figure (iii): Delineation of WHPAs for Palgrave Wells 2, 3 an 4

The new WHPA's were delineated and groundwater vulnerability, issues evaluation and threats assessment were completed by Aqua Insight in December 2022. Key findings include:

- Due to a deep and confined production aquifer, particles take over 25 years to reach Palgrave Well 4, often redirecting to local streams and wetlands. Most of the source water pumped by Palgrave Well 4 is recharged outside the WHPA-D area.
- Palgrave Well 4 has predominantly low vulnerability according to Surface to Well Advective Travel Time (SWAT).
- Vulnerability scores were assigned to WHPA polygons, with WHPA-C and -D at score 2 (low vulnerability), WHPA-B at score 6, and WHPA-A at score 10.
- The area around Palgrave Well 4 has 40-80% Managed Land due to residential presence.

- WHPA-A to -D polygons have under 0.5 nutrient units per acre from barn areas and interpreted livestock.
- Road salt application in WHPAs is classified as Low Drinking Water Threats.

Drinking Water Vulnerability Analysis and Threats Evaluation

As per the Clean Water Act, 2006, a drinking water threat is defined as an activity or condition that adversely affects or has the potential to adversely affect the quality or quantity of any water that is or may be used as a source of drinking water.

Ontario Regulation O. Reg. 287/07 under the 2006 Clean Water Act, has prescribed 22 threats for which policies must be written in areas where these threats could be significant. The Region recently conducted, as a separate assignment to the Class EA study, a Significant Drinking Water Threat (SDWT) enumeration exercise in accordance with the 2021 Director's Technical Rules.

The SDWT exercise identified Threat #2. The establishment, operation or maintenance of a system that collects, stores, transmits, treats, or disposes of sewage as the only prescribed SDWT associated with PAL4. The sources for the identified SDWT are associated with existing residential land uses in the vicinity of the PAL4 area. Specific actions related to septic systems governed under the Building Code Act and the Ontario Building Code, are to be implemented by the local Municipality. The responsible authority for policy implementation in this specific case is the Town, which addressed septic system through the Town’s Septic Re-inspection Program for on-site sewage disposal systems that discharge 10,000 litres and less.

In addition to the above, Threat #15. The handling and storage of fuel, is currently a SDWT for PAL4, based on the existing system configuration. The preferred recommended design concept, identified in this Class EA study and outlined in this report, includes the replacement of the existing emergency standby diesel generator with a new larger natural gas generator unit. The new generator unit will be supplied by natural gas delivered to the site, eliminating the need for a separate fuel tank, and therefore, removing the existing threat for standby fuel handling/storage.

The Source Protection Updates for the Communities of Palgrave, Caledon East, and Caledon Village, completed by Aqua Insight, December 2022, included an assessment of the potential threats related to winter road salt application. Consideration to the percentage of impervious surface area (e.g., roads, parking lots) was part of the impervious cover assessment exercise. Within the Palgrave area, road salt application on all roads within the WHPAs were classified as Low Drinking Water Threats, using the Circumstance Tables in the Technical Rules (MECP, 20221). The report Source

Protection Updates for the Communities of Palgrave, Caledon East, and Caledon Village by Aqua Insight (December 2022) has been attached as **Appendix H**.

The Credit Valley, Toronto and Region and Central Lake Ontario (CTC) Source Protection Plan includes the following policies related to Low/Moderate drinking water threats associated with road salt application:

- SAL-12 encourages municipalities to mandate salt management plans for unassumed roads and private parking lots exceeding 200 square meters in specified WHPAs and HVAs, focusing on minimizing salt usage through alternative measures and involving trained individuals in application.
- SAL-13 urges municipalities to annually report sodium and chloride monitoring results to the Source Protection Authority in areas where road salt application poses a moderate or low drinking water threat, facilitating the Source Protection Authority in carrying out trend assessment and advising the Source Protection Committee on the need for new plan policies to prevent potential drinking water issues.

As noted previously, activities related to winter road salt application were identified as a low threat; however, the Region is implementing a winter maintenance pilot project with best management practices (BMPs) to minimize salt usage and its impact on municipal wells. BMPs include adhering to Site Plans for snow pile locations and salt instructions, removing snow before applying de-icing products, having Smart About Salt certified contractors, sweeping and removing excess salt or de-icing products, considering temperature and conditions before application, and requiring monthly tracking of salt usage at each well facility by contractors.

Threat #16. The handling and storage of a dense non-aqueous phase liquid (DNAPL) has not been identified as a significant threat resulting from the operation of the Palgrave Drinking Water System, following the proposed upgrades identified in the Class EA study. However, construction activities associated with the project may introduce potential risks related to fuel and DNAPL. Heavy machinery and construction equipment, powered by fuels like diesel, pose a risk of fuel spills through accidental leaks or improper handling. Additionally, the use of DNAPLs, such as degreasers and industrial chemicals during construction, can contribute to soil and water contamination. Stormwater runoff from construction sites may carry pollutants, including residues of fuel and DNAPL, into nearby water bodies.

To address potential risks during construction, the following mitigation measures are proposed:

- Implementation of erosion and sediment control measures, including silt fences and sediment basins, to prevent contaminated runoff.

- Regular inspections of the construction site to promptly identify and address potential sources of fuel spills and DNAPL contamination.
- Implementation of monitoring programs to assess the quality of soil, groundwater, and surface water during and after construction.
- Adoption of proper storage and handling practices for fuel and chemicals, ensuring equipment maintenance and proper disposal procedures.
- Obtaining all necessary permits for construction activities and promptly reporting incidents to relevant environmental authorities.
- Development of comprehensive spill response plans outlining procedures for containing and cleaning up fuel spills and DNAPL releases.
- Ensuring construction personnel are adequately trained in spill response and emergency procedures, including the use of personal protective equipment.

No other activities or prescribed threats were identified as a SDWT for PAL4 based on 2021 Technical Rules criteria.

Climate Change

Increasing the capacity of the PAL4 and existing treatment plant may result in higher energy requirements and additional greenhouse gas emissions due to heating, lighting, electrical requirements as well as chemical delivery needs. In addition, the existing landscape of the area would need to be altered to accommodate new infrastructure.

Implementation of the following climate mitigation measures should be considered to reduce the long-term generation of carbon emissions arising mainly from operation of the new treatment facility and to enhance carbon storage due to proposed changes in the landscape:

- Construction equipment should be appropriately maintained to ensure that exhaust emissions meet industry standards.
- Use of energy efficiency features within the treatment facility such as LED lighting features and insulation to reduce the energy needs. Moreover, using energy-efficient pumps and equipment and optimizing system design would also contribute to the mitigation of climate change impacts.
- Chemical delivery is expected to be minimal; however, delivery could be scheduled on a monthly/bi-monthly basis to reduce the number of delivery trucks to/from the new reservoirs and new facilities.
- Implementation of an adequate landscape plan, comprising planting of new trees and local non-invasive vegetation species within the new site.

Socio-Cultural Environment

Specific mitigation measures are recommended for implementation to reduce anticipated short-term impacts associated with the duration of construction.

Public health and safety are a priority to the Region and as such, all design and construction activities related to the project will adhere to strict safety guidelines and all applicable codes and standards. All construction work must be carried out in accordance with the Occupational Health and Safety Act (OHSA) and other local regulations.

Most of the construction activities associated with enhancing the capacity of PAL 4 and the water treatment plant will be localized within the existing plant premises, affecting the few neighbouring property owners. The private residences in the vicinity are anticipated to have a low impact from potential disturbances from operations and maintenance activities.

The increased construction activities may lead to an increase in traffic volume and congestion in the project area. Increased truck traffic on Highway 50 and Buckstown Trail will be experienced during the duration of construction from the delivery of construction equipment, construction materials and potential removal of excavated material from the site. This could potentially disrupt regular traffic patterns and impact the overall safety and convenience for road users. The proposed mitigation measures include:

- Appropriate hours of work to be specified in the contract and in accordance with local by-laws.
- Completion of lane closures in accordance with best practices to protect the safety of the workers and public.
- Informing residents of any road closures and anticipated timing as well as the overall schedule of construction.
- Employment of all standard best practices for vehicle and pedestrian safety throughout all construction areas in adherence with strict safety guidelines.

Construction traffic and activities could create additional dust and mud. There are no anticipated concerns regarding dust and mud during normal facility operation. The proposed mitigation measures include dust control measures such as the application of water to be implemented as required. The Region will ensure that the contractor maintain public roadways clean and free of mud on a consistent basis.

Temporary noise and vibration effects are anticipated in connection with construction traffic and construction equipment. Noise during operation of the well and treatment

facility is not expected to be significantly different from the existing conditions. However, standard proposed mitigation measures include ensuring all vehicles and construction equipment are equipped with effective muffling devices and are operated in a fashion to minimize noise in the project area, and ensure the contractors undertake measures to reduce noise disturbances as much as possible and adhere to local noise by-laws.

Cultural Heritage and Archaeological Resources

Construction activities for the Project within the defined area are not expected to cause archaeological or cultural impacts. If buried artifacts are found during ground disturbance, work must stop, and the Archaeology Division of the Ministry of Heritage should be notified.

VIII. Public and Review Agency Consultation

Schedule C undertakings under the Municipal Class EA planning process require that members of the public, interest groups, review agencies and Indigenous Communities are given opportunities to provide input and comments from the early stages of the Class EA Study. The project team met this requirement by issuing and providing a Notice of Study Commencement advising of the start of the project and public notices advising of two (2) Public Information Centres (PIC). The public notices were placed for two (2) consecutive publications in local newspapers: The Caledon Enterprise and Caledon Citizen.

Through the consultation process, no major public concerns or issues were raised associated with the preferred recommended design concept. Comments and feedback were received after the Notice of Commencement and first virtual PIC in relation to the Supply Capacity Increase for Palgrave Well #4 Class EA Study. The major comments received include inquiries about private well impacts, compensation, development effects, water quality, project disruptions, and timeline. These were addressed by conducting inspections on private wells to assure no disruption, clarifying compensation absence, providing capacity projections for developers' confidence, sharing data to explain minimal impacts on wells, and offering estimated completion dates for project timeline queries.

Public concerns continued during PIC 2, focusing on well water quality, potential disruptions, and project timeline. These concerns were addressed by presenting detailed water quality assessments, assuring minimal disruptions based on project data, and providing an updated timeline for project completion. The project team provided transparent communication and thorough information sharing to successfully address all concerns.

Communication and consultation with Indigenous Communities was also undertaken and accommodated throughout the archaeological assessments, completed to support the Class EA study. Through the consultation process, concerns were raised by the Haudenosaunee Development Institute (HDI) regarding the project and potential impacts to Haudenosaunee heritage sites and their rights. The Region had separate consultation with HDI representatives in July 2023. The Region and HDI agreed to review individual project concerns on as needed basis.

Communication and consultation with MECP, TRCA and MHSTC were undertaken at various key stages of the Class EA process. Consultation will continue, as required, with public and agency stakeholders during the design and construction stages of the project.

A Notice of Study Completion will be published in the local newspapers and distributed to all in the project contact list. The notice will notify the public and agencies that this report has been placed on the public record for review. The Notice will advise available methods to review the report, the time period to provide comments, and the opportunity to provide further comments.

The Region will continue to inform the public during the project design and construction phases. Project updates will be issued, as necessary, and notices will include a dedicated contact person from the Region to respond to issues or concerns that may arise.

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1 Introduction

1.1 Background

The Region of Peel (Region) encompasses the City of Mississauga, the City of Brampton, and the Town of Caledon. The Region is responsible for the planning, design, construction, operation, and maintenance of the water systems within its municipal boundaries. In the rural areas of the Town of Caledon (Town), drinking water is provided through a well-based system where groundwater is drawn from municipal wells and treated at small scale water treatment plants.

The Region owns and operates four (4) groundwater systems in the Town, namely, Alton/Caledon Village, Palgrave/Caledon East, Cheltenham, and Inglewood. Ten (10) villages, hamlets and rural service centres are currently serviced by the four (4) municipal groundwater systems. The Palgrave/Caledon East Drinking Water System (DWS) supplies drinking water to the communities of Caledon East, Palgrave, Palgrave Estates, Mono Road, Albion, Centreville, and Cedar Mills in the Town. The system is currently supplied by six (6) municipal groundwater sources; three (3) located in Palgrave and three (3) in Caledon East.

In June 2020, the Region completed a comprehensive review of its municipal water and wastewater systems in the Town to understand the unique needs of each community, assess the capacity to service future population based on the projected and planned growth in these areas, and confirm infrastructure needs to accommodate existing and future demands. The review also included a risk assessment of system reliability, current ongoing planning review, development pressures, and available system capacity.

The findings of the comprehensive review revealed that current and projected growth in the service area can be supported through the existing Palgrave/Caledon East DWS. From an overall system perspective, some redundancy and operational flexibility is currently provided through the existing interconnection which allows treated water to be conveyed from Palgrave to Caledon East and vice versa. However, some limitations in the system were identified specific to limited redundancy with the security of supply and a historical decline in well efficiency in some of the system's production wells. This provided an opportunity for the Region to explore alternatives to enhance the security of water supply in the Palgrave/Caledon East DWS and reduce the associated risks.

To this end, the Region completed a hydrogeological investigation in 2019, as a separate assignment, to assess the feasibility of increasing the pumping rate of the existing Palgrave Well #4 (PAL4), located at 9 Buckstown Trail. The pump test carried out in October 2019 revealed that the water taking capacity at PAL4 can be increased from the current permitted rate of 30 L/s to 60 L/s, with minimal impact to the natural environment or the production aquifer resulting from the long-term operation of the well at the increased rate. A potential increase in water taking with PAL4 will require treatment capacity upgrades to the current PAL4 treatment facility.

Accordingly, the Region has undertaken a Schedule C Class Environmental Assessment (Class EA) study to identify the necessary infrastructure upgrades/modifications at the existing water treatment facility, needed to accommodate an increase in water taking of the existing municipal production well, PAL4. This will enable the existing Palgrave/Caledon East DWS to provide an appropriate level of service while meeting the long-term water needs of the serviced area and minimizing potential risks associated with declined well efficiency. CIMA+ was retained by the Region to complete the Class EA study to plan for the Supply Capacity Increase for Palgrave Well No.4

This report, referred to herein as the Environmental Study Report (ESR), documents the planning and decision-making process followed in the Class EA study to arrive at the preferred recommended solution for the security of water supply in the Palgrave/Caledon East Drinking Water System.

1.2 Study Context

1.2.1 Palgrave Well #4 Hydrogeological Investigation

Prior to the initiation of this Class EA study, the Region completed a hydrogeological investigation in 2019 to explore alternatives to enhance the security of water supply in the Palgrave/Caledon East DWS. The purpose of the investigation was to assess the feasibility of increasing the pumping rate of PAL4 from the current maximum of 30.3 L/s to 60.6 L/s.

The 2019 hydrogeological investigation included several key components such as the characterization of the geological and hydrogeological settings; a review of long-term water level trends within production aquifers; a 72-hour constant rate pumping test; water level monitoring at observation wells and surface water monitoring stations, and assessment of potential impacts from increased takings at PAL4.

The impact assessment considered cumulative drawdowns at municipal well locations (PAL2, PAL3 & PAL4), impacts on existing groundwater users including private wells, as well as impacts to surface water. MECP Water Well Records and Permit to Take Water (PTTW) records were utilized to identify existing groundwater users within a 500 m radius of PAL2, PAL 3, and PAL4.

Additionally, the investigation assessed the potential impact of increased takings at PAL 4 and evaluated PAL 4 in accordance with the Ministry of Environment's Terms of Reference for Hydrogeological Study to Examine Groundwater Sources Potentially Under Direct Influence of Surface Water, 2001 (GUDI TOR) and the Ministry of the Environment, Conservation and Parks (MECP) Draft Terms of Reference for Determination of Minimum Treatment for Municipal Residential Drinking Water Systems Using Subsurface Raw Water Supplies, 2019 (Draft TOR).

The key findings from the 2019 Hydrogeological Investigation were:

- PAL4 can yield in excess of 60.6 L/sec for extended periods (assuming no changes in hydrogeologic conditions from testing conditions).
- No significant interference is anticipated from an increased pumping rate to 60 L/s at PAL4.
- The estimated Radius of Influence (ROI) measured during the 72-Hour pumping test was approximately 1 km from PAL4.
- Rehabilitation of PAL4 is not anticipated prior to increasing the capacity of the well. Last rehabilitation was completed in late 2018.
- Long-term impacts to the Lower Aquifer are not expected at the increased capacity.
- Cumulative drawdown impacts for the combined operation of all municipal wells in the Palgrave DWS indicated that there are no anticipated adverse impacts on well capacity.
- 10 drilled or dug wells near PAL2, 19 near PAL3, and 24 near PAL4 were identified. A private well survey was undertaken to confirm the presence and current usage characteristics of private wells that could be affected by increased water takings at PAL 4, details are summarized in **Table 1**. The properties visited during the well survey are illustrated in **Figure 1**.

Table 1: Water Well Records within 500m radius of PAL4

Well Use	Number of Records	Percentage of Total (%)
Water Supply - Domestic	7	29
Water Supply - Commercial	2	8
Water Supply - Industrial	1	4
Monitoring/Observation/Test Hole	8	33
Abandoned/Other/Unknown	6	25

- Impacts on existing groundwater users are not expected under current and future operating conditions.
- No long-term impacts are anticipated on surface water resulting from an increase in water taking at PAL4, due to the substantial depth of confining material and the absence of observed drawdowns at surface water monitoring stations during the pumping test.
- The raw water quality obtained during long-term pumping at 60 L/s was found to be comparable to the current operating conditions at PAL4. Therefore, it is expected that the existing PAL4 treatment facility can accommodate an increase in water taking to 60 L/s, subject to a review and determination of necessary upgrades.
- PAL4 is not susceptible to surface contamination or contamination by protozoa. It was determined that with the increased pumping rate of 60.6 L/s, PAL4 would still be classified as Non-GUDI (Category 1 as per the 2019 Draft TOR).

Complete details on methodology, findings, and recommendations from the 2019 hydrogeological investigation are documented in the Palgrave Drinking Water System, Category 3 Permit to Take Water Application Report (Watermarks Environmental, 2020), included in **Appendix A**, and the Stage 1 Report on Assessment of Vulnerability to Contamination by Protozoa (Watermarks Environmental, 2021), included in **Appendix B.**

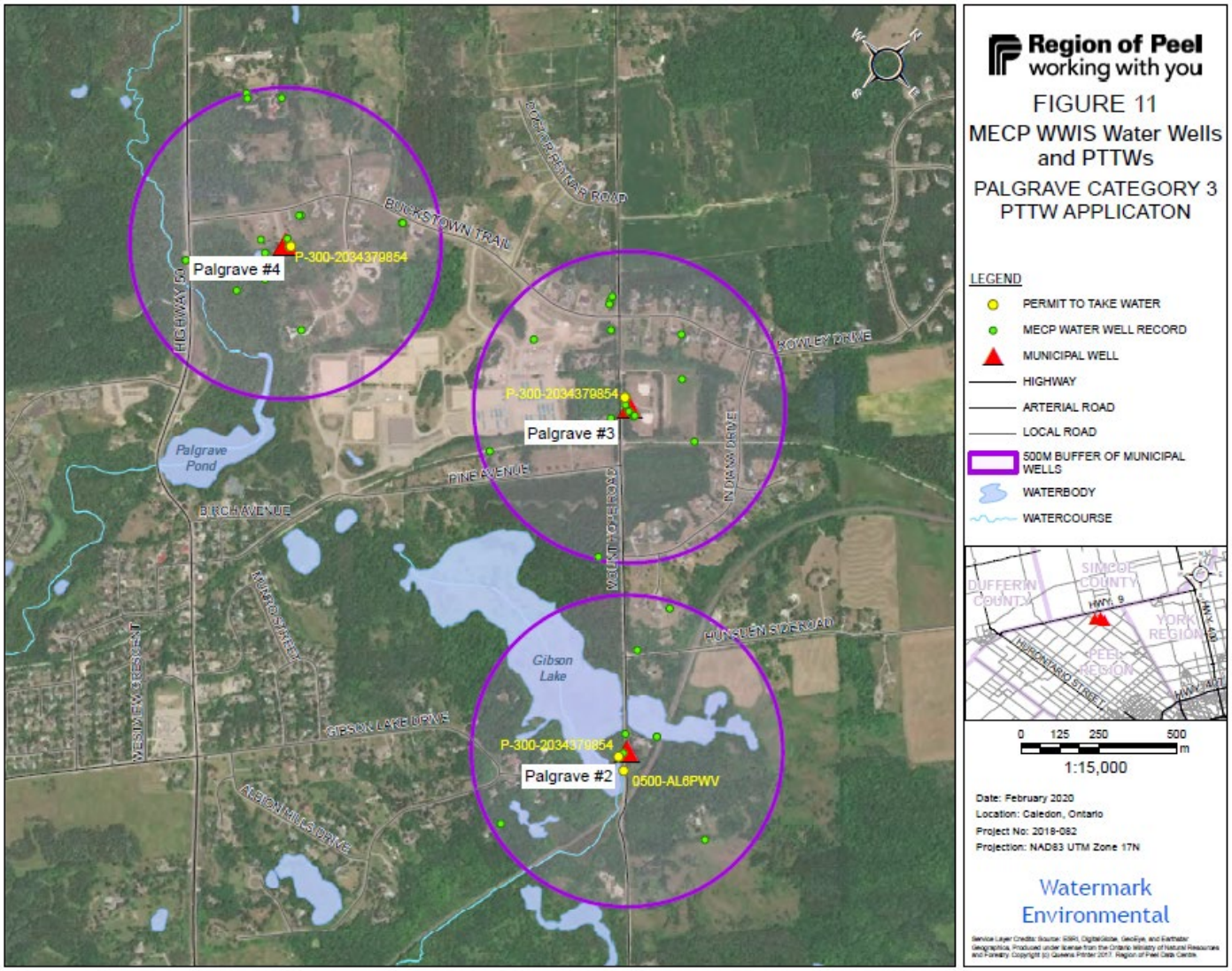

Figure 1: MECP Water Well Records and PTTWs within 500 m Buffer of Palgrave Wells

1.3 Objectives of the Class EA Study

The main objective of this Class EA Study is:

To objectively evaluate water servicing alternatives and identify the preferred water servicing solution to provide the necessary infrastructure improvements for the Palgrave/Caledon East DWS. The preferred water servicing solution should be sustainable, technically, and environmentally sound and economically mindful in terms of capital and operating costs.

Other Class EA objectives include:

- To provide appropriate consultation with all potentially affected and interested parties, including participation of a broad range of stakeholders and Indigenous Communities to allow for the sharing of ideas, education, feedback; and
- To document the study process in compliance with all phases of the Municipal Class EA planning process.

This Environmental Study Report (ESR) completes the Schedule C Class EA requirements and provides a description of the planning and decision-making process as well as the recommendations for the preferred water servicing solution for the Palgrave/Caledon East area.

1.4 Objectives of the Environmental Study Report

This ESR describes the planning and decision-making process followed during the Class EA Study for the provision of infrastructure improvements required to increase the water taking capacity at PAL4.

The ESR describes the:

- Various alternative solutions considered for water servicing, including the expansion/retrofit of existing PAL4 Water Treatment Plant
- Evaluation methodology and evaluation criteria used to assess the different alternatives,
- Anticipated potential impacts,
- Proposed mitigation measures associated with the alternatives, and
- Rationale for the selection of the preferred water servicing solution and implementation plans, and

- Public and agency consultation records and feedback.

The Class EA process provides an opportunity for members of the public, interest groups and review agencies to review the ESR during a 30-day review period. The 30-day review period gives individuals additional opportunities to raise additional concerns regarding the project with the Region. Any outstanding concerns are to be addressed directly to the Region.

In addition, a request may be made to the Ministry of the Environment, Conservation and Parks (MECP) for an order requiring a higher level of study (i.e., requiring an individual/comprehensive EA approval before being able to proceed), or that conditions be imposed (e.g., require further studies), only on the grounds that the requested order may prevent, mitigate, or remedy adverse impacts on constitutionally protected Indigenous and treaty rights. The request, also known as a Section 16 Order, must be submitted in writing to the Minister of the Environment, Conservation and Parks, and should be submitted to the Director of the Environmental Assessment Branch and the Region.

Provided that no additional concerns or Section 16 Order requests are received within the 30-day review period, the project will proceed through the detailed design and construction phases as outlined in this ESR.

1.5 Report Outline

This report has been prepared to meet the requirements of the Ontario Municipal Engineer's Association (MEA) Municipal Class EA Planning Process (October 2000, as amended in 2007, 2011 & 2015). This report combines all phases of the planning process under one (1) cover and includes steps that are considered essential for meeting the requirements of the Environmental Assessment Act (EAA). The report includes the following sections:

Section 1: Introduction – Provides background information leading to the initiation of this study, providing the objectives of the Class EA study and the ESR, and describes the format of this report.

Section 2: Municipal Class Environmental Assessment Process – Provides a summary description of the framework and activities to be completed to meet the Municipal Class EA process requirements.

Section 3: Public and Agency Consultation Process – Describes the consultation program with the public and agencies, and public engagement activities.

Section 4: Planning Policy Context - Describes background information relevant to growth and development in the study area, including provincial, regional, and municipal planning policy documents.

Section 5: Existing Conditions – Presents an overview of current conditions in the Drinking Water System that currently provides municipal drinking water servicing to Caledon East/Palgrave.

Section 6: Design Criteria – Presents the design criteria for drinking water servicing in Caledon East/Palgrave area.

Section 7: Class EA Phase 1 – Problem / Opportunity Statement – Presents the problem/opportunity statement for this Class EA Study.

Section 8: Study Area – Presents an overview of the study area.

Section 9: Capacity Assessment – Presents the capacity assessment of the major processes and treatment equipment at the existing treatment facility.

Section 10: Evaluation Methodology – Presents the evaluation methodology used to ultimately select the preferred recommended water servicing alternative.

Section 11: Class EA Phase 2 – Identification and Evaluation of Alternative Solutions – Describes the water servicing strategies explored in the Class EA study by providing information on a long-list of alternatives and identifies a short-list of feasible alternatives based on a set of must-meet criteria.

Section 12: Class EA Phase 3 – Identification and Evaluation of Alternative Design Concepts – Describes the key considerations used to develop potential implementation strategies for the short-listed alternatives. Summarizes the results of the detailed comparative evaluation carried out for the short-listed water supply alternatives described as well as the results of the sensitivity analyses.

Section 13: Preferred Recommended Alternative Design Concept – Presents the preferred recommended water servicing solutions with relevant findings and recommendations from desktop studies and technical considerations and economic factors.

Section 14: Anticipated Potential Impacts and Mitigation Measures – Describes potential impacts from implementation of the preferred water servicing solution and the proposed mitigation measures.

2 Municipal Class EA Process

This section provides an overview of the Municipal Class EA process and the steps involved in bringing a municipal infrastructure project to the design and construction phases.

2.1 Municipal Class Environmental Assessment

The Supply Capacity Increase for Palgrave Well # 4 Class EA Study has been undertaken in accordance with the requirements of the Municipal Class Environmental Assessment document (October 2000, as amended in 2007, 2011, 2015 & 2023). The Municipal Class EA process is an approved decision-making and planning process that proponents of municipal infrastructure projects must follow to meet the requirements of the Environmental Assessment Act (EA Act).

All municipal infrastructure projects in Ontario, including water and wastewater project, are subject to the Municipal Class EA process. The Municipal Class EA was created to ensure that all aspects of the environment are considered during the planning and construction phases of a project. The Class EA process outlines the steps that must be followed to satisfy the EA requirements for water, wastewater, and road projects.

The Municipal Class EA process includes five (5) phases to be followed to ensure that the best approach is identified to address a specific problem, requiring the evaluation of possible solutions, design concepts, and recommends the best approach based on a comprehensive evaluation of environmental effects and how to minimize them. As shown in **Figure 1**, the five (5) phases include:

- Phase 1: Identification of the problem or opportunity.
- Phase 2: Identification of alternative solutions to the problem or opportunity and their respective impacts to the environment. Evaluation of alternative solutions and selection of a preferred solution considering public and review agency input.
- Phase 3: Identification and evaluation of alternative design approaches for the preferred solution. Selection of the preferred design concept based upon public and review agency input.
- Phase 4: Documentation of the planning, rationale, design and consultation process in a final Environmental Study Report (ESR). The ESR must be available to the public and review agencies.

- Phase 5: Implementation of the preferred alternative design concept and monitoring for environmental provisions and mitigation measures.

Public and agency consultation is an important part of the Class EA planning process. Gaining input from individuals and groups can help identify project concerns early, and to find ways to address concerns wherever possible. Public consultation is carried out at key stages of the Class EA process to allow time to review and provide input related to the project.

Projects subject to the Class EA process are classified into three (3) possible "schedules" (or categories), depending on the degree of expected impacts:

- Schedule A projects represent are minor operational and maintenance activities and are approved without the need of further assessment.
- Schedule A+ projects also represent minor activities and are pre-approved but require public notification prior to project implementation.
- Schedule B projects require screening of alternative solutions based on their environmental impacts. Phases 1 and 2 must be completed and are typically presented in a report with a Notice of Completion from the project proponent, followed by a 30-day public review period. If no significant impacts are identified and there are no requests for a Section 16 Order by the Minister for an Individual EA, then the Schedule B projects are approved and may proceed to Phase 5.
- Schedule C projects typically have greater potential to impact the environment and must complete all five phases of the Class EA planning process. In addition to Phases 1 and 2, Phase 3 involves the assessment of alternative solutions followed by a public consultation of the preferred design concept. Phase 4 typically entails the preparation of an Environmental Study Report to be filed for public review. If no significant impacts are identified and no Section 16 Order is received from the Minister, then Schedule C projects are approved and proceed to Phase 5.

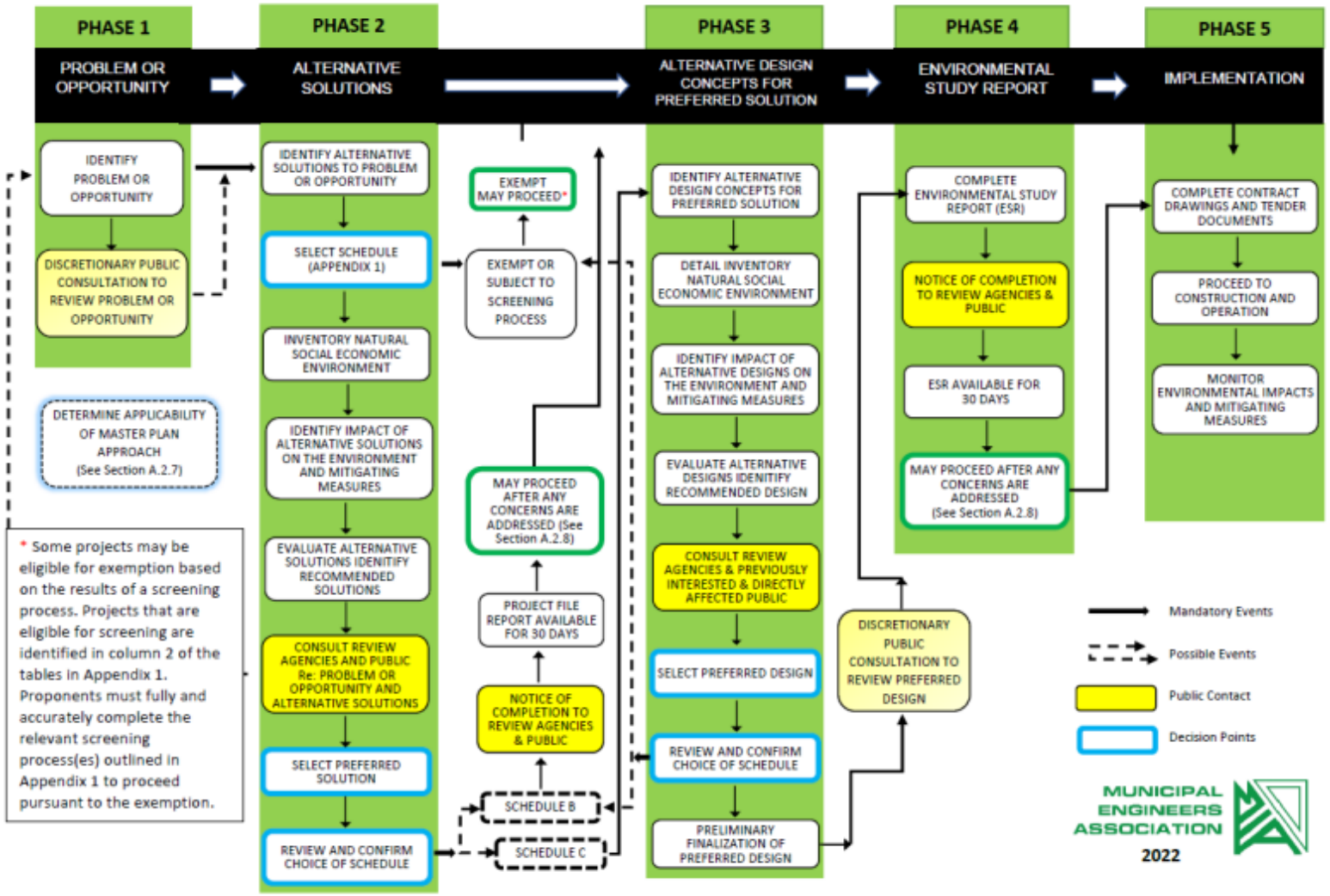

Figure 2: Municipal Class EA Planning and Design Process (Source: Municipal Engineers Association, 2023)

2.2 Supply Capacity Increase for Palgrave Well # 4 Class Environmental Assessment Process

The planning and development of Supply Capacity Increase for Palgrave Well #4 has been conducted as a Schedule C undertaking under the Municipal Class EA process.

The project was originally commenced as a Schedule B Class EA study. However, as the project advanced and various alternative solutions were identified and developed, it became evident that elevating the project schedule to Schedule C Class EA study was necessary. The project has since been undertaken to fulfill the requirements for Schedule C activities under the Municipal Class EA process satisfying Phases 1 through 4.

Phase 1 (Identification of the Problem/Opportunity), Phase 2 (Identification of Alternative Solutions), Phase 3 (Identification and Evaluation of Alternative Design Concepts for Preferred Solution) and Phase 4 (Preparation of the Environmental Study Report) have been carried out accordingly for this Class EA Study. Review agencies, stakeholders, indigenous communities and the general public were consulted at several points in the project to solicit input and comments.

This document, referred to herein as the Environmental Study Report (ESR), summarizes Phases 1, 2 and 3 of the Class EA process and fulfills the requirements for the Municipal Class EA process for Schedule C undertakings. The ESR will be placed on the public record for at least 30 calendar days for review by the public. Notification to the public and review agencies will be through the issuance of a Notice of Study Completion.

The Notice of Completion will advise that interested persons may provide written comments to the project team within the review period and all comments and concerns should be sent directly to the Proponent. In addition, if there are outstanding concerns regarding potential adverse impacts to constitutionally protected Indigenous and treaty rights, Section 16 Order requests on those matters should be addressed in writing to the Minister of Environment, Conservation and Parks (MECP), the Director of Environmental Assessment Branch and the Region.

If no significant issues arise during the review period which cannot be resolved in consultation with the Region, and no Section 16 Order requests are received, the project will be considered approved and may proceed directly to implementation.

2.3 Information on Section 16 Order Requests

Under the Class EA planning process, there is an opportunity for the Minister or delegate to review the status of a project. A request may be made to the MECP for an order requiring a higher level of study (i.e., requiring an individual/comprehensive EA approval before being able to proceed), or that conditions be imposed (e.g., require further studies), only on the grounds that the requested order may prevent, mitigate, or remedy adverse impacts on constitutionally protected Indigenous and treaty rights. Requests on other grounds will not be considered. Requests should include the requester contact information and full name for the ministry.

Requests should specify what kind of order is being requested (request for additional conditions or a request for an individual/comprehensive environmental assessment), how an order may prevent, mitigate, or remedy those potential adverse impacts, and any information in support of the statements in the request. This will ensure that the ministry is able to efficiently begin reviewing the request. The requests should also be sent to the Proponent by mail or email.

The request should be sent in writing or by email to:

Minister of the Environment, Conservation and Parks

Ministry of Environment, Conservation and Parks

777 Bay Street, 5th Floor

Toronto ON M7A 2J3

minister.mecp@ontario.ca

and,

Director, Environmental Assessment Branch

Ministry of Environment, Conservation and Parks

135 St. Clair Ave. W, 1st Floor

Toronto ON, M4V 1P5

EABDirector@ontario.ca:

Other comments and concerns about the proposed works related to the preferred recommended water servicing alternatives or the Class EA study should be dealt directly with the Region. Interested persons may provide written comments to the project team, within the established review period.

3 Public and Agency Consultation Process

Public consultation is an integral component of the Class EA study process. Successful public consultation programs build and maintain community trust and credibility, improve project decision-making, and identify community issues far enough in advance so that they can be effectively addressed.

This section provides a summary of public and agency consultation activities undertaken at key stages of the Supply Capacity Increase for Palgrave Well # 4. Comments, feedback, and relevant information received throughout the course of the Class EA study from review agencies and the public are described in the following sections. Detailed information regarding public and agency consultation can be found further in the appendices referenced in the following sections.

3.1 Public Consultation and Communication Program

A Communication and Consultation Program was implemented to manage public relations between the community and the Project Team and to establish opportunities to gather feedback from the public. Key objectives of this program were to:

- Inform the public, stakeholders, and Indigenous Communities of the project
- Facilitate and communicate opportunities for public input
- Obtain input on project components at key decision-making points
- Involve stakeholders and Indigenous Communities by identifying appropriate mitigation measures and to assure them that these measures will be implemented

3.2 Stakeholders and Indigenous Communities

Various groups of stakeholders and Indigenous Communities which were considered to have an interest in the Supply Capacity Increase for Palgrave Well # 4 Class EA were identified, as outlined below.

- Residents: local residents within the limits established for the project study area, delineated to capture a 1 km radius from the existing PAL4 well, were included in the project contact list and contacted throughout the project through direct mailing of all project notices.
- Local and Regional Ward Councillors and Councils

- Review agencies: Provincial ministries and agencies, Federal Government departments and agencies, local area municipalities, district and planning boards, emergency services (fire, police, ambulance), school boards, transit authorities and utilities (natural gas, cable, telephone, etc.)
- Environmental stakeholders and conservation authorities: Toronto and Region Conservation Authority (TRCA), Nottawasaga Valley Conservation Authority (NVCA), Credit Valley Conservation-Watershed Plans and Monitoring, Credit Valley Conservation-Watershed Plans and Source Water Protection, Lake Simcoe Conservation Authority.
- Indigenous Communities: Chiefs of Ontario and First Nations including Mississaugas of the Credit First Nation, Metis Nation of Ontario, Fort William First Nation, Haudenosaunee Development Institute (HDI), Six Nations of the Grand River, Huron-Wendat Nation. Project notices were mailed out and emails were sent to all Indigenous Communities listed in the Project Contact List. Follow up phone calls were conducted and PIC materials were shared via email as requested.
- Local businesses, groups, and associations like Construct Connect, Caledon Pastures, Palgrave Rotary Club etc.
- Land developers: Kaneff Group of Companies, TAC Projects Inc., Ballantry Homes.

3.3 Public Consultation, Communication Strategies and Tactics

The following outlines the specific consultation activities undertaken to support the Palgrave No. 4 Supply Well Class EA Study:

- **Project Mailing List**: A master project contact list, including local residents within the study area, members of community groups, local businesses and developers, Indigenous Communities, and several technical review agencies and organizations was developed. Interested members of the public were added to the project mailing list if requested and kept informed of project developments. All individuals on the project list were contacted at the appropriate stages of the study to inform them of meetings and events. A copy of the Project Mailing List is included in **Appendix C** for further reference.
- **Notice of Study Commencement:** A “Notice of Study Commencement”, advising of the start of the Class EA study as a Schedule B project, was placed in The Caledon Enterprise and Caledon Citizen news on two (2) consecutive publications on June

10 and June 17, 2021. Copies of the notice were mailed and/or emailed to those on the project mailing list. A copy of the notice was also posted on the Region's webpage, on June 10, 2021: https://www.peelregion.ca/public-works/environmental-assessments/caledon/palgrave-ea-well4.asp. A copy of the original Notice of Commencement is provided in **Appendix D**. Subsequently, the project's status was elevated to a Schedule C Class. Revised project schedule was communicated to the public, agencies and stakeholders through issuance of Notice of PIC, and this change was communicated in the Notice of Public Information #1 and Revised Project Schedule.

- **Online Public Information Centre No. 1 (PIC 1):** Due to the COVID restrictions at the time of the first PIC, the format of PIC 1 was virtual with PIC related information posted on the Region's website on February 14, 2022, for approximately three (3) weeks, until March 4, 2022. Everyone on the Project Contact List, including review agencies, indigenous communities, and members of the general public were notified by mail and/or email of the virtual PIC. Copies of the Notice of PIC 1 and Revised Project Schedule were mailed out to residents to inform about the virtual PIC and the reason for elevating the project from Schedule B to Schedule C.

  The purpose of PIC 1 was to introduce the project, present the decision-making process proposed for the study and the preliminary options under consideration, and to actively seek public input and feedback on the information presented.

  The presentation boards for the online PIC were posted on the Region's webpage: https://www.peelregion.ca/public-works/environmental-assessments/caledon/palgrave-ea-well4.asp. Contact information was provided for both the Region's and the consultant's project managers if stakeholders wanted to further discuss any content presented.

  An online comment form was also made available online on the project's webpage. Comments received after the PIC are summarized in Section 3.4 of this report. A copy of the formal invitation letter and the notice of the PIC is provided in **Appendix D**. The information presented at the virtual PIC is included in **Appendix E.**

- **Public Information Centre No. 2 (PIC 2):** A second PIC was held in the Palgrave Equestrian Facility – Palgrave Community Room on October 27, 2022, from 4:00 pm to 7:00 pm. Everyone on the Project Contact List, including review agencies, indigenous communities and members of the public were notified by mail and/or email of the PIC. Copies of the Notice of PIC were mailed out to residents in the contact list.

The in-person PIC 2 was held as an open forum where attendees were encouraged to review information displayed on poster boards and have one-on-one conversations with staff from the Region and its consultant team, CIMA+. The purpose of PIC 2 was to present the study recommendations and the results of the selection process for the preliminary preferred design concept to the public, and to identify the next steps in the study and gather public feedback on the information presented. The PIC also identified potential impacts and mitigation measures resulting from the preliminary preferred design concept being recommended.

The PIC 2 meeting materials available included:

- Display panels, including information about the project using both text and visuals
- Comments Sheets, which the attendees were encouraged to fill out as an opportunity to provide comments, make suggestions or ask questions about the project and/or the Class EA Study process

The information for PIC 2 was also posted on the Region's webpage: https://www.peelregion.ca/public-works/environmental-assessments/caledon/palgrave-ea-well4.asp. The comments received after PIC 2 are summarized in Section 3.4 of this report. A copy of the formal invitation letter and the notice of the PIC is provided in **Appendix D**. The information presented for the PIC 2 is included in **Appendix E.**

- **Notice of Study Completion:** A "Notice of Study Completion" notifying the public and agencies that the ESR will be placed on the public record for review will be issued. The Notice will advise available methods to review the ESR, as well as their ability to address outstanding issues and concerns with the Region or a request for a Section 16 Order, provided that the concern(s) raised deals with constitutionally protected Indigenous or treaty rights. The Notice of Study Completion will be advertised in the local newspapers as well as posted on the Region's project website and mailed out/emailed to all in the Project Contact List. The appropriate follow up phone calls with Indigenous Groups and Communities will take place prior to issuing the Notice of Completion to ensure any additional consultation is accommodated before the report is filed on the public record.

3.4 Summary of Public Issues, Comments and Concerns

Comments were received from residents and local businesses/developers in response to the Notice of Study Commencement (June 2021) and PIC 1 (February 2022). Comments were received by the Project Team mostly through email. All comments collected are included in the comment log in **Appendix E.**

The following summarizes the action items and outcomes of activities carried out to address concerns raised by the residents in response to the Notice of Study Commencement:

- A local resident requested ongoing communication and expressed concerns over the impact of this project on his private well water level which was already low. The project hydrogeologist Geo Kamp Ltd conducted inspections on the resident's property and found that the lower water levels are a result of a relatively low well yield of 11.4 L/min, which is slightly below the suggested minimum yield for private well supplies. The lower well yield could be further intensified by having an existing installed VFD pump that requires a minimum flow of 11.3 L/min. Based on this investigation it was concluded that the proposed increase of capacity at Palgrave Well No. 4 would not interfere with the water supply at the private well. A technical memorandum summarizing the results of the well inspection was prepared by Geo Kamp Limited, dated June 21, 2021, and the recommendations were forwarded to the resident.
- Another resident expressed concerns regarding interference from Palgrave Well No. 4 at their private well and inquired about the existence of any compensation process for private well owners who would be affected by the project. The resident also requested information on mitigation of impacts on the water table. The project team provided background information on the project and confirmed that no established compensation program is in place. An inspection of the well was carried out by Geo Kamp Limited, and it was concluded that the proposed increase of capacity at Palgrave well 4 is not expected to interfere with the water supply at the private well. Based on the well record, it was found that water levels at this well have remained stable since the well was drilled and it does not suggest aquifer decline. However, the well yield was found to be below the suggested minimum guideline yield which suggests that the homeowner could experience water disruptions, unless well improvements are undertaken. A technical memorandum by Geo Kamp dated July 15, 2021, was shared with the resident.
- A local resident requested for available information on all water related projects in the Caledon area. The individual was added to the contact list and the Region's website link including details of two ongoing Class EA's (including Palgrave No.4 Supply Well) was shared.

The following summarizes the major questions/comments highlighted by the residents in response to PIC 1:

- A resident inquired about the need for the increase in supply capacity at PAL4, and the water consumption of private wells in and around Palgrave. The background on the Class EA and link to the PIC boards was shared with the resident. It was clarified that water can be consumed by private water haulers at a metered hydrant on a permit basis in Caledon from April to October. The total volume taken by private water haulers was 13,654 m^3 in 2021 which is approximately 1.98% of the annual water-taking from the three Palgrave Wells #2, #3 and #4 (690,081 m^3) and approximately 2.35% of the Palgrave Wells water-taking between April 15th and October 1st (580,347 m^3).
- A resident inquired about potential impacts of the project on their private well. The well records were obtained from the Ministry of Environment's online database by the project team and shared with the resident. A memo dated May 9, 2022, was shared by the Region, indicating that drawdown was only observed in intermediate wells within a distance of 30 meters from PAL 4 during a pumping test carried out in October 2019. As such, long term impacts to nearby groundwater users including the resident's property are not anticipated.

The following summarizes the major concerns raised by local businesses and developers in response to PIC 1:

- A local developer inquired whether the increase in capacity at Palgrave Well No. 4 would help his development on Mount Hope Road. The project team confirmed that the future growth of his proposed development has been accounted for in the future capacity projections, and Palgrave-Caledon East system will have more capacity because of this project. The Region also addressed the developer's query regarding cost sharing for the proposed watermain extension to the future development and confirmed that it would not be possible under existing policies.
- A local business inquired whether the project is regarding future subdivisions in the area of Mount Hope Road and raised some concerns over high water hardness. The business was informed that the proposed increase in capacity is to ensure current and projected growth in areas serviced by the Palgrave/Caledon East drinking water system can continue to be serviced by the groundwater system. The inquiry about hard water was passed on to the water quality inquiries team.
- A local business requested for an estimated timeline for the completion of the project. The project team shared the estimated timeline for the second PIC in late summer 2022 and preparation of the Class EA report by the end of 2022.

3.5 Agency Consultation

In conformance with the consultation program established for the Class EA Study, the Project Team ensured that similarly to the public, appropriate review agencies were informed and given opportunities to contribute during the study.

Opportunities for review agencies to participate in the project were provided through the distribution of the Notice of Study Commencement and Notice of PIC via direct letter mailing and/or through email, if specified. The complete list of all agencies contacted is included in **Appendix C**. Detailed agency consultation information is included in **Appendix F.**

This section describes major considerations and key input and feedback sought/received from review agencies during the study. Standards letters and exchange of information was carried out as part of the communication and consultation component, which can be found in **Appendix F.**

3.5.1 Ministry of Environment, Conservation and Parks

A Notice of Study Commencement and Project Information Form was submitted to MECP on June 10, 2021. A response letter was received from MECP via email on June 16, 2021, advising the proponent of the Crown's duty to consult and that the MECP is delegating the procedural aspects of rights-based consultation to the proponent through the letter. The letter provided a list of Aboriginal communities potentially affected by the project and to be consulted as part of this EA including Mississaugas of the Credit First Nation, Six Nations of the Grand River (both the Six Nations Elected Council and the Haudenosaunee Confederacy Chiefs Council), and the Huron-Wendat Nation (if there is potential for the project to impact archeological resources). The letter also advised of circumstances under which the Director of Environmental Assessment Branch should be contacted after initial discussions with the communities identified by MECP.

Moreover, the letter included a standard list of "Areas of Interest" for the proponent to identify and address, as applicable, on a project basis. The following summarizes how applicable areas of interests were addressed and incorporated into the planning and decision-making process for this Class EA study:

- **Planning and Policy:** Provincial, regional, and municipal planning policy documents relevant to the growth and development at Palgrave and Caledon East, as well as current and planned works projects, are considered as part of this Class EA study and are described in Section 4: Planning Context.

- **Source Water Protection and Groundwater:** A hydrogeologic review was undertaken by Geo Kamp Limited in April 2021 to inform the selection of the preferred solution. This included a peer review of the Hydrogeologic investigation (February 2020) and GUDI Assessment Report (April 2021) prepared by Watermark Environmental Ltd, discussed in **Section 1.2** of this report. Groundwater resources, geotechnical and hydrogeological conditions of the study area specific to the site under consideration, and potential impacts to existing groundwater users and surface water features were identified and assessed. A stand-alone report documenting the findings of the hydrogeological review is included in **Appendix G**.

  The Region also completed, as a separate assignment but in parallel to this Class EA study, a Source Water Protection Update to assess the impact on the existing Wellhead Protection Areas (WHPAs) from the proposed water taking increase from PAL4. The existing groundwater flow model was updated, based on which new wellhead protection areas (WHPAs) were delineated for the three municipal wells located in Palgrave. Additionally, evaluation of the aquifer vulnerability, and calculation and identification of non-point source threats within the newly delineated WHPAs were carried out as part of the Source Water Protection study discussed in **Section 8.4** of this report. The study involved consultation and communication with the public, including all property owners located within the re-delineated WHPA's. The complete Source Protection Update report (Aqua Insight, December 2022) has been attached as **Appendix H.**

- **Climate Change:** The short-listed alternative solutions were evaluated against a set of categories that include considerations such as 'climate change' criteria, as described in Section 12.6. In addition, potential impacts to climate change anticipated from implementation of the preferred recommended alternative solutions, along with available mitigation measures proposed to minimize or avoid such impacts, are described in Section 14 of this report.

- **Air Quality, Dust and Noise:** The short-listed alternative solutions were evaluated against a set of categories that include socio-cultural considerations, such as aesthetics and operational impacts of new infrastructure, described in Section 12.6. Potential impacts to air quality, dust and noise anticipated from implementation of the preferred recommended design concept, along with available mitigation measures proposed to minimize or avoid such impacts, are described in Section 14.

- **Ecosystem Protection and Restoration:** The short-listed alternative design concepts were evaluated against a set of categories that include natural environment considerations, described in Section 12.6. A baseline natural features assessment including a combination of desktop assessment and field investigations

was undertaken by LGL Limited to determine the sensitivity of the study area, identify the existing features and natural heritage constraints, and to identify potential impacts and mitigation measures. The findings and recommendations of these studies were used in the selection of the preferred recommended design concept. In addition, potential impacts due to the implementation of the preferred recommended design concept are identified and mitigation measures proposed to minimize or avoid such impacts, described in Section 14. Stand-alone report documenting the findings of the natural heritage investigations is included in **Appendix I**.

- **Species at Risk:** A desktop review as well as field investigations were conducted by LGL to assess the natural heritage constraints in the study area. The study found low potential for impacts on natural heritage, including vegetation, aquatic habitats, and wildlife within the construction areas. No species at risk (SAR) habitats or individuals were identified. Recommendations to minimize disturbance to wildlife include limiting construction to manicured lands, avoiding vegetation removal during the breeding bird window (April to August), and using fencing to isolate construction activities. LGL's report documenting the findings of the SAR review, including impacts assessment and mitigation measures, is included in **Appendix I.**

A draft copy of the ESR was submitted to MECP for their review in October 2023. The following comments were received:

- The MECP will conduct a detailed review of potential impacts resulting from the proposed increased daily water taking and associated construction activities at Palgrave Well #4 during the amendment and/or renewal of the current Permit to Take Water (P-300-2034379854) and related Conditions (4.1, 4.2, 4.3, and 4.4).
- The MECP mandates the abandonment of all wells not used for extended monitoring or water supply, following the guidelines of Ogre. 903 under the Ontario Water Resources Act.

No revisions to the ESR were made as a result of these comments.

In addition to the above, comments were received from the Ministry's Conservation and Source Protection Branch (CSPB) in a letter dated November 8, 2023, attached in **Appendix F**. The key points from the recommendations include:

- The report should comprehensively identify potential threats to drinking water associated with the project, such as handling/storage of fuel, application of road salt, handling/storage of DNAPL, snow storage, etc.
- Mitigation measures for potential threats should be clearly outlined in the report, ensuring alignment with the CTC Source Protection Plan policies.

- The proponent should assess if other types of drinking water systems (e.g., private systems, designated facilities) could be affected during the construction or operation of the project, beyond what is explicitly addressed in source protection plans.

The ESR was revised accordingly to address the above noted comments. Sections within the Executive Summary, Section 1.2 Study Context, Section 8.4 Source Water Protection, and Section 14 Anticipated Potential Impacts and Mitigation Measures include the required additional information.

3.5.2 Toronto and Region Conservation Authority

Consultation with the Toronto and Region Conservation Authority (TRCA) was carried out throughout the study. The following summarizes the key interactions/feedback and communication between the project team and TRCA:

- TRCA provided commenting roles and areas of interest in an email in response to the Notice of Commencement on August 13, 2021, and recommended contact points and document reviews for the Class EA process.
- TRCA was informed of the first PIC and revised project schedule for the Schedule ‘C’ Class EA on February 11, 2022. Post-PIC comments were provided on March 9, 2022, recommending including a review of the Oak Ridges Moraine Conservation Plan and the associated Planning Zones in the Class EA, notifying the need for Permission to Enter requirements for TRCA lands on west side of Highway 50, and requesting a review of technical studies.
- A notice of the second PIC was sent to TRCA on October 21, 2022, and TRCA requested documentation on November 18, 2022, describing natural features and functions, and assessing potential impacts resulting from the proposed development. TRCA also commented that the wellhead is adjacent (within 50m) to unevaluated wetlands and Candidate ANSI Life Sciences (Humber Headwaters), and all four alternatives being considered for the proposed development would result in doubling groundwater extraction from 30L/s to 60L/s. Accordingly, the project team was requested to provide documentation assessing potential impacts to surface water features and wetlands.
- The project team shared Draft Baseline Natural Features Assessment Report by LGL Limited (2021), hydrogeological report by Watermark Environmental (2021), and the Source Water Protection Updates Report by Aqua Insight (2022) on November 25, 2022, and a revised Source Water Protection Updates report on December 19, 2022. TRCA was also informed that the Region would apply for PTTW license once the EA is completed.

- On February 7, 2023, TRCA responded that there is insufficient information regarding potential hydraulic impacts, the zone of impact of proposed works, and proposed upgrades to the well facility. The potential impacts on natural heritage features and hydrological features adjacent to the site are also unknown. An updated report was requested, assessing the potential impacts resulting from the proposed development and proposed mitigation measures, once known. Since the wellhead is within 50m of unevaluated wetlands and Candidate ANSI Life Sciences (Humber Headwaters), it was requested to include an assessment of potential impacts and mitigation measures to the ecological and hydrological functions of the wetland in the report.
- On March 9, 2023, the project team shared a technical memorandum to address the comments, along with Palgrave Well#4 Construction and Testing Program (AMEC Earth and Environmental Limited, January 2002) and Category 3 Permit to Take Water Application (Watermark Environmental Ltd., February 2020). The response memo discussed monitoring regarding shallow groundwater and surface water stations to assess potential impacts such as drawdown and interference. It also presented two previous reports regarding PAL 4 aquifer performance testing at 30.3 and 60.6 L/s and shallow groundwater/surface water impacts. Construction details of PAL 4 and a distance drawdown curve were included, indicating no interference to shallow depth wells or surface water features. The memo concluded that PAL 4 can yield in excess of 60.6 L/s for extended periods without significant interference. Additionally, the GUDI evaluation found that PAL 4 is not susceptible to surface contamination or contamination by protozoa, and with the increased pumping rate PAL 4 is still considered non-GUDI. Therefore, no negative effects are expected on the fisheries resources at the monitored sites, and no cumulative impacts are expected due to base flow reductions. As a result, no natural resource mitigation plan is needed for the monitored locations.
- On March 31, 2023, TRCA confirmed that the review had been completed and they had no further comments.

3.5.3 Ministry of Heritage, Sports, Tourism and Culture Industries

In response to the PIC1, the MHSTC emailed the project team on March 2, 2022, commenting that the PIC1 boards do not mention impacts to cultural heritage and asked to confirm if technical cultural heritage studies are being undertaken for this project. The project team responded via email on March 3, 2022, that the options being considered for further evaluation are limited to treatment capacity increase within the existing site boundaries. Any new infrastructure is anticipated to be fully contained within the existing

site; therefore, potential impacts to cultural heritage features are negligible. It was further noted that studies related to archaeological or cultural heritage were not planned at this stage and in case the outcome of the study resulted in a different alternative with works outside of the existing site boundaries, the appropriate investigations would be conducted.

MHSTC agreed with the project team's response and recommended in their email on March 3, 2022, that this explanation be provided in the ESR and additionally asked to fill out the archaeological potential checklist to document due diligence. The project was screened as requested, using MHSTCI's Criteria for Evaluating Archaeological Potential as well as Criteria for Evaluating Potential Built Heritage Resources and Cultural Heritage Landscapes. The completed checklists can be found in **Appendix J** and the relevant correspondence with MHSTCI can be found in **Appendix F**

3.5.4 Fisheries and Oceans Canada

In response to the notice of the PIC1, the project team received an email from DFO on February 8, 2022. The email stated that DFO reviews projects conducted near waterbodies supporting fish and evaluates project proposals for impacts on Species at Risk. They clarified that they do not review administrative notifications. The project team was requested to determine if the EA project required a review by DFO and submit a Request for Review Form to FisheriesProtection@dfo-mpo.gc.ca if necessary. The provided email address was added to the project contact list.

The aquifer testing results, and hydrogeological reports conducted by Watermark (Watermark Environmental, 2019) indicate that all surface water features are hydraulically disconnected from the production aquifer. Therefore, pumping at PAL 4 does not affect the surface water features in the project study area, and increasing water takings at PAL 4 would not cause any long-term impacts. Based on the pumping test findings, the project team concluded that no further review was required since the project is not expected to have any effects on aquatic habitat. This conclusion was later affirmed by LGL in their Baseline Natural Features Assessment Report (April 2023).

3.6 Indigenous Communities

To coordinate the engagement of Indigenous Community members, a list of Indigenous Communities was developed, including communities with existing or asserted rights or claims within the study area based on similar projects in the area and the list provided by MECP after the Notice of Commencement was released. The identified Indigenous Communities were notified about the Class EA as well as the consultation activities (e.g., PIC) proposed as part of the project. Additional project information was provided

by the Project Team, as requested by each group, and follow up phone calls were made by CIMA+ to ensure that they have received the Project Notices and to solicit their feedback on the project. A separate consultation log was maintained for Indigenous Communities, included in **Appendix K**. The following sections summarize the key action items and outcomes of consultation activities carried out to address concerns specific to each Indigenous Community:

3.6.1 Haudenosaunee Development Institute

Consultation with the Haudenosaunee Development Institute (HDI) was undertaken as part of the Supply Capacity Increase for Palgrave Well # 4 Class EA Study. Major comments received from HDI and a description of how these comments were incorporated or addressed are summarized in **Table 2** below.

Table 2: HDI Summary Key Comments

Date	Comments/Concerns	Action Item/Outcome
June 23, 2021	HDI requested to be engaged in any further environmental and archaeological surveys, via email, in response to the Notice of Study Commencement (dated June 2022). They also communicated their requirement for an Archaeological and Environmental monitor to be on site and take valid reporting for their community.	The Project Team, including representatives from the Region and its consultant CIMA+, had a virtual meeting with HDI on June 30, 2021. The Project Team explained that the project involves a capacity expansion of an existing municipal facility on an existing municipal site, and any proposed upgrades will be contained within the boundaries of the existing site. It was clarified that no archaeological assessment was planned due to previous construction disturbance, eliminating potential archaeological resources. It was further noted that a Natural Heritage Investigation was underway to address ornamental vegetation and trees. The Project Team offered to share

Date	Comments/Concerns	Action Item/Outcome
		the Natural Environmental Report with HDI for their review, once available. This was also confirmed in a follow-up email sent by the Region on July 7, 2021.
October 31, 2022 – December 1, 2022	During a follow up call after PIC 2, HDI introduced a new project engagement protocol. Information regarding HDI's project engagement application process and a request to initiate the application and payment was shared via email on November 1, 2022.	The Region responded on December 1, 2022, asking HDI to complete their standard Document Review Agreement for the Region to send them the Draft Baseline Natural Features Assessment Report.
December 1, 2022 – April 25, 2023	HDI advised the Region to submit application and payment for them to complete the Document Review Agreement.	Legal representatives from the Region and HDI had discussions, resulting in the Region sharing a document review agreement on April 25. HDI was requested to review, sign, and return the agreement. They were also informed that a draft version of the ESR would be provided for their review before the final ESR is filed publicly as part of the Class EA study's completion. An optional in-person meeting was also offered.

3.6.2 Huron-Wendat Nation

On June 29, 2021, in response to the Notice of Study Commencement, the Huron-Wendat Nation (HWN) group inquired about any archaeological studies or fieldwork being undertaken as part of this project. The project team explained in email on July 7, 2021, that archaeological studies would not be undertaken as any new equipment and upgrades would remain within the existing building footprint. Any expansions to the

current water treatment facility, if required, would be limited to the existing property on 9 Buckstown Trail, Caledon. Furthermore, they were also informed that a vegetation/tree survey was conducted on the Palgrave Well 4 property, and further fieldwork is not anticipated. The draft ESR can be provided to HWN when available.

4 Planning Policy Context

Palgrave and Caledon East are part of a two-tier municipality system, with the Regional Municipality of Peel serving as the upper tier municipality and the Town of Caledon serving as the lower tier municipality. This section provides a description of background information relevant to the growth and development in Palgrave and Caledon East, including provincial, regional, and municipal planning policy documents.

4.1 Provincial, Regional and Municipal Planning Policies

4.1.1 Region of Peel Official Plan

Within the Region of Peel Official Plan, Chapter 2, “The Natural Environment,” contains policies aimed at protecting key natural heritage features, key hydrologic features, and the adjacent lands required to maintain these features as part of a connected system. In Peel Region, the Oak Ridges Moraine Conservation Plan (ORMCP) area is situated within the geographic boundaries of the Town of Caledon and extends westward to connect with the Niagara Escarpment.

According to the Region of Peel Official Plan, the lands located south of the study area are identified as part of the “Core Areas” of the “Greenlands System” and “Area with Special Policies” under Schedule A, as depicted in

Figure **3**. Selected Areas of Provincial interest, as outlined in the Region of Peel Official Plan, indicate that the study area falls within the Greenbelt Plan area, specifically within the lands encompassed by the Oak Ridges Moraine Area. Schedule D and Schedule D1 further specify that the study area is designated as part of the “Palgrave Estate Residential Community” land use designation. Planned growth within this designation will occur in phases, serving as a logical expansion of the existing estate areas and servicing systems.

4.1.2 Town of Caledon Official Plan

The study area is situated within the “Settlement Area” of the Town of Caledon, as illustrated in Schedule I of the Official Plan. The Town of Caledon Official Plan further confirms the study area’s location to be entirely within the “Palgrave Estate Residential Community,” as indicated in Schedule P and Figure 1 of the plan. Within this residential rural community, the study area specifically falls under the designation of “Policy Area 3” in the Town of Caledon Official Plan, as outlined in Schedule G. Detailed information regarding permitted density and lot areas for lands within “Policy Area 3” can be found in Section 7 of the Caledon Official Plan.

The study area is depicted within the "Environmental Policy Area" in Schedule A. It is important to note that the Palgrave Estate Residential Community is included in the regional water service area and is situated within an area of high aquifer vulnerability.

Typically, the “Environmental Policy Area” does not permit the construction of new or private infrastructure, except in cases where essential infrastructure may be allowed, subject to approval requirements from the Town and other relevant agencies. Policy 5.7.3.5.1 of the Town of Caledon Official Plan stipulates that any proposed infrastructure within the Environmental Policy Area must demonstrate that all reasonable alternatives for locating the infrastructure outside of the area have been explored. Furthermore, the policy emphasizes adherence to the Town’s ecosystem principle, objectives, policies, and performance measures to the greatest extent possible. Appropriate mitigation, restoration, and management measures should also be recommended as part of the proposal.

4.1.3 Places to Grow – Growth Plan for the Greater Golden Horseshoe, 2020

The 2006 Growth Plan for the Greater Golden Horseshoe (2006 Growth Plan) was prepared under the Ontario Provincial Government’s 2005 Places to Grow Act, which enables the development of regional growth plans that guide government investment and land use planning policies.

This Growth Plan is intended to support sustainable development and address key challenges associated with population growth, infrastructure needs, and environmental protection. It outlines policies and strategies to promote compact, transit-supportive, and complete communities, while conserving natural areas and agricultural lands.

The plan designates specific growth areas and intensification targets to accommodate population and employment growth, with a focus on promoting mixed-use development, efficient land use, and the provision of affordable housing. It also emphasizes the importance of preserving and enhancing green spaces, natural heritage systems, and water resources.

The 2006 Growth Plan was the first growth plan to provide a framework for implementing Ontario’s vision for building stronger, prosperous communities by better managing growth in this region. Since the introduction of the 2006 Growth Plan, the Greater Golden Horseshoe (GGH) has seen a shift to more compact development patterns.

The 2017 Growth Plan for the Greater Golden Horseshoe (2017 Growth Plan) was released on May 18, 2017, and came into effect on July 1, 2017, updating the 2006

Growth Plan. The 2017 Growth Plan builds on the progress that has been made towards the achievement of communities that are compact, transit-supportive, and make effective use of investments in infrastructure and public service facilities. Policy 3.2.6 in the 2017 Growth Plan outlines the requirements for Water and Wastewater Infrastructure to support growth.

The 2019 Growth Plan for the Greater Golden Horseshoe (2019 Growth Plan) was prepared and approved under the 2005 Places to Grow Act and came into effect on May 16, 2019, updating the 2017 Growth Plan. Amendment 1 (2020) to the 2019 Growth Plan was approved and came into effect on August 28, 2020.

4.1.4 Provincial Policy Statement, 2020

The Provincial Policy Statement (PPS) (Ministry of Municipal Affairs and Housing, 2020) issued under Section 3 of the Planning Act provides policy guidance for development, aiming to protect provincial resources, public health and safety, and the natural environment. Relevant natural heritage policies from Section 2.1 of the PPS are outlined below.

- Policy 2.1.2 emphasizes the importance of maintaining, restoring, and improving the diversity, connectivity, and long-term ecological function of natural features and heritage systems, while recognizing the interconnections with surface water and groundwater features.
- Policy 2.1.3 mandates the identification of natural heritage systems within Ecoregions 6E and 7E1, acknowledging that their size and form may differ in settlement areas, rural areas, and prime agricultural areas.
- Policy 2.1.4 restricts development and site alteration in significant wetlands in Ecoregions 5E, 6E, and 7E1, as well as significant coastal wetlands.
- Policy 2.1.5 prohibits development and site alteration in significant wetlands in the Canadian Shield north of Ecoregions 5E, 6E, and 7E; significant woodlands in Ecoregions 6E and 7E (excluding islands in Lake Huron and the St. Mary's River); significant valleylands in Ecoregions 6E and 7E (excluding islands in Lake Huron and the St. Mary's River); significant wildlife habitat; significant areas of natural and scientific interest; and coastal wetlands in Ecoregions 5E, 6E, and 7E1 (not covered by Policy 2.1.4(b)). However, exceptions can be made if it is demonstrated that there will be no negative impacts on the natural features or their ecological functions.
- Policy 2.1.6 prohibits development and site alteration in fish habitat, except in compliance with provincial and federal requirements. Similarly, Policy 2.1.7 restricts

development and site alteration in habitat of endangered and threatened species, subject to provincial and federal regulations.

- Policy 2.1.8 prevents development and site alteration on adjacent lands to natural heritage features and areas identified in policies 2.1.4, 2.1.5, and 2.1.6, unless the ecological function of the adjacent lands has been evaluated, and it is demonstrated that there will be no negative impacts on the natural features or their ecological functions.

This project aligns with the PPS by considering ecological function, negative impacts on fish habitat in accordance with the Fisheries Act, and negative impacts on natural heritage features and areas, which encompass degradation that poses a threat to their health and integrity due to development or site alteration activities.

4.1.5 Oak Ridges Moraine Conservation Plan, 2017

The Oak Ridges Moraine Conservation Plan (ORMCP), established by Ontario Regulation 140/02 under the Oak Ridges Moraine Conservation Act, 2001, serves as a policy framework for land use decisions within the Moraine, providing guidance for protecting its ecological and hydrological features and functions.

The ORMCP classifies the Moraine into four land use designations: ‘Natural Core Areas,’ ‘Natural Linkage Areas,’ ‘Countryside Areas,’ and ‘Settlement Areas.’ The study area falls within the ORMCP area and is specifically categorized as ‘Countryside Areas.’ These areas act as buffers and transitional zones between the Natural Core and/or Natural Linkage Areas and urban Settlement Areas, emphasizing their agricultural and rural significance. Within the ‘Countryside Areas,’ the study area is specifically identified as part of the ‘Palgrave Estates Residential Community,’ as indicated in Schedule A1 and Schedule P of the Town of Caledon Official Plan, and Figure 2 of this report.

Additionally, the study area is situated within the Landform Conservation Area (Category 1) lands, as depicted in Schedule P-3 of the Town of Caledon Official Plan and

Figure **3** of this report. These lands, recognized by the government of Ontario, are characterized by steep slopes, complex landform patterns, and a high diversity of land slope classes. To minimize impacts on landform character and related ecological processes, appropriate planning, design, and construction techniques will be necessary.

For lands within the Oak Ridges Moraine area, the requirements of the ORMCP generally applies and the Protected Countryside policies under the Greenbelt Plan do not apply. Section 41 of the ORMCP outlines the policies for infrastructure within the ORMCP area. For Countryside Areas, the policy states that municipalities shall ensure

that the development of new infrastructure, or the upgrading or extension of existing infrastructure is supported by necessary studies, such as environment assessments and other relevant studies, and meet the requirements under Section 41.1.2. The list below identifies how this Class EA study has addressed the applicable policies for the proposed project, specifically those under Section 41 (Infrastructure).

- Section 4 of this ESR describes the Planning Context for this Class EA Study which is further accounted for in the planning and financial analysis exercise completed as part of the study.
- This Class EA presents the need for the project and the evaluation of alternatives to arrive at the preferred alternative solution.
- Financial feasibility and sustainability are addressed in Section 12.5 of this report.
- Proposed mitigation measures of potential impacts are identified in Section 14 of this report to ensure that the planning, design, and construction practices adopted will keep any adverse effects to a minimum.

4.1.6 Greenbelt Plan, 2017

The Greenbelt Plan was prepared and approved under the Greenbelt Act, 2005 and took effect on December 16, 2004, to protect the agricultural land base and the ecological and hydrological features, areas, and functions in the Greenbelt. The Greenbelt Plan was amended in 2017.

The Greenbelt Plan includes lands within, and builds upon the ecological protections provided by, the Niagara Escarpment Plant (NEP) and the Oak Ridges Moraine Conservation Plan (ORMCP). For lands within the Oak Ridges Moraine area, the requirements of the ORMCP generally apply and the Protected Countryside policies under the Greenbelt Plan do not apply.

The Region of Peel Official Plan shows that the study area lies within Greenbelt Plan area, specifically on lands within the Oak Ridges Moraine Area. Schedule D and Schedule D1 identify the study area within the ‘Palgrave Estate Residential Community’ land use designation. Growth within this land use designation is planned to occur in phases as a logical extension to existing estate areas and servicing systems.

4.1.7 The Living City Policies – Toronto and Region Conservation Authority, 2018

TRCA’s Regulation of Development, Interference with Wetlands, and Alterations to Shorelines and Watercourses objectives aim to ensure public safety, protect against

natural hazards, and preserve watershed health by preventing pollution and destruction of sensitive environmental areas, such as wetlands, shorelines, and watercourses.

Under Ontario Regulation 166/06, Regulated Areas are designated where development may be exposed to flooding, erosion, dynamic beaches, or where interference with wetlands and alterations to shorelines and watercourses could have adverse effects on these environmental features. Within these regulated areas, any proposed development, interference, or alteration requires a permit from TRCA. The study area is partially located within such a regulated area, as depicted in **Figure 2.**

The Living City Policies (LCP) serve as a conservation authority policy for planning and development within TRCA-regulated watersheds. It enables TRCA to implement legislation and delegate responsibilities to third-party organizations throughout the planning and development process. The LCP consolidates existing plan and permit review procedures, facilitating TRCA's review of planning, development applications, and environmental assessments under Section 28 of the Conservation Authorities Act. The document aims to strengthen existing policies, incorporating updated requirements from federal, provincial, and municipal levels, with a focus on restoring, remediating, and enhancing existing natural heritage features.

Policy 8.9.5 specifically addresses underground infrastructure, stating that development, interference, or alterations associated with new, replacement, or expanded underground infrastructure may be permitted following an environmental assessment process that explores all feasible alternative sites and alignments.

The project's scope and scale must demonstrate several factors, including avoiding negative impacts on groundwater and surface water quality and quantity, minimizing and mitigating impacts on groundwater flow and discharge, avoiding erosion hazards in valley and stream corridors, considering alignments that minimize impacts on aquifers and surface water receptors, managing dewatering and discharge during and after construction, and utilizing design and construction technologies that reduce the risk of hydrological and ecological impacts while minimizing grade alterations to the existing topography.

Figure 3: Planning Policies

5 Existing Palgrave /Caledon East Drinking Water System

The following sections summarize the overall Palgrave Drinking/ Caledon East Water System including supply, treatment, and distribution; with particular emphasis on the PAL4 supply and treatment system.

5.1 Overview of Palgrave / Caledon-East Drinking Water System

The Palgrave/Caledon East/Drinking Water System is an interconnected groundwater supply system, servicing the communities of Caledon East, Mono Road, Albion, Centreville, Cedar Mills, Palgrave and Palgrave Estates. The system is comprised of the Caledon East and the Palgrave Drinking Water Systems and include six (6) municipal wells, four (4) Water Treatment Plants (WTPs), two (2) storage facilities and 108 km of watermains.

Each drinking water system, Caledon East and Palgrave, comprises a total of three (3) production wells and two (2) WTPs, geographically distributed in each community. The Caledon East/Palgrave system is an integrated drinking water system interconnected via a watermain along Old Church Road. Both water systems can serve as a back up water supply to each other, to meet water demands, as required. Under normal operating conditions, treated water generally moves from Palgrave to Caledon East.

A map showing the overall location of the existing Palgrave/Caledon East drinking water systems is shown in **Figure 4**.

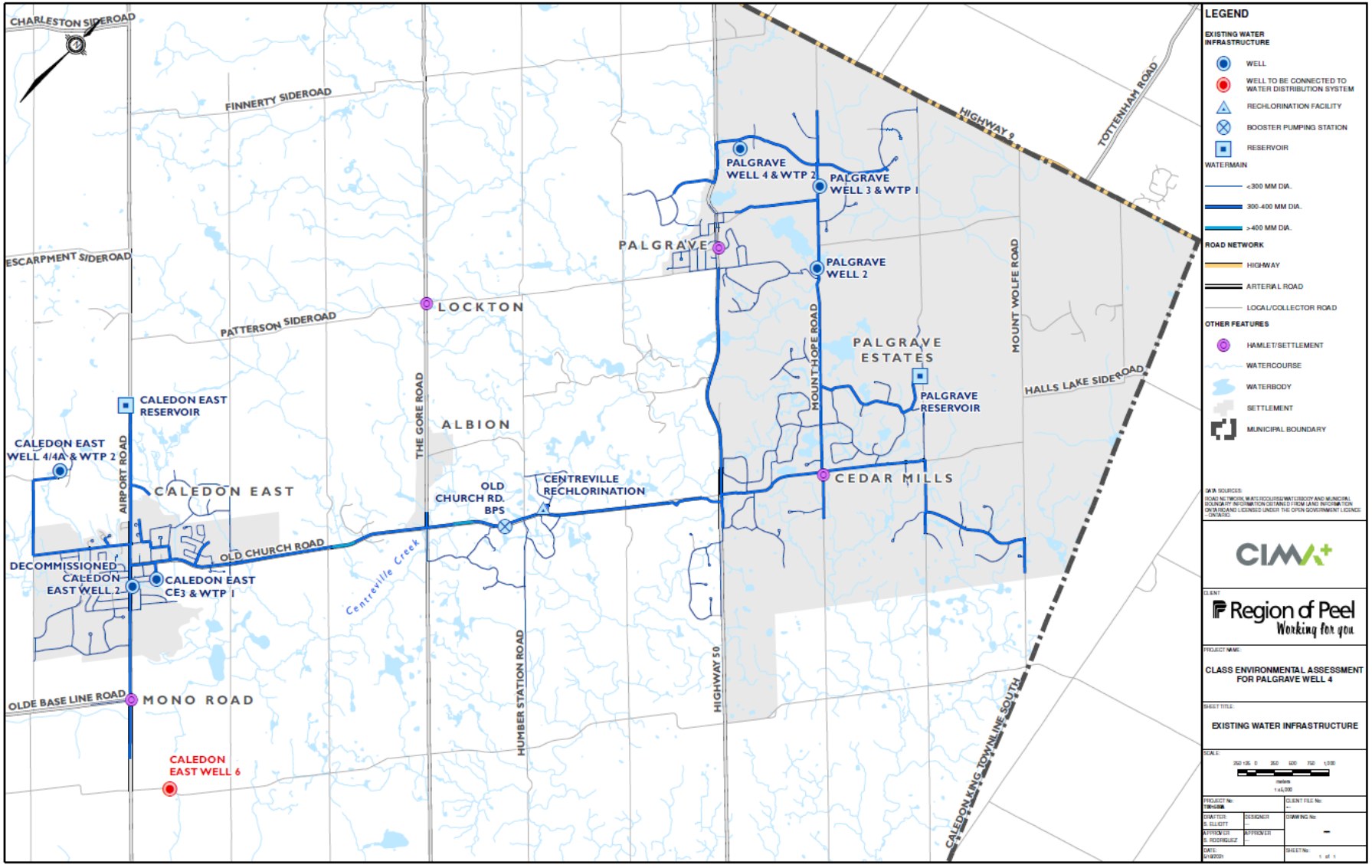

Figure 4: Location of Existing Caledon East/Palgrave Drinking Water Systems

5.1.1 Water Supply

The Palgrave/Caledon East water supply system is owned and operated by the Region. The system currently obtains its raw water from six (6) groundwater wells, three (3) wells in Palgrave and the other three (3) in Caledon East. The main components of the water supply system include:

- Palgrave well No.2 (PAL2): 305 mm diameter and 47.2 m deep drilled well equipped with a submersible well pump rated at 30.3 L/s at 120 m Total Dynamic Head (TDH).
- Palgrave well No.3 (PAL3): 254 mm diameter and 82.5 m deep drilled well equipped with a submersible well pump rated at 68.2 L/s at 126.5m TDH.
- Palgrave well No.4 (PAL 4): 610 mm diameter and 91.4 m deep drilled well equipped with a submersible well pump rated at 30.3 L/s at 93 m of TDH.
- Caledon East Well No. 3 (CE3): 300 mm diameter and 48 m deep drilled well equipped with a submersible well pump rated at 30.3 L/s at 100.6 m TDH.
- Caledon East Well No. 4 (CE4): 254 mm diameter and 57 m deep drilled well equipped with a submersible pump rated at 36 L/s at 59 m TDH.
- Caledon East Well No. 4A (CE4A): 254 mm diameter and 57 m deep drilled well with a Pitless adapter assembly. It includes a submersible pump rated at 37 L/s at 55 m TDH.

A new well in Caledon East, refer to as Caledon East Well No.6 (CE6), has been developed and is planned to be connected to the system. A separate Municipal Class EA study is currently being undertaken to address the infrastructure requirements associated with the integration of the new CE6 to the existing Caledon East/Palgrave Drinking Water System.

All production wells in the Caledon East/Palgrave Drinking Water System are classified as true groundwater (not Groundwater Under the Influence of Surface Water, GUDI), as per existing Drinking Water Works Permit (DWWP) No. 009-205 Issue Number 8, dated October 6th, 2020. Permitted rated capacity of the supply wells in the Caledon East / Palgrave Drinking Water System, as well as the corresponding permit / license number, are summarized in **Table 3**.

Table 3: Permitted Water Taking Rated Capacity of Caledon East / Palgrave Water System Wells

Supply Source	Rated Capacity m^3/day (L/s)	Permit to Take Water Number	Effective Date	Renewal Date
PAL2	2,619 m^3/day (30 L/s)	PTTW P-300-2034379854 Version 1.0	May 10, 2019	May 9, 2024
PAL3	5,892 m^3/day (68 L/s)	PTTW P-300-2034379854 Version 1.0	May 10, 2019	May 9, 2024
PAL4	2,619 m^3/day (30 L/s)	PTTW P-300-2034379854 Version 1.0	May 10, 2019	May 9, 2024
CE3	2,557 m^3/day (30 L/s)	PTTW P-300-2095321129 Version: 1.0	December 30, 2020	December 26, 2025
CE4	3,629 m^3/day (42 L/s)	PTTW P-300-2095321129 Version: 1.0	December 30, 2020	December 26, 2025
CE4A	6,480 m^3/day (75 L/s)	PTTW P-300-2095321129 Version: 1.0	December 30, 2020	December 26, 2025
CE6	4,320 m^3/day (50 L/s)	PTTW P-300-2095321129 Version: 1.0	December 30, 2020	December 26, 2025

The current Palgrave PTTW limits the combined production from the three (3) Palgrave wells to 128.8 L/s (11,129 m^3/day). The PTTW for the Caledon East wells, issued on December 30, 2020, reflects all four (4) Caledon East wells, including the new CE6 well (yet to be connected). The new Caledon East PTTW limits the combined production from the four (4) Caledon East wells to 125.0 L/s (10,800 m^3/day). The combined pumping rate for Caledon East reflects an existing limitation in the aquifer which prevents wells CE4 and CE4A (drilled in the same aquifer) from pumping together at rates greater than 75 L/s (6,480 m^3/day).

The Palgrave Drinking Water System supplies water to the community of Palgrave and also supports potable water demands within the communities of Caledon East, Centerville, and Cedar Mills. Since the Palgrave wells have a slight greater combined supply capacity than the Caledon East wells, the combined capacity of the Palgrave wells enhances the capacity of the overall interconnected system.

The maximum combined PTTW capacity for all production wells in the Caledon East / Palgrave Drinking Water System is 21,929 m^3/day (253.8 L/s).

5.1.1.1 Available Supply Capacity

In groundwater-based systems, supply capacity is influenced by several factors beyond the permitted water taking capacity of the production well(s); such as maximum well/pumping capacity, aquifer sustainability, or restrictions imposed by the Ministry of Environment, Conservation and Parks (MECP) in the PTTW related to potential effects on nearby surface or groundwater features, operational limitations, or water quality issues. Routine assessment of well performance and rehabilitation needs is part of the Region's regular operation and maintenance activities.

The efficiency of the Caledon East wells CE4 and CE4A has been declining over the last seven (7) years due to changes in the aquifer pressure. CE4 has been historically experiencing plugging issues since 2014 and is currently not capable of pumping its current PTTW rate without more rehabilitation. In addition, a decline in specific capacity of approximately 50% has been reported based on a comparison from post well construction testing in 1975 and the latest step test records from 2009 (CIMA+, Well Asset Management Report Card, 2020).

As a general practice, a 15% buffer or reserve capacity is accounted for in water and wastewater systems to establish the need for additional capacity expansions. As such, planning for future capacity expansions and/or the need for new infrastructure is generally initiated when 85% of existing capacity is reached. The combined well rated capacity and the available supply capacity in the Palgrave/Caledon East system is summarized in **Table 4**.

Table 4: Combined Permitted and Available Supply Capacity

Supply Wells	Combined Rated Capacity	85% of Combined Rated Capacity[1]
Connected supply wells only: PAL2, PAL3, PAL4, CE3, CE4, CE4A	17,609 m^3/day (204 L/s)	14,968 m^3/day (173 L/s)
Connected supply wells + new unconnected well (CE6): PAL2, PAL3, PAL4, CE3, CE4, CE4A, CE6	21,929 m^3/day (254 L/s)	18,640 m^3/day (216 L/s)

Notes:

1. Available supply capacity assumes a 15% reserve capacity.

5.1.2 Water Treatment

Water treatment is facilitated through four (4) WTPs, two (2) of which are located in Palgrave and two (2) in Caledon East.

Raw water from PAL 2 is pumped to the Palgrave WTP1, where it is combined with the raw water from PAL 3 for treatment. PAL 4 has its own treatment facility, Palgrave WTP2. Palgrave WTP1 and WTP2 both independently provide primary and secondary disinfection treatment via liquid sodium hypochlorite; as well as iron removal via a combination of oxidation with chlorine followed by greensand filtration. In the Palgrave system, treated water is pumped from WTP1 and WTP2 to the Palgrave Reservoir which provides storage and sufficient system pressure to maintain the water supply demands. Each WTP in Palgrave includes the following major treatment equipment:

- Sodium hypochlorite feed pumps for primary and secondary disinfection, and iron oxidation.
- Sodium hypochlorite storage tank.
- Chlorine contact tank.
- Greensand filter system including process residue holding tank, supernatant pumps, sludge transfer pumps, piping, valves, controls, and backwash supply from the water distribution.

Raw water from CE3 is pumped to the Caledon East WTP1 for treatment, consisting of primary and secondary disinfection treatment via sodium hypochlorite, no other treatment is provided in Caledon East WTP1. Major treatment equipment in the Caledon WTP1 includes the following:

- Caledon East WTP1:
    - Sodium hypochlorite feed pumps for primary and secondary disinfection.
    - Sodium hypochlorite storage tank.
    - Chlorine contact pipe.

Raw water from CE4 and CE4A is treated at the Caledon East WTP2 for primary and secondary disinfection via sodium hypochlorite. Iron is removed by oxidation followed by greensand filtration. Major treatment equipment in the Caledon WTP2 includes the following:

- Caledon East WTP2:
    - Sodium hypochlorite feed pumps for primary and secondary disinfection, and iron oxidation.
    - Sodium hypochlorite storage tank.

- Chlorine contact tank.
- Greensand filter system including process residue holding tank, supernatant pumps, sludge transfer pumps, piping, valves, controls and backwash supply from the water distribution.

In the Caledon East water system, treated water is pumped from WTP1 and WTP2 to the Caledon East Storage Reservoir which provides sufficient pressure to meet the supply demands. A booster pumping station at WTP2, (Granite Stones Booster Pumping System) is equipped with booster pumps and pressure regulating tanks to service the Granite Stones subdivision, located at a higher elevation. Permitted rated capacity of the treatment equipment and plants, as well as the corresponding permit / license number, are summarized in **Table 5**.

Table 5: Permitted Treatment Rated Capacity in Caledon East / Palgrave Water System

Water Facility	Rated Capacity m^3/day (L/s)	Permit/License Number	Renewal Date
Palgrave WTP1	8,493 m^3/day (98 L/s)	MWDL 009-105 Issue No.: 8	May 7, 2024
Palgrave WTP2	2,618 m^3/day (30 L/s)	MWDL 009-105 Issue No.: 8	May 7, 2024
Caledon East WTP1	2,618 m^3/day (30 L/s)	MWDL 009-105 Issue No.: 8	May 7, 2024
Caledon East WTP2	5,530 m^3/day (64 L/s)	MWDL 009-105 Issue No.: 8	May 7, 2024

5.1.3 Water Distribution

The Caledon East / Palgrave Drinking Water Systems are interconnected via a 400 mm diameter watermain on Old Church Road. The Old Church Booster Pumping Station connects the two (2) systems and allows both water systems to serve as a back up water supply to each other, to meet the demands in either system. As per the 2019 Water Quality Report for the Caledon East / Palgrave Drinking Water System, the distribution system comprises approximately 108 km of watermains and feedermain, about 3,000 service connections, servicing over 13,000 people.

5.2 Palgrave Well # 4 (PAL 4)

PAL 4 and its treatment facility, WTP 2, are both located north of Palgrave at 9 Buckstown Trail, in the Town of Caledon, on municipally owned property. The site is located within a residential neighbourhood with large areas of green space and adjacent to the Palgrave Forest and Wildlife Area. The nearby estate has currently service

connection of potable water from PAL 4. Location of PAL 4 site, relative to the overall existing Palgrave Drinking Water System, is shown in **Figure 5**. The overall location of PAL4 and Palgrave WTP 2 is shown in **Figure 6.**

5.2.1 PAL 4 Supply Well

PAL 4 was constructed in 2001 by International Water Supply (IWS). The water source of PAL 4 is a deep aquifer in a bedrock valley. The well was classified as not under the direct influence of surface water, or "Non-GUDI", by AMEC Earth & Environment (AMEC) in 2005. The well operates under the PTTW P-300-2034379854 with a maximum permitted rate of 30.3 L/s.

Key design parameters for PAL 4 well and its well pump are summarized in **Table 5** and **Table 6**, respectively.

Table 6: PAL 4 Well Specifications

Parameter	Specification
Well Location Coordinates	592892 E 4867928 N
Ground Elevation	288.56 masl[2]
Non-pumping Aquifer Elevation	279.60 masl
Maximum Drawdown Aquifer Level[3]	268.25 masl
Well Depth	91.40 mbgs[4]
Outer Casing	600mm steel casing at 76.5m depth
Inner Casing	350 mm steel casing at 79.5m depth
Screen Casing	350 mm at 92.0 depth

Notes:

1. Design parameter as per Palgrave Well 4 Inspection, Rehabilitation and Testing (Lotowater, 2018) and Category 3 Permit To Take Water Application (Watermark Environmental, 2020).
2. Meters above sea level (masl).
3. Aquifer level test completed in 2019 at 60.6 L/s and 72 hrs (Watermark Environmental, 2019).
4. Meters below ground surface (mbgs).

Table 7: PAL 4 Well Pump Specifications

Parameter	Specification
Number of Pumps	1
Well Pump Type	Grundfos, Submersible Vertical Turbine Pump1
Suction Intake	22.5 mbgs (267.04 masl)
Pump Capacity	30.3 L/s
Pump Total Dynamic Head	93 m
Number of Stages	6
Motor Size[2]	60 HP
Motor Speed	3450 rpm
Motor Voltage	575 V
VFD Motor	No

Notes:

1. Grundfos pump manufactured in 2007. The pump was refurbished and re-installed in 2008 along with the replacement of the column pipe (Lotowater, 2018).
2. Pump motor was replaced in 2012 (GDE, 2013).

PAL 4 well pump can operate based on level of the Palgrave Reservoir or the system pressure measured by the pressure discharge to distribution. The pump is equipped with a control valve with solenoid valve for positioning and SCADA control.

The most recent PAL 4 well efficiency evaluation completed in 2017 by Watermark Environmental (Watermark Environmental, 2018) indicated that the overall efficiency of PAL 4 would remain in good standing upon completion of rehabilitation work and no further work would be required. Along with the hydrogeological results discussed in **Section 1.2**, PAL 4 was therefore considered to be in a suitable condition to support an increase in the maximum permitted water taking rate to 60.6 L/s.

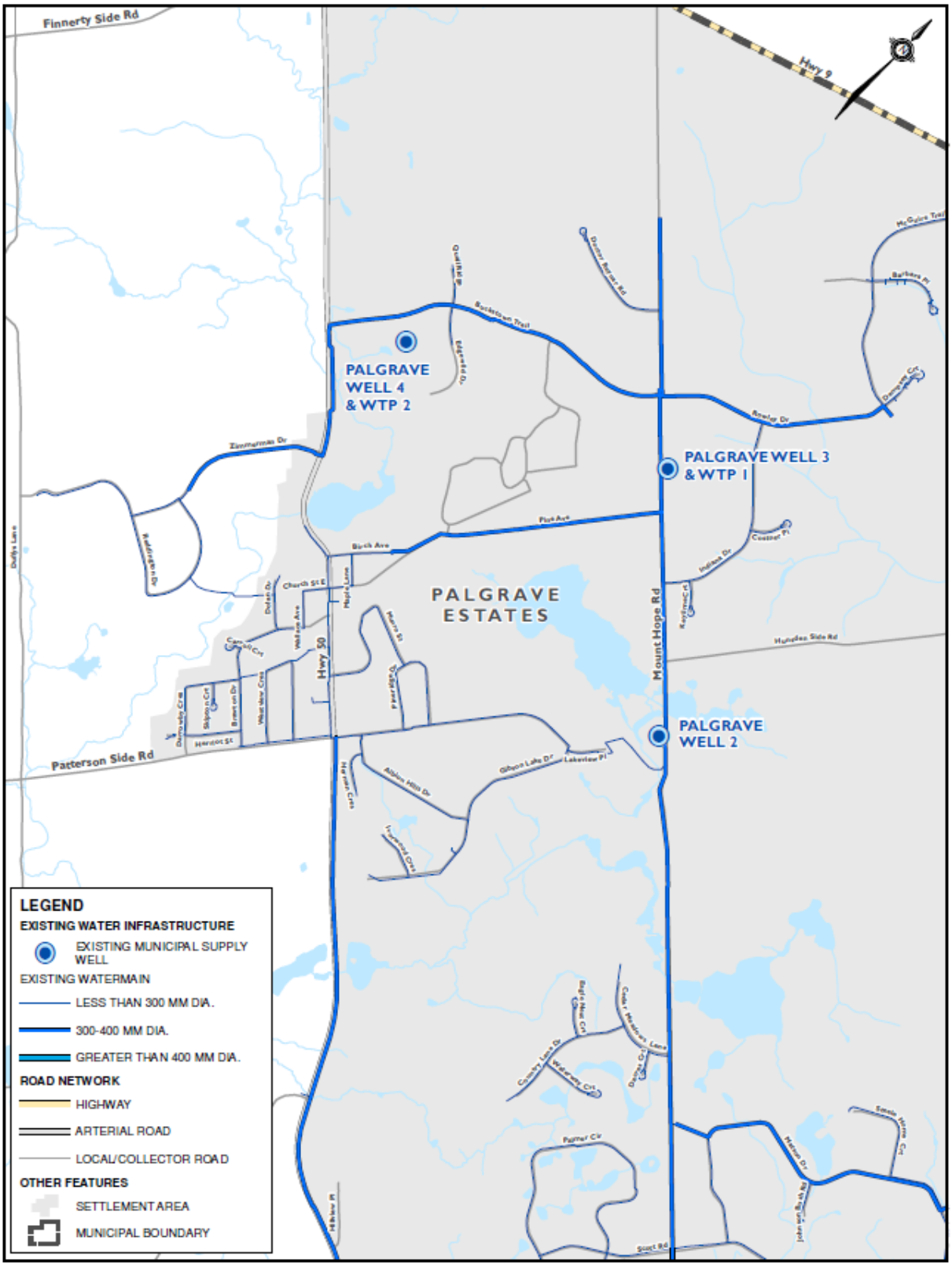

Figure 5: Location of Existing Palgrave Drinking Water System

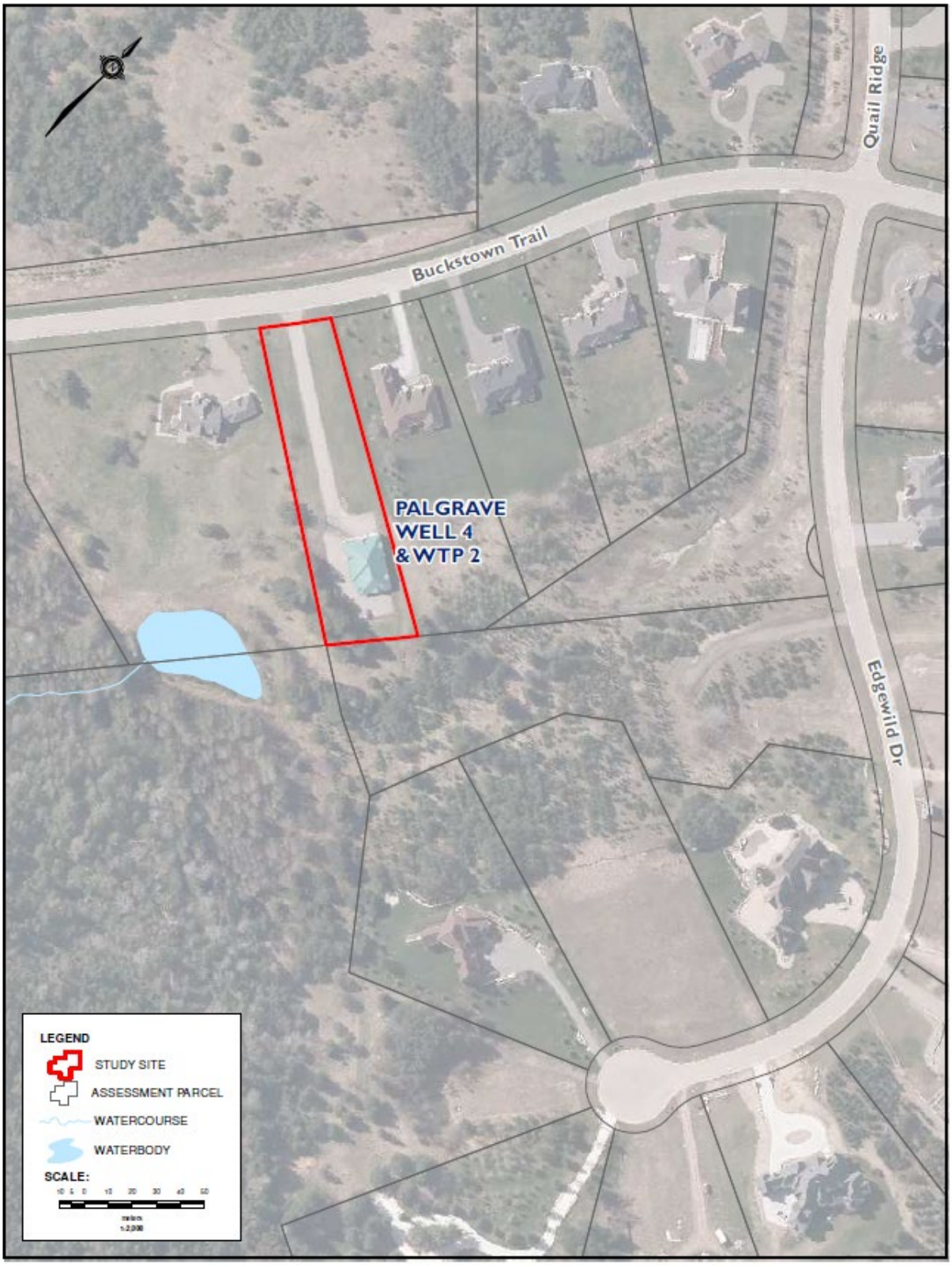

Figure 6: Location of Existing PAL4 and WTP 2

5.2.2 PAL 4 Treatment

Water treatment at PAL4 is provided on-site. The Palgrave WTP2 facility was originally constructed in 2007. The system overall is classified as a Class II water treatment subsystem. Currently, the main treatment process at the Palgrave WTP2 include:

- Pre-chlorination through addition of sodium hypochlorite on the raw water discharge header for pre-oxidation of iron.
- Greensand filtration containing two (2) vertical pressure filters, with anthracite and greensand filter media, for iron removal.
- Disinfection through addition of sodium hypochlorite on the greensand filtration common discharge header for chlorination.
- One (1) chlorine contact pipe to achieve the required chlorine residual for disinfection.
- A waste management system comprised of a wastewater decanting tank, supernatant transfer pumping and sludge transfer pumping. The waste streams from backwash, filter-to-waste and analyzers are collected in the decanting tank where supernatant is separated from the sludge. The supernatant is pumped back to the raw water header and the sludge is hauled from site to landfill.
- One (1) emergency standby generator.

The existing facility includes separate rooms for filtration, standby power, electrical, waste management, future sodium bisulphite storage, future fluoride storage, chlorine storage and a vestibule. The facility was originally designed to accommodate fluoridation and de-chlorination with sodium bisulphite; but these systems have not been implemented and the rooms have been unoccupied since construction. Each room is physically separated with individual ventilation system.

A simplified process schematic of the Palgrave WTP2 is shown in **Figure 7**.

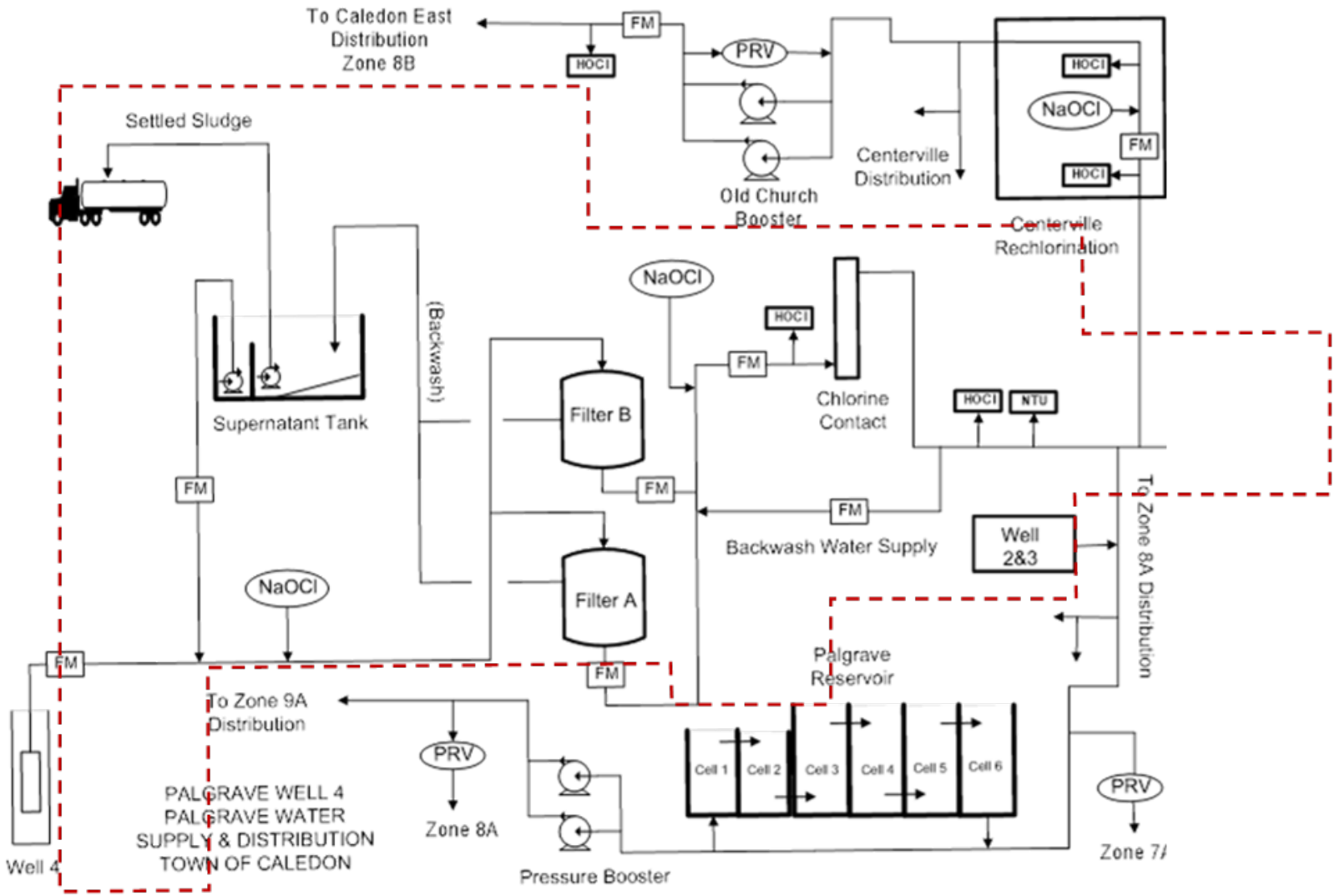

Figure 7: Process Flow Chart for PAL4 System (Region of Peel, O&M Manual, April 2012)

The current rated capacity of the Palgrave WTP2 is 2,618 m^3/day (30 L/s), as per current Municipal Drinking Water License MWDL 009-105 Issue No.: 8 and shown in **Table 5**. A maximum of 10% of supernatant from the decanting tank can be returned to the head of the plant to reach 33.3 L/s treatment flows. The design flowrates and key characteristics of each major treatment process at the plant are presented in **Table 8**.

Table 8: PAL4 and Palgrave WTP2 Design Flowrates and Key Equipment Characteristics

Treatment Process	Equipment
Well Pump	• One (1) Vertical Turbine Pump
Pre-chlorination Post-chlorination	• Two (2) 3.4 L/h peristaltic pumps (1 duty/1 standby) • Two (2) 3.4 L/h peristaltic pumps (1 duty/1 standby)
Filtration	• Two (2) greensand pressure filters (2 duty), each rated at 17.2 L/s
Primary Disinfection	• One (1) 500mm diameter watermain pipe, 82 m length
Chemical Storage	• One (1) 400 L polyethylene tank
Waste Management	• One (1) 80 m^3 process residue holding tank • Two (2) 43.2 m^3/h submersible sludge transfer pumps at 12 L/s (1duty/1 standby) • Two (2) 3 L/s supernatant return pumps (1 duty/1 standby)

The following sections provide additional details for each of the major treatment processes at the Palgrave WTP2.

5.2.2.1 Oxidation / Disinfection

The facility includes two (2) sodium hypochlorite chemical feeding systems, used separately for iron oxidation and disinfection purposes. One (1) chemical storage tank is provided, common to the oxidation / disinfection processes. All chemical feeding and storage equipment is housed in a common dedicated chemical room within the building.

Addition of sodium hypochlorite for oxidation purposes is provided on the well pump discharge header upstream of the greensand filters. Sodium hypochlorite is added for disinfection purposes, on the common discharge header downstream of the greensand filters. The required disinfection is achieved in a 500mm diameter contact pipe, located

between the building and the property line. The contact pipe was originally designed to provide a 2-log inactivation of viruses.

5.2.2.2 Iron Removal – Greensand Filtration

As PAL4 was designated as a “non-critical” well during the original plant design, the greensand filtration system was designed to provide 100% well capacity with two (2) filters; therefore, no redundancy is currently provided. There is a designated area within the existing building, immediately adjacent to the filters, for an additional third future filter. The Region currently operates all wells with the same level of criticality on demand basis and does not operate the wells based on prioritization.

The filter media is comprised of anthracite and greensand with graded gravel support bed. The greensand is impregnated with manganese oxide which acts as a catalyst on the presence of chlorine to oxidize, precipitate and filtrate manganese and iron. The filter vessel contains an inlet water distributor/backwash collected system and underdrains that allow flow for production or backwash. Backwash water is supplied from the distribution system back to the filters.

5.2.2.3 Wastewater Management System

The capacity of the waste management was designed based on the amount of backwash volume produced by the two (2) pressure filters operating at 30.3 L/s in addition to filter to waste and analyzer water volumes.

The supernatant return pumps capacity was designed to recycle 10% of the well pump capacity.

5.2.2.4 Emergency Power Supply

One (1) 165 kW, 600 V standby diesel generator is installed, in its own dedicated room, to provide standby power to all the pumps and equipment. The generator fuel storage tank provides 26 hrs of power supply at 100% load.

5.2.3 PAL 4 Water Production Data

Volumes for raw and treated water of the PAL4 system, as reported in the Region of Peel, 2020 Summary Report, Drinking Water in Peel, are summarized in **Table 9.** **Figure 8** provides a graphical representation of the daily average per month and daily maximum per month of raw and treated water volume.

Table 9: Raw and Treated Water Volumes of PAL4 System[1]

	Raw Water (m^3)	Treated Water (m^3)
Total Annual (m^3)	122,541	123,719

Notes:

1. Flow data as per Region of Peel, 2020 Summary Report, Drinking Water in Peel, 2020.

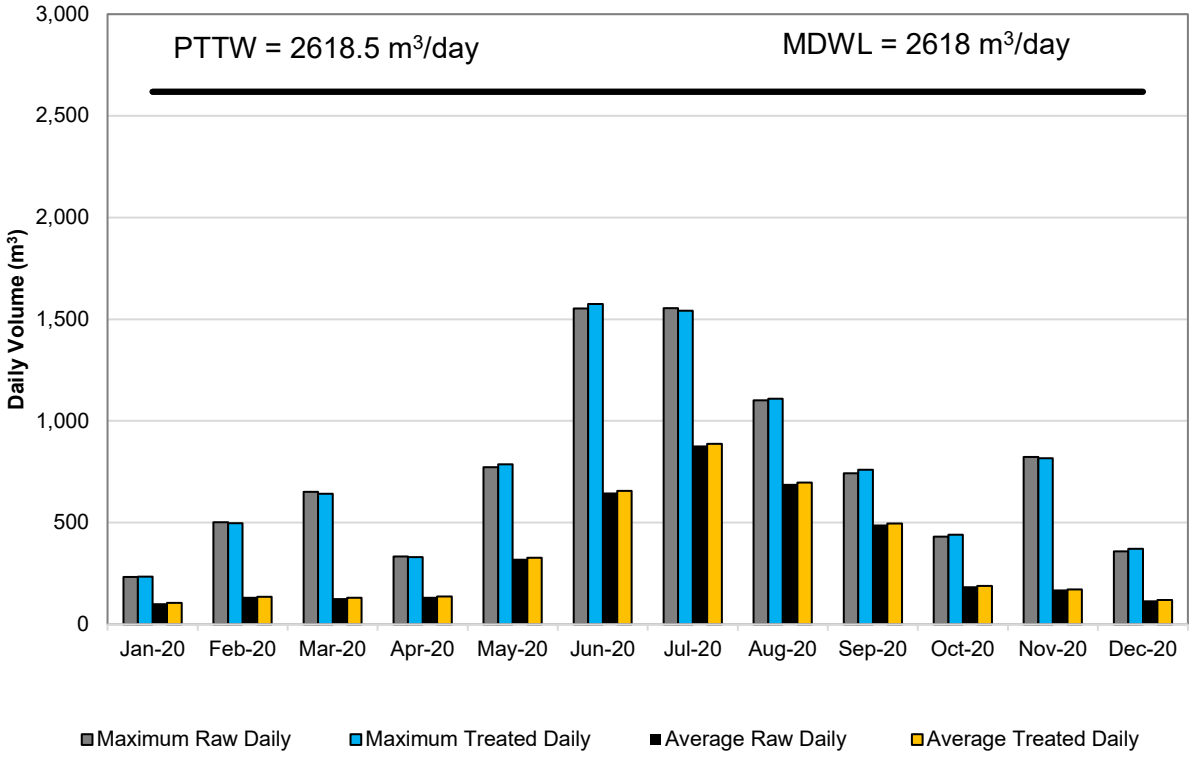

Figure 8: Treated and Raw Water Historical Flows

As shown in **Figure 8**, the maximum daily raw water taking and maximum daily treated water for PAL 4 are well below the maximum limits established in the current PTTW and MDWL. Treated water volumes are slightly higher than the raw water due to recycling supernatant to the head of the plant. The supernatant return flow does not exceed 10% of the raw water flow rate.

The total monthly volumes of PAL 4 raw water intake in 2020 are summarized in **Figure 9.** The figure also provides the percentage of PAL 4 water taking relative to the entire Palgrave / Caledon East System.

Consistent with typical small drinking water systems, the water demand of PAL4 increased during the warmest months, up to 27,281 m^3/month, and decreased during colder months, down to 3,188 m^3/month. In 2020, the water taking from PAL 4 represented an average of 8% of the total combined water taking from all production wells in the Palgrave / Caledon East System.

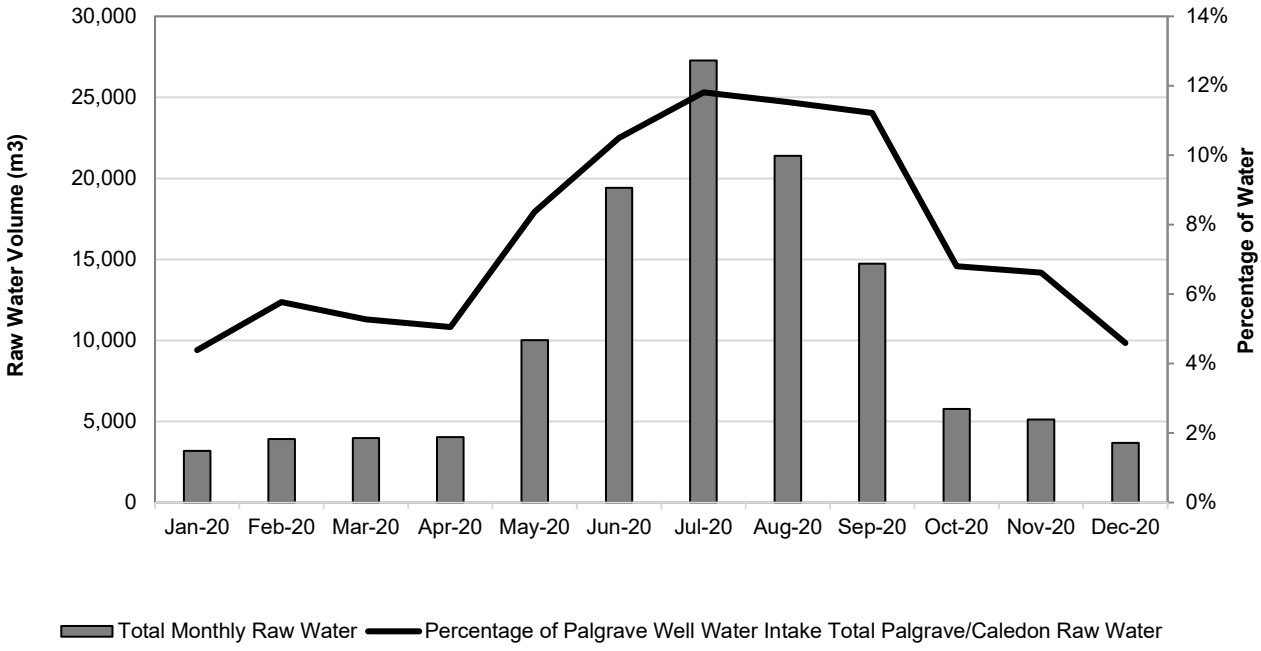

Figure 9: Total Monthly Raw Water Flows of PAL4 and Percentage of PAL 4 Water Intake in respect to the Palgrave / Caledon East System

5.2.4 PAL 4 Water Quality

5.2.4.1 Raw Water

Raw water quality data for selected physical and chemical parameters are summarized in **Table 10**. The limits set out in the Ontario Drinking Water Quality Standards (ODWQS), Objectives and Guidelines are also included in the tables. These standards, objectives and guidelines apply only to treated / distribution water and do not apply directly to raw water; however, they provide an indication of treatment requirements at the plants and have been included in the tables for comparative purposes only. The raw water quality data was obtained from different sources and time periods based on available parameter data. It is considered the data is comparable since the values are consistent and no significant changes in raw water quality were observed over the reporting periods.

Table 10: Raw Water Quality of the PAL4 Water System

Parameter	Parameter Description	Units	Palgrave System (Min-Max)	ODWQS limits	AO/OG/ Health-based Standard[3]
Turbidity[1]	Suspended particles of organic/ inorganic matter	NTU	0.03 – 0.55	5 (at point of consumption) 1 (adverse water quality level)	AO
Iron[1]	Naturally occurring in mineral deposits and from sediment decay	mg/L	0.52 – 1.52	0.3	AO
pH[1]	Water acidity	-	6.8 – 8.1	6.5 – 8.5	OG
Temperature[1]	Varies seasonally	^{0}C	7.7 – 11.4	15	AO
Chloride[2]	Non-toxic material naturally present in drinking water	mg/L	8.8 – 14	250	AO
Hardness[2] (as $CaCO_3$)	Naturally occurring; related mainly to calcium and magnesium	mg/L	230 – 240	80 – 100	OG
Organic Nitrogen[2,4]	Natural decay of organic material	mg/L	<0.10 – 0.20	0.15	OG
Sulphate[2]	Naturally occurring	mg/L	30 – 37	500	AO

Notes:

1. Water quality data as per Region of Peel monthly report spreadsheet from January 1, 2015 to February 14, 2021.
2. Water quality data as per Region of Peel, 2020 Water Quality report, Palgrave Caledon, Centerville and Cedar Mills, Palgrave – Caledon Drinking Water System, 2020.
3. From O. Reg. 169/03 and Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines (June 2003). OG is the Operational Guideline and AO is the Aesthetic Objective.
4. Organic nitrogen calculated from the available data on Total Kjeldahl Nitrogen (TKN) and Total Ammonia Nitrogen. Total Organic Nitrogen = TKN – Total Ammonia Nitrogen.

In comparing the reported raw water data against treated water quality objectives outlined in the ODWQS, only hardness and iron are outside the recommended range. Iron removal treatment is provided as described in **Section 5.1.2**. The levels for

hardness also exceed the operational guideline. This specific parameter is not substantially affected by conventional treatment. Hardness in the range of 80-100 mg/L are considered to provide an acceptable balance between corrosion and incrustation. Hardness level of around 200 mg/L is considered tolerable, while levels above 500 mg/L for domestic use could results in larger maintenance due to scaling of appurtenances. Organic nitrogen concentrations higher than the operational guideline of 0.15 mg/L may affect taste and odour of the water. The maximum organic nitrogen in the Palgrave system slightly exceeds the operational guideline, however it is not expected to have an adverse effect on human health.

All other physical and chemical water quality parameters are well below the ODWS limits; therefore, besides iron removal, only disinfection treatment is required.

5.2.4.2 Treated Water

Treated water quality data for selected physical and chemical parameters are summarized in **Table 11**. The turbidity values were obtained from SCADA raw water data and may include data points with high turbidity values caused by air entrapped in the sampling line. The maximum turbidity value may not be a true representation of the filtered water quality. In addition, the treated water quality data was obtained from different sources and time periods based on available parameter data. It is considered the data is comparable since the values are consistent and no significant changes in treated water quality were observed over the reporting periods.

Table 11: Treated Water Quality of the PAL4 Water System

Parameter	Parameter Description	Units	Palgrave System (Min-Max)	ODWQS limits	AO/OG/ Health-based Standard[4]
Turbidity[1]	Suspended particles of organic/ inorganic matter	NTU	0.05 – 0.85	5 (at point of consumption) 1 (adverse water quality level)	AO
Iron[2]	Naturally occurring in mineral deposits and from sediment decay	mg/L	<0.01 – 0.28	0.3	AO
Alkalinity[3]	Water resistance to effects of acids added to water	mg/L	200 – 240	30 – 500	OG[3]

Parameter	Parameter Description	Units	Palgrave System (Min-Max)	ODWQS limits	AO/OG/ Health-based Standard[4]
Lead[3]	Resulting from corrosion of process fitting containing lead	mg/L	<0.0005	0.01	MAC[4]
Total Dissolved Solids[3]	Mainly inorganic substances dissolved in water	mg/L	280	500	AO5
Hardness (as $CaCO_3$)[3]	Naturally occurring; mainly calcium and magnesium	mg/L	230 – 240	80 – 100	OG
Manganese[3]	In groundwater as a result of mineral deposits	mg/L	<0.002	0.05	AO
Nitrate[3]	Present in groundwater as a result of plant or animal material decay	mg/L	<0.10	10	MAC
Nitrite[3]	Present in groundwater and is oxidized to nitrate when chlorinated	mg/L as N	<0.01	1	MAC
Sulphate[3]	Naturally occurring	mg/L	35	500	AO
Sodium[3]	Naturally occurring or due to water softening	mg/L	7.0 – 9.4	2003	AO

Notes:

1. Water quality data as per SCADA historian from January 1, 2015 to March 14, 2021.
2. Water quality data as per Region of Peel monthly report spreadsheet from January 1, 2015 to February 14, 2021.
3. Water quality data as per Region of Peel, 2020 Water Quality report, Palgrave Caledon, Centerville and Cedar Mills, Palgrave – Caledon Drinking Water System, 2020.
4. From O. Reg. 169/03 and Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines (June 2003). OG is the Operational Guideline, MAC is the Maximum Allowable Concentration, AO is the Aesthetic Objective.
5. The aesthetic objective for sodium in drinking water is 200 mg/L. The local Medical Officer of Health should be notified when the sodium concentration exceeds 20 mg/L so that this information may be communicated to local physicians for their use with patients on sodium restricted diets.

In comparing the ODWQS limits against treated water quality, the treated water quality for PAL4 System meets the ODWQS. As noted before, hardness levels of around 200 mg/L are considered tolerable and not related to public health.

The ODWQS states that the presence of any total coliform bacteria or Escherichia coli (E. coli) in water leaving a treatment plant or in any treated water immediately post treatment signifies inadequate treatment and is unacceptable. A summary of the treated water microbiological test results in the PAL4 System, as extracted from the 2020 Water Quality Report is shown in **Table 12**. All sample results analysed from the Caledon East / Palgrave system were in compliance with the ODWQS.

Table 12: Treated Water Microbiological Test Results for Caledon East/Palgrave Water System[1]

Sample Location	No. of samples	E. coli (CFU/100 mL) (Min – Max)	Total Coliform (CFU/100 mL) (Min – Max)	Criteria (ODWQS)	Health Based Standard[2]
Palgrave WTP2 (PAL4)	52	0 – 0	0 – 0	Not Detectable	MAC

Notes:

1. Data as per Region of Peel, 2020 Water Quality report, Palgrave Caledon, Centerville and Cedar Mills, Palgrave – Caledon Drinking Water System, 2020.
2. From O. Reg. 169/03 and Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines (June 2003). MAC is the Maximum Allowable Concentration.

6 Design Criteria

6.1 Service Populations and System Demands

In June 2020, the Region completed a study to establish servicing requirements and confirm population projection and servicing approaches in the Town of Caledon. The study included a detail analysis of each individual municipal groundwater system to confirm capacity and servicing needs of the existing systems to accommodate projected growth in accordance with Official Plan Amendments. Future growth in the subject areas was projected based on the Town of Caledon's growth projections up to 2031, as well as development applications / inquires for the villages with the Town of Caledon that could add further growth beyond 2031.

The Region's study concluded that projected equivalent serviced population in the Caledon East/Palgrave Drinking Water System is anticipated to increase from an existing 12,187 people to 14,184 people, beyond 2031, as shown in **Table 13**. Correspondingly, maximum water demands are expected to increase from approximately 9,041 m^3/day to 13,263 m^3/day, representing an increase of system demands of almost 50%.

Table 13: Existing and Projected Population and Demand for Palgrave Water System[1]

System	Existing Equivalent Service Population (2020)	Existing Max. Day Demand (m^3/day)	Potential Projected Population[2] (2031+)	Potential Projected Max Day Demand (m^3/day)
Caledon East / Palgrave	12,187	9,041	14,184	13,263

Notes:

1. Population and system demand excerpted from Servicing Update of Groundwater-Based Drinking Water Systems, Region of Peel, 2020.
2. As per Region's report, potential projected population includes current development applications approved but not yet serviced, as well as future potential growth.

As shown previously in **Table 4**, the currently available supply capacity in the Caledon East / Palgrave Drinking Water System, excluding the new well CE6 (yet to be connected) is approximately 14,968 m^3/day. Based on the projected maximum day demands for the Caledon East / Palgrave Drinking Water System for 2031 and beyond, of 13,263 m^3/day (shown in **Table 13**), the existing municipal supply wells have enough combined capacity, from a supply perspective, to accommodate the projected demands.

The life cycle of a production well is generally influenced by a few factors or processes that are external to well construction or well operation. This include material or performance deterioration resulting from physical, chemical and/or biological processes occurring in the aquifer where the well has been built. In the case of the Caledon East / Palgrave system, the efficiency of Caledon wells CE4 and CE4A has been declining over the last seven (7) years due to changes in the aquifer pressure.

Furthermore, under the current system configuration, the Palgrave wells alone, or the Caledon East wells alone, would not be able to satisfy the projected combined system demands, should anything happen with the wells, their aquifers, or the interconnecting watermain between the two (2) systems. To this effect, the Region recognized an opportunity to explore options to enhance the redundancy of supply in the system and mitigate the associated risks.

7 Class EA Phase 1 – Problem / Opportunity Statement

7.1 Needs Assessment and Justification

A review of the existing Palgrave/Caledon East Drinking Water System identified limited system redundancy with the security of supply, coupled with a historical decline in well efficiency in a few of the system's production wells. To this effect, the Region recognized an opportunity to explore alternatives to enhance the security of water supply in the Palgrave/ Caledon East Drinking Water System and reduce the associated risks.

A hydrogeological evaluation and an extended pumping test identified that the capacity of the existing Palgrave Well 4 could be increased from its current permitted water taking rate of 30.3 L/s to 60 L/s. In addition, as described in **Section 1.2.1**, the results for the raw water quality of the well when operating at 60.6 L/s are comparable with the ones reported under current well operating conditions. The hydrogeological and water quality assessments suggest that PAL 4 can accommodate the increased flows with modifications to the existing treatment in Palgrave WTP 2. An increase in water taking capacity from the current well will require infrastructure upgrades/modifications to be implemented.

The works associated with the increase of water taking capacity of an existing well at an existing municipal well site, where the existing rated capacity will be exceeded, are considered Schedule C undertakings under the Municipal Class Environmental Assessment document (March 2023), and thus, completion of a Class EA study was required. The Class EA study was originally initiated as a Schedule B project but was subsequently elevated to Schedule C.

7.2 Problem / Opportunity Statement

The problem/opportunity statement for the Palgrave Well No 4 Supply Well Class EA Study was defined as follows:

Infrastructure improvements to the Palgrave/Caledon East Drinking Water System are required to:

- Increase the well supply capacity and enhance the security of water supply
- Minimize potential risks associated with declined well efficiency

- Provide an appropriate level of service while meeting the long-term water needs of the serviced area

The preferred water supply servicing solution to meet the above Problem / Opportunity Statement was identified and developed in this Class EA study in a way that is reliable, sustainable, and environmentally and financially responsible.

8 Study Area Overview – Existing Conditions

This section provides an overview of the main features, characteristics, and existing conditions of the study area delineated for the Palgrave No 4 Supply Well Class EA study.

8.1 Study Area Location

For the purpose of this Class EA Study, a Project Study Area was delineated to encompass approximately 10 km radius from the Palgrave Well #4. The Project Study Area was selected based on the potential extent of the Well Head Protection Area (WHPA) B for the well with the increased taking capacity to 60 L/s (The extended expanded WHPA was further evaluated and developed by Aqua Insight as part of this Class EA). The limits of the study area provided an indication of the area/properties anticipated to be impacted and correspondingly, the area that needs to be assessed and notified. The limits of the Project Study Area are shown in **Figure 10**.

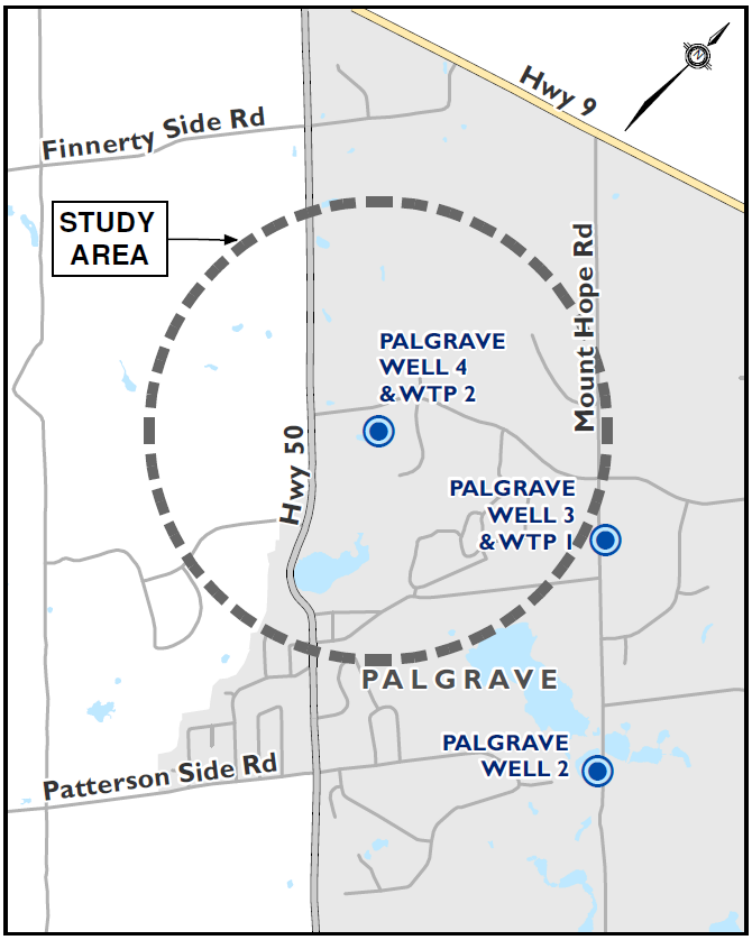

Figure 10: Project Study Area

A preliminary overview of key significant features within the study area is provided in the following sections. Detailed desktop studies and field investigations were undertaken as part of the Class EA study to support the decision-making process and recommendations of the Class EA study.

8.2 Natural Environment

A desktop assessment along with in-season field investigations was undertaken, as part of this Class EA study, to establish the environmental sensitivities of the study area and provide direction on protecting these features in relation to the proposed works. LGL Limited (LGL) was retained by CIMA+ to provide the natural sciences services in support of the Palgrave No 4 Supply Well Class EA Study. LGL's findings and recommendations have been documented in a stand-alone report "Draft Natural Features Impact Assessment Report for Palgrave 4 Supply Well, April 2023", and is included in **Appendix I** for further reference.

The study area is located within the Humber River watershed. Areas within the Toronto & Region Conservation Authority (TRCA) and Nottawasaga Valley Conservation Authority (NVCA) are within the limits of the study area, as shown in **Figure 11**: Study Area Map with Natural FeaturesKey natural heritage features (KNHF) and hydrological features are located within 120 metres of the study area. The Humber River along with its riparian forest and associated habitats are the main components of natural heritage in the study area. Most of these features lie within the TRCA's Ontario Regulation 166/06 limits.

The background review and environmental field investigations' findings will be further discussed in the following sections.

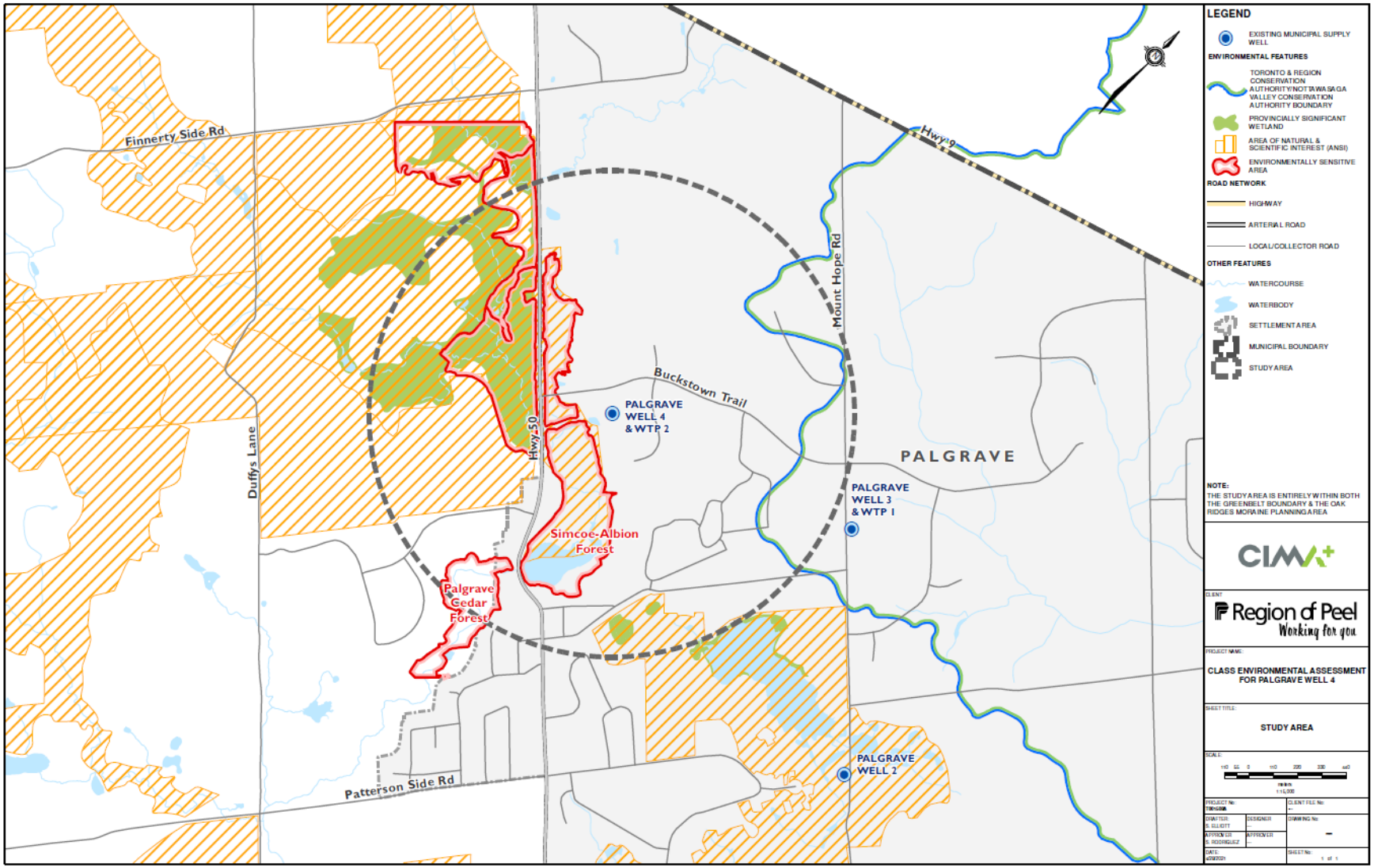

Figure 11: Study Area Map with Natural Features

8.2.1 Background Information Review

A desktop-based review of natural heritage constraints for the study area was conducted by LGL. The review was intended to determine if there are any known natural areas (i.e., Areas of Natural and Scientific Interest, Provincially Significant Wetlands, Environmentally Sensitive Areas, Significant Woodlands, or Significant Wildlife Habitat) or records of rare or sensitive species that could be impacted by the project. The databases or references reviewed included the following:

- Land Information Ontario (LIO) (natural areas and species)
- Atlas of the Mammals of Ontario
- Bat Conservation International Species Profiles
- Atlas of the Breeding Birds of Ontario
- eBird
- iNaturalist
- Aquatic species at Risk Maps (Fisheries and Oceans Canada)
- Butterfly Atlas of Ontario
- Alvars of Ontario
- The Vascular Plants of Ontario (2009)
- Vascular Plants at Risk in Ontario (2018)
- Toronto and Region Conservation Authority Regulation Limits (O.Reg 166/06)
- Oak Ridges Moraine Conservation Plan
- Region of Peel Official Plan (December 2018 Office Consolidation)
- Town of Caledon Official Plan (April 2018 Office Consolidation)

From these references, LGL developed figures showing where the natural feature polygons occur in relation to the alignment. A table of the species at risk (SAR) with potential to occur in the area was also developed at the screening stage. Each of the SAR was classified as Low, Moderate, High potential, or Confirmed to occur in the study area and be impacted by the project based on review of the habitat through aerial imagery. The presence of SAR was then evaluated through species inventories where potential impacts to SAR habitat were identified.

The results provided in this section characterize the existing conditions for the areas where impacts on the environment could be experienced and where mitigation will be required. The natural heritage and hydrological features located on and adjacent to the study area are delineated in **Figure 11**.

8.2.1.1 Landform and Physiography

The study area is situated within the physiographic region classified by Chapman and Putnam (1984) as the Oak Ridges Moraine. The Oak Ridges Moraine has a general altitude of 1,000 feet a.s.l. and extends from the Niagara Escarpment to the Trent River. The Oak Ridges Moraine is a series of ridges deposited and shaped by advancements and recessions of past glaciers. The physiography of the Oak Ridges Moraine is characterized by its hilly terrain with knob-and-basin relief, high water tables, and common sandy and gravelly till deposits. The saddles in this region are crossed by multiple highways including Highway 50. The bedrock formation and the distribution of the soil parent materials lie within Peel County.

The dominant soils within the study area are known as pontypool sandy loam in Peel County. Deposited by glacio-fluvial action, pontypool sandy loam is coarse textured and consists mainly of sand, with smaller amounts of gravel and silt. These soils are highly susceptible to erosion, well-drained, and have well-developed soil horizons. General farming can take place on these soils but is limited by low fertility and droughtiness. The topography of this area is irregular with steep slopes.

8.2.1.2 Designated Natural Areas

Designated natural areas include areas that have been identified for protection by the Ontario MNRF, TRCA, Peel Region, and the Town of Caledon. The location of all designated natural areas within the study area are summarized below:

- No Provincially Significant Wetlands located within 120 metres of the study area.
- Unevaluated wetlands are located within 30 metres of the study area.
- Ballycroy, an evaluated wetland, is associated with the Palgrave Moraine (ANSI, Earth Science) and is located within 293 metres of the study area. Direct and indirect impacts are not anticipated as the evaluated wetland is located at a considerable distance from the proposed works area.
- Humber Headwaters, an Area of Natural and Scientific Interest (ANSI, Life Science) is located south of the study area. The Humber Headwaters contains a total area of 1108 hectares and is considered provincially significant (MNRF, 2011a). Direct and indirect impacts are not anticipated as the Humber Headwaters ANSI is located outside of the study area and the proposed works will approximately maintain a 46-metre setback from the designated natural area.
- Palgrave Moraine, an Area of Natural and Scientific Interest (ANSI, Earth Science) contains a total area of 2.3 hectares. Palgrave Moraine ANSI was deposited during the Late Wisconsinan period by glaciers moving out of the Lake Ontario basin. Palgrave End Moraine has a typically rugged topography composed of Halton Till

and ice contact stratified drift. Portions of the moraine are constructional, others palimpsest. Typical rugged topography of the Palgrave Moraine was deposited by the Ontario ice lobe during the Port Huron Stadial (Earth Science Database, 1998). Palgrave Moraine is located further south of the study area, adjacent to Highway 50. Direct and indirect impacts are not anticipated as Palgrave Moraine is located outside of the study area and the proposed works will approximately maintain a 300-metre setback from the designated natural area.

- There are no Environmentally Significant Areas located within 120 meters of the study area.

8.2.1.3 Aquatic Habitat and Communities

The study area is located within the Main Humber sub watershed of the Humber River. The Main Humber sub watershed contains a length of approximately 126 km and drains an area of approximately 357 km^2 that includes Centreville Creek, Cold Creek, and Rainbow Creek (TRCA 2008b). Its headwaters are in the Oak Ridges Moraine and flows down the South Slope into the Peel Plain. There are no creeks flowing through the study area within 120 metres. The Humber River watershed is the largest of the TRCA watersheds and drains an area of approximately 911 km^2 (TRCA 2013c).

LGL's report provides a summary of fish species in the vicinity of the study area and **Figure 11** indicates the locations of the fish surveys. A total of 4 fish species are identified within the Humber River located south of the study area. The Main Humber tributary is managed as a coldwater system. According to the background review, the Humber River and its main tributary near the study area are not reported to support any aquatic species at risk.

The Humber River Watershed Report Card (TRCA 2013c) rated the water quality a C grade, which is fair. The grade is based on benthic invertebrate sampling, and concentrations of Total Phosphorus as well as Escherichia coli levels. While chloride levels are not used as a measurement in the water quality rating, they are known to be high in the watershed.

8.2.1.4 Wildlife and Wildlife Habitats

With the study area being in a predominantly a rural setting, the natural areas associated with the Humber River provide some of the main habitat for wildlife in the area. The Humber River and its associated natural areas provide a wildlife corridor through the area. The Humber River provides a variety of habitat types within the immediate study area, including riparian/deciduous woodlands/forests, open riparian habitats, meadow, and unevaluated and evaluated wetlands. The Region of Peel identifies woodlands associated with the Humber River south of the study area, and north-west of the study area. In addition to the natural habitats associated with the

Humber River, open, human-made habitats exist for species that prefer edges and/or open field habitats.

A review of TRCA fauna data, Ontario Nature, Ontario Butterfly Atlas, Ontario Reptile and Amphibian Atlas, iNaturalist, OBBA, and eBird data identified the potential presence of 12 species at risk in a 10-kilometre square that includes our study area. The list can be found in LGL's report and includes birds, turtles, and butterflies which have some potential to be found in a larger area, however, a suitable habitat may not be available for them on site.

In general, the study area encompasses a highly urban influenced section of the Humber River. In this section, wildlife communities must be very tolerant of urban influence due to the location of residential homes within the immediate study area. Notwithstanding, the immediate study area provides an important east-west corridor through the watershed at Highway 50, a high-capacity arterial highway. It is warranted to seek to minimize impacts to wildlife habitat to the extent feasible and to restore to existing or as-better conditions where feasible. A table of potential SAR species has been compiled (given in LGL's report) using information from various sources such as TRCA database, NHIC, OBBA, eBird, Ontario Nature, DFO Aquatic SAR Mapping, as well as information gathered during LGL's environmental field investigations carried out in Spring 2021.

8.2.2 Environmental Field Investigation Findings

8.2.2.1 Vegetation and Vegetation Communities

The geographical extent, composition, structure, and function of vegetation communities were identified through air photo interpretation and field investigations. Air photos were interpreted to determine the limits and characteristics of vegetation communities. A field investigation of the vegetation communities within the study area and beyond to the extent possible, was undertaken on April 9, 2021.

The study area is comprised of a large, manicured area with planted trees and turf grass. Vegetation communities immediately adjacent to the study area consists of a mixture of cultural vegetation communities including Dry-Moist Old Field Meadow (CUM1-1) and Coniferous Plantation (CUP3) as shown in **Figure 11.** All the vegetation communities identified are considered widespread and common in Ontario and secure globally.

In general, cultural vegetation communities are comprised of a high proportion of non-native, disturbance tolerant plant species that are well adapted to persist in areas that are regularly disturbed including species that are adapted to high light conditions,

limited soil moisture and species that are tolerant of salt spray. These communities are generally considered to be of low quality.

A list of flora observed within the study area is also given in LGL's report. A total of 19 species were found, out which only one species was identified to genus only. Of the 18 plant species identified, 10 (56%) plant species identified are native to Ontario and 8 (44%) plant species are considered introduced and non-native to Ontario.

Two TRCA plant species of concern were identified within the study area: white spruce and tamarack. Tamarack was identified within the coniferous plantation community outside of the immediate study area. White spruce was identified within both the coniferous plantation and manicured lands. No plant species that are regulated under the Ontario Endangered Species Act (ESA) and the Canada Species at Risk Act (SARA) were identified within the study area.

8.2.2.2 Tree Resources

An inventory of tree resource was conducted by LGL in the study area and included those trees on adjacent properties that are within 1 m of the property line. A total of 32 trees were identified and assessed. Most of the trees surveyed were planted as amenity features. Overall, trees within the study area range in size from 1 to 80 cm DBH and are generally considered to be in good to fair condition. A number of the trees displayed signs of abiotic and biotic defects which are typically associated with the urban setting including epicormic branching and stunted growth. A detailed summary of all trees surveyed are presented in LGL's report. No tree species that are regulated under the Ontario Endangered Species Act (ESA) and the Canada Species at Risk Act (SARA) were identified within the study area.

Figure 12: Project Study Area - Natural Heritage

8.3 Archaeological and Cultural Heritage Resources

All the activities of this project including any new infrastructure is anticipated to be fully contained within the existing site boundaries located at 9 Buckstown Trail, Palgrave. Since this is a brownfield project, limited to an area that is already deeply and extensively disturbed by previous construction activities, it was discerned that the study area does not exhibit any archaeological potential.

As recommended by the Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI) during the public and agency consultation process, the project was also screened using MHSTCI's Criteria for Evaluating Archaeological Potential to determine if the project may impact archaeological resources and requires an archaeological assessment. Moreover, the project was also screened using the MHSTCI Criteria for Evaluating Potential Built Heritage Resources and Cultural Heritage Landscapes and it was concluded that potential impacts to cultural heritage features are negligible. Hence, no studies related to archaeological or cultural heritage were carried out. The completed checklists and relevant correspondence with MHSTCI can be found in **Appendix J** and **Appendix F,** respectively.

8.4 Source Water Protection

The study area for Palgrave Well No. 4 is in the Toronto and Region Source Protection Area that falls within the CTC Source Protection Region. The Region has developed a Source Protection Plan and Assessment Report to meet the requirements under the 2006 Clean Water Act (Bill 43), and to protect the quality and long-term sustainability of our drinking water sources.

Mapping data from MECP confirms the presence of Wellhead Protection Areas, Significant Groundwater Recharge Areas, and Highly Vulnerable Areas in the project study area. These areas are associated with existing well fields or water wells supplying a municipal residential system or other designated systems, as well as areas where an aquifer is significantly replenished from natural processes.

As new subsurface data are collected, new water supply wells are brought online, wells are taken offline, or the pumping rates for the wells change, the capture zones and WHPAs for the community need to be updated. An increase in water taking from Palgrave Well 4 will result in new WHPAs; the updates to the current source protection for Palgrave and Caledon East are discussed in the following section.

Aqua Insight Inc. was retained by the Region to conduct, as a separate assignment, a groundwater vulnerability assessment for municipal wells located in Palgrave, Caledon East, and Caledon Village. The scope of work for this assessment included local updates to an existing groundwater flow model, application of the model to delineate

wellhead protection areas (WHPAs) for the three municipal wells, evaluation of the aquifer vulnerability, and calculation and identification of non-point source threats within the newly delineated WHPAs. The methodologies undertaken conform with the MECP (2021) Technical Rules and forms the background for a water quality threats assessment. Results from the source water protection update were communicated to potentially impacted residents through a separate consultation program led by the Region's Source Water Protection Group. A Notice of Proposed Wellhead Protection Area Update, dated February 3, 2022, was sent to stakeholders within the proposed updated Palgrave WHPAs.

The report Source Protection Updates for the Communities of Palgrave, Caledon East, and Caledon Village (December 2022) by Aqua Insight summarizes those updates conducted in the three communities as part of Peel Region's ongoing Source Protection initiatives. The full report and Notice of Proposed Wellhead Protection Area Update have been attached as **Appendix H**.

8.4.1 Re-delineation of Wellhead Protection Areas (WHPAs)

The limits of existing WHPAs and the new WHPAs delineated for the Palgrave Wells 2, 3 and 4 are illustrated on **Figure 12**.

The WHPA-As are illustrated as 100 m buffers surrounding each of the wells. The WHPA-B and -C zones extend broadly in a near radial direction away from each of the municipal wells. There is a small zone north of the wells where the WHPA-B and -C (and 10-year time of travel zone) are nearly overlapping and this is due to an interpreted pinch out to the north of the production aquifer, which causes the pathlines to move westward within the production aquifer, or vertically upward through the overlying aquitard. Palgrave Well 2 is screened in a shallower unit (Lower ORM Sands) than Palgrave Wells 3 and 4 (Thorncliffe Formation), so it has a smaller WHPA that draws water from shallow sources. Most of the pathlines associated with Palgrave Well 4 were simulated to remain underground throughout the 25-year time of travel, moving through the production aquifer to the west towards the Niagara Escarpment.

Groundwater vulnerability, issues evaluation and threats assessment completed for the new WHPA's have been discussed in Section 14.

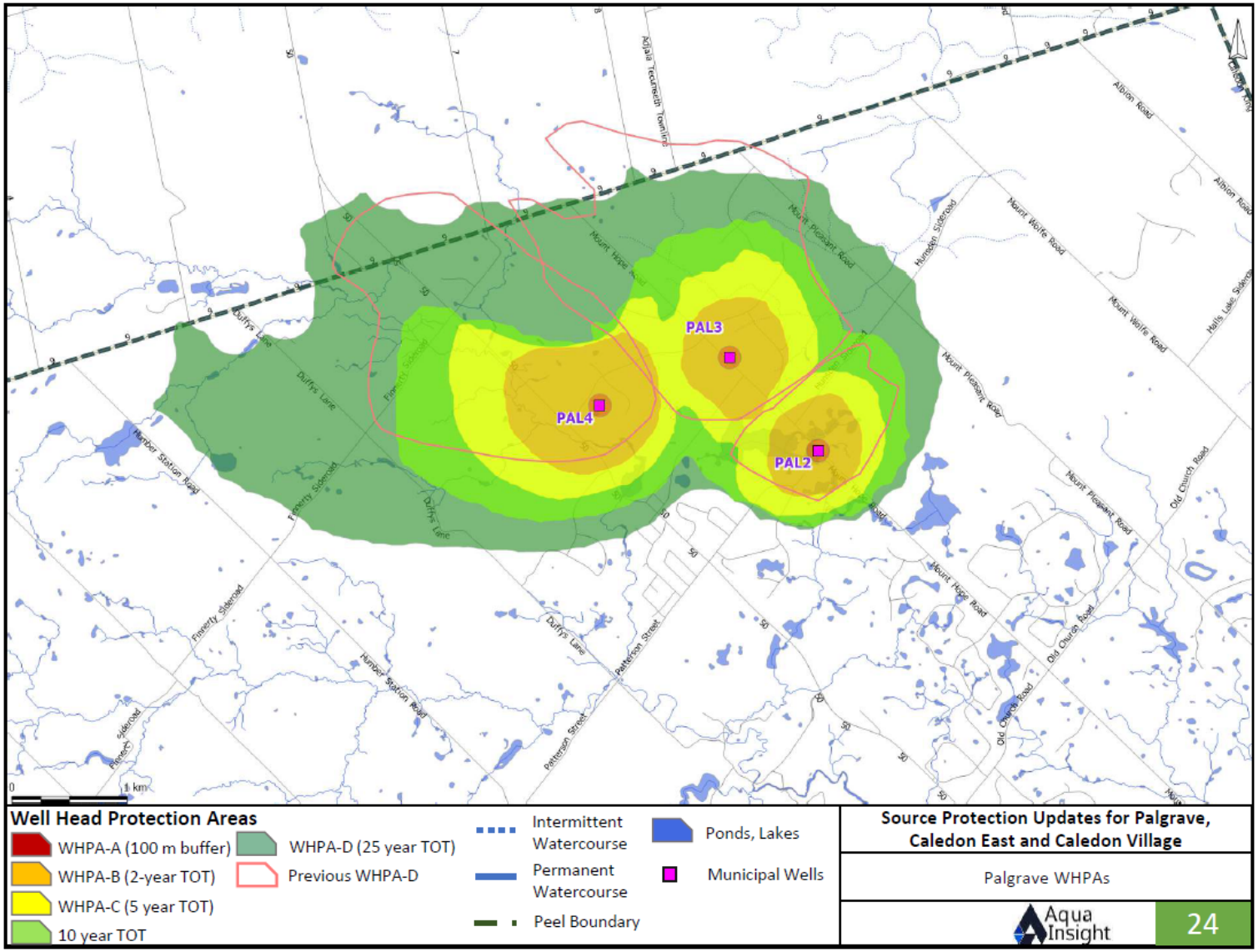

Figure 13: Delineation of WHPAs for Palgrave Wells 2, 3, and 4

9 Capacity Assessment of Palgrave Water Treatment Plant 2

A desktop capacity assessment of the major processes and treatment equipment at the PAL4 WTP2 was undertaken to provide the information and data necessary for the next steps of the Class EA study. The assessment aimed to inform the decision-making process regarding the upgrade of PAL4 WTP2 and to ensure that the treatment processes and equipment could effectively handle the proposed increase in water taking capacity.

The methodology involved site visits, data analysis, capacity evaluations, infrastructure reviews, and consideration of relevant guidelines and regulations. The assessment included a review of the treatment, hydraulic, mechanical, instrumentation and control, electrical infrastructure, as well as footprint restrictions within the existing treatment building. Historical operating data from 2015 to March 2021 was also obtained and reviewed to establish baselines for the operation and capacity of PAL4 WTP2. The data included raw water flows, filtration rates, backwash rates, filter differential pressure (FDP), and chlorine residuals.

A summary of the key recommendations of the study is provided in **Table 14** below.

Table 14: Summary of Recommendations based on Capacity Assessment

Area	Equipment Restriction	Recommendation
Raw Water	Pump and motor do not have capacity to pump water at a rate of 60.6 L/s.	Upgrade raw water pump and motor.
Treatment Process	Filtration system does no have capacity to treat water at a rate of 66.6 L/s.	Increase capacity of filtration system.
Treatment Process	Existing chlorine contact pipe requires excessive chlorine concentration to achieve log virus inactivation.	Increase capacity of chlorine contact pipe by twinning the existing pipe.
Treatment Process	Current chemical dosing system may be sufficient to accommodate for 66.6 L/s.	Dosage control may need to be revised based on raw water pump controls.

Area	Equipment Restriction	Recommendation
Treatment Process	Current chemical storage tank does not have capacity to store volume required for 11 days at a rate of 66.6 L/s.	Increase chemical storage for sodium hypochlorite.
Waste Management	More wastewater generated from rate of 66.6 L/s.	Further evaluations of decanting tank volume to be completed to accommodate larger waste volume.
Waste Management	More sludge generated from rate of 66.6 L/s.	Re-evaluate waste management philosophy and sequencing. Upgrades to sludge transfer pumps may not needed.
Waste Management	Supernatant pumps capacity is not sufficient to recycle supernatant to the raw water header (based on 10% recycling).	Replace supernatant pumps to accommodate for 10% of 60.6 L/s.
Hydraulic	Velocity in several pipes will exceed recommended guideline, pipes may need to be reconfigured with upgraded equipment.	Upgrade raw water header filtered water header and overflow pipe. Backwash header upgrades to be revisited based on filter diameter.
Mechanical / Electrical	Larger flows from the well pump require a bigger pump/pump motor, increasing load on power distribution system.	Upgrade pump from existing 60 hp to 125 hp. Retrofit existing system, including main 600VAC “MCC-1” and standby power generation.
I&C	New process related field I/O.	Retrofit existing “ICP-01” to accommodate new I/O.
Facility Footprint	More space would be required to accommodate upgraded equipment to treat flow rate of 66.6 L/s.	Re-purpose unused spaces inside facility. The dehumidifier located in the filter room may need to be relocated to allow space for additional filter and piping installation.

Area	Equipment Restriction	Recommendation
Civil	More space may be required to house the equipment needed to treat flow rate of 66.6 L/s.	Consider moving suitable equipment outside such as the generator. Expansion of the decant tank and chlorine contact pipe twin to be located underground at site.

It was concluded that WTP2 should be able to transition to an increased flow capacity of 60 L/s for PAL4 by implementing the recommendations provided in the table above.

10 Evaluation Methodology

This section provides an overview of the evaluation framework developed to assist the comparative assessment of alternative solutions considered in the Class EA study and the selection of the preferred recommended solution.

10.1 Overview

The development of a systematic, stepwise method for making decisions at the start of the project helps to focus and clarify decision-making. A comprehensive evaluation methodology provides the basis of a decision making that is sound, defensible, traceable, and consistent with the specific objectives of the project.

The evaluation process for this Class EA study consists of the following major steps:

1. Identification and Evaluation of Alternative Solutions – This first step allows the project team to identify a long list of available potential alternative solutions and select only those that are considered feasible and eliminate the alternatives that are not. This first step leads to the preliminary identification (screening) of short-listed feasible alternatives and avoids the need to carry unrealistic alternatives through the detailed evaluation step. Preliminary screening is based on a set of “must-meet” criteria.
2. Comparative Evaluation of Feasible Alternative Solutions – The short-listed alternative solution(s) are further developed into potential implementation options. Detailed evaluation of the implementation options using a multi-criteria decision analysis based on technical, socio / cultural, natural environment and economic considerations grouped in categories as outlined in this technical memo and scored comparatively using performance scales.
3. Selection and Recommendation of the Preferred Solution – The outcome of the detailed evaluation is the selection of the preliminary preferred solution.

The major steps of the evaluation process are also depicted in **Figure 14**. The preliminary screening and detailed evaluation criteria are described in the following sections.

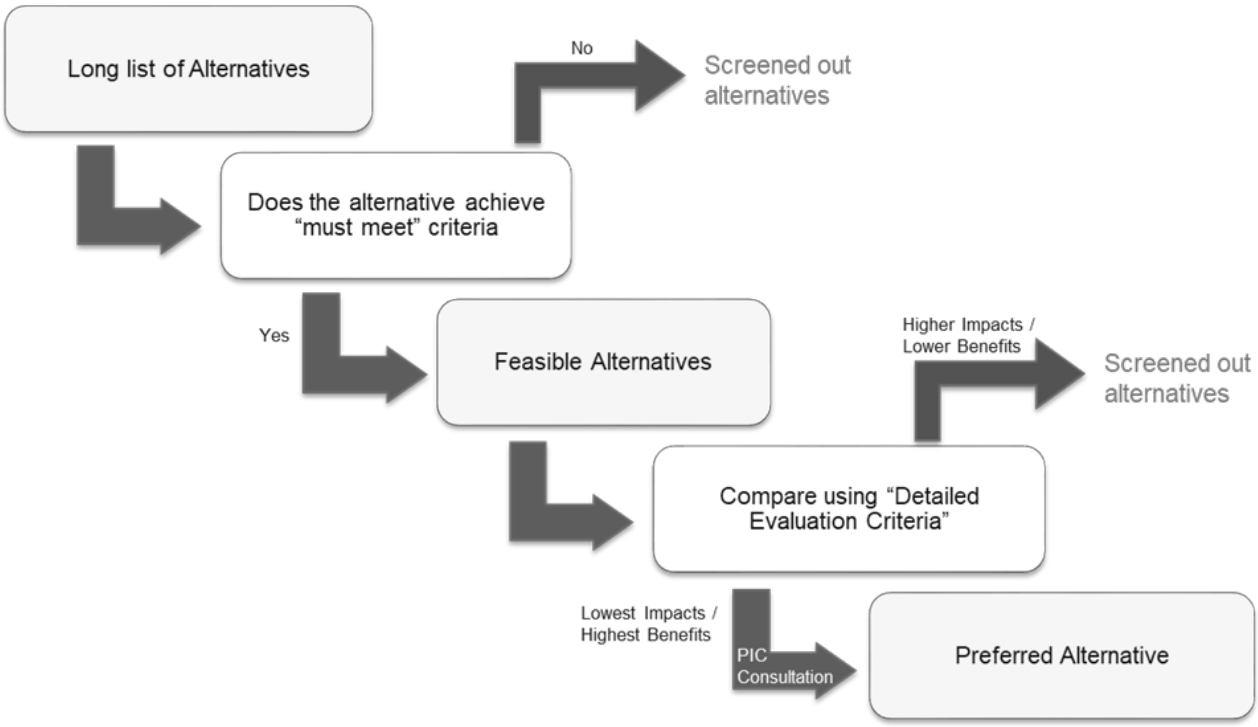

Figure 14: Overview of Evaluation Methodology

10.2 Preliminary Screening

In accordance with Phase 2 of the Municipal Class EA process, a long list of available alternative solutions is initially developed to address the Problem/Opportunity Statement and project objectives . Once a long list of alternative solutions is developed, each alternative solution is subjected to preliminary screening.

Preliminary screening is accomplished by applying a set of "must meet" criteria, as shown in **Table 15**, against the alternative solutions under consideration. The "must meet" criteria are developed by the project team based on professional judgment and experience with projects of similar nature.

The criteria listed in **Table 15** are considered on a "Yes" or "No" basis. If an alternative solution under consideration fails against any or all the criteria, the alternative solution is not carried forward to detailed evaluation. Only those alternatives that meet all the "must meet" criteria are short-listed and considered feasible for a more detailed evaluation.

Table 15: Preliminary "Must-Meet" Criteria

Must-Meet Criteria	Description
Supply Capacity	• Does the alternative solution contribute to an increase in system redundancy with the security of water supply in the Palgrave/Caledon East DWS, consistent with the Problem / Opportunity Statement defined for the Class EA study?
Compliance	• Can the alternative solution consistently meet or exceed applicable provincial water quality standards / objectives and guidelines?
Technical Feasibility	• Does the alternative solution maximize the use of existing municipal infrastructure without the need for major expansions? • Is the alternative solution compatible with existing treatment processes and operational practices, such that its implementation will not significantly impact the existing operations? • Can the alternative solution be implemented in a manner that minimizes the constructability complexity, relative to other alternative solutions, and within a timeframe that enables the continuous provision of drinking water in the Palgrave – Caledon East DWS?
Financial Feasibility	• Is the alternative solution fiscally responsible by balancing capital and operating costs, relative to other alternatives considered in the study?

10.3 Detailed Evaluation Methodology

Water supply alternative solutions that meet all must-meet criteria are short-listed and further developed to rationalize potential alternative concepts.

Potential alternative concepts developed for the short-listed alternatives are then subjected to a detailed comparative evaluation using a weighting and ranking system to enable a systematic and rational comparison of the options, and ultimately, the identification of the preliminary preferred solution. A detailed evaluation methodology is used as a basis to compare key features of each alternative concept, relative to each other, and their ability to perform under each evaluation criterion.

A multi-criteria evaluation methodology that focuses on a set of natural environmental, socio-cultural, technical, and operational, and economic considerations grouped in categories is proposed to be used to assess potential alternative concepts. Main categories are further broken down into detailed evaluation criteria, representing specific aspects within the category.

Options are scored comparatively using an evaluation matrix and a scoring rationale. An evaluation matrix is prepared to reflect the specific advantages and disadvantages that each alternative concept offers for each criterion under consideration. For each alternative concept under consideration, detailed information is gathered and used to provide a relative score that accounts for the following:

- Risk and/or potential impacts for each criterion
- Available approaches to mitigate risks and/or impacts
- Scoring rationale, based on degree of risk and/or mitigation required

A weighted scoring method was proposed for this Class EA study. The weighted scoring method is a form of multi-criterion analysis that involves identification of all the attributes that are relevant to the project, the allocation of weights to each of them reflect their relative importance, and the allocation of scores to each option to reflect how it performs in relation to each criterion. The result is a single weighted score for each option, which is used to indicate and compare the overall performance of the options in non-monetary terms. Due to the character of this project and the possible options under consideration, the use of a weighted scoring method was recommended to weight the criteria according to the relative importance of priority of the criteria.

Lastly, a sensitivity analysis is performed on the decision-making model to check that the results would not change if changes to the weighting factors were made. This effectively verifies that any decisions made are robust and defensible.

10.3.1 Weighting Factors

Preliminary weighting factors are assigned to the main criteria categories to reflect the degree of importance of each category within the overall evaluation scheme. Preliminary proposed weights for the primary criteria categories are:

- Natural Environmental – 10%
- Socio-Cultural – 20%
- Technical/Operational – 40%
- Economic – 30%

The weighting factors are based on the specific nature and anticipated potential impacts of the project. Higher weighting is assigned to criteria that carry more influence on the alternative evaluation results. It is anticipated that the relative difference of impacts of each alternative on natural environmental and socio-cultural will be minor, so a lower weighting is assigned. The relative difference on technical/operational and economic impacts for each alternative is expected to be significant, so these categories are weighted heavily.

Weighting factors were confirmed with input from the Region. They were also presented to the public at the second Public Information Centre for feedback and confirmation. No comments to the evaluation methodology, criteria or weighting factors were received.

10.3.2 Evaluation Criteria, Rationale, and Indicators

Secondary criteria or sub-criteria have been identified within each primary criterion, as shown in **Table 16**. The sub-criteria are intended to represent specific aspects and considerations of the category being evaluated, and most relevant to this project.

Table 16: Evaluation Criteria and Indicators

Criteria	Description	Indicators
Natural Environment (10%)		
Natural Environmental Features	Potential impacts to existing natural environment	• Impacts during construction on environmental features such as terrestrial habitats, vegetation, areas of natural significance, regulated and protected areas, species at risk, etc.
Water Resources and Source Water Protection	Potential temporary and permanent effects on surface water and groundwater quantity/quality	• Potential impact on existing groundwater wells and wellhead protection areas (WHPAs), areas of groundwater recharge and discharge and highly vulnerable aquifers • Conformity with policies and requirements of existing source water protection program • Potential significant drinking water threats • Potential impacts to existing and future land use

Criteria	Description	Indicators
Climate Change	Maximize resiliency to extreme conditions and minimize greenhouse gas emissions	• Relative energy intensity of construction and energy requirements of treatment technology/process • Ability to incorporate energy efficient equipment/treatment processes
Socio-Cultural (20%)		
Health and Safety	Minimize potential impact of health and safety of operation staff	• Special training requirements / certification of staff • Safety requirements
Nuisance (short-term) Impacts	Potential short-term disruption during construction (i.e., noise, dust, visual, truck traffic, access to property)	• Noise and dust production from construction • Potential effects on sensitive receptors (adjacent neighbours and area users) during excavation and construction
Aesthetic and Operational (long-term) Impacts	Potential long-term visual, noise and air quality impacts on adjacent residents and local users from new infrastructure and activities related to operation of facilities	• Noise and visual effects on sensitive receptors (adjacent neighbours and land users) during operation • Presence of existing natural or other features around proposed infrastructure that may help reduce visibility • Ability to maintain views of natural landscapes and prominent features (rural settings) and/or implement landscaping features • Distance between proposed infrastructure and the closest sensitive receptor(s) • Air emissions
Technical/Operational (40%)		

Criteria	Description	Indicators
Constructability	Maximize ease of construction and facilitate integration with existing system(s)	• Compatibility with existing system • Length of construction period • Ease of implementation (construction schedule and phasing opportunities) • Scalability and ability for future expansion and upgrades • Ability to maintain water servicing during construction • Ability to maximize existing footprint / site capacity
Water Quality Considerations	Ability to meet water quality considerations as per provincial and federal guidelines	• Maximize water stability in distribution system • Minimize Disinfection By-Products and taste and odour concerns • Flexibility to respond to variable raw water quality • Flexibility for future objectives
Operational Complexity	Improve operational efficiencies and minimize operational and monitoring requirements	• Compatibility with existing system • Complexity of treatment processes • Operational flexibility and ability to respond to future treatment objectives • Operation and maintenance requirements
Financial/Economic (30%)		
Life Cycle Cost	40-year life cycle cost	• Evaluation of the capital costs plus operating and maintenance costs for a 40-year life cycle period

10.3.3 Scoring Approach Rationale

Alternative concepts developed for the short-listed alternative solutions were assessed relative to each other, against all criteria/sub-criteria shown in **Table 16**.

The evaluation of the options was carried out using the Reasoned Argument Method, comparing differences in impacts, and establishing a clear rationale for the selection of the alternative concept that provided the most overall benefits to this project. The

performance of each alternative design concept against the various sub-criteria was assessed and assigned a preliminary score relative to the potential net impact, which intended to reflect the impact that remained, or was predicted to remain, after mitigation measures were in place. Options were assessed and scored on a 1 to 5 basis with higher scores (5) given to better performing options. The scoring approach used is summarized in **Table 16.**

Table 17: Overall Scoring Approach

Performance Score	Score Representation	Description
5		Potential impacts are negligible, no mitigation is required. Most preferred.
4		Potential impacts are minor and can be easily mitigated through implementation of standard mitigation measures.
3		Potential impacts are moderate and implementation of a number of mitigation measures are required to reduce / eliminate the risks.
2		Potential impacts are major, and implementation of extensive mitigation measures are required to reduce / eliminate the risks.
1		Potential impacts are significant, and implementation of substantial mitigation measures are required to reduce the risks; however, risk cannot be completed eliminated. Least preferred.

Individual scores assigned to each alternative concept are totaled with consideration to the relative weighting factor of each primary criteria category. The alternative concept with the highest final score is technically considered to provide the most overall benefits to this project and thus, is selected as the preliminary preferred water treatment solution for recommendation.

11 Class EA Phase 2 - Identification and Evaluation of Alternative Solutions

In accordance with Phase 2 of the Municipal Class EA process, alternative solutions have been identified to address the need to service the planned growth in the Zone 4 Pressure District.

The following general alternative solutions were identified:

- Alternative 1 – Do Nothing
- Alternative 2 – Limit Community Growth
- Alternative 3 – Reduce Water Demands
- Alternative 4 – Improve Operation and Maintenance of Existing System
- Alternative 5 – Obtain Additional Supply Capacity from Another Source
- Alternative 6 – Expand / Retrofit Existing PAL4 Water Treatment Plant
- Alternative 7 – Establish / Develop a New Water Treatment Facility

A description of each available alternative solution is provided in the following sections.

11.1 Alternative 1 – Do Nothing

The “Do Nothing” alternative represents the existing conditions where the current Palgrave – Caledon East DWS will be maintained as is. No improvements or changes would be made to address the identified problem (system limitations) or opportunity.

The “Do Nothing” alternative does not address the current limitations identified with the security of supply in the Palgrave – Caledon East DWS.

11.2 Alternative 2 – Limit Community Growth

The “Limit Community Growth” alternative represents a scenario where future growth in the areas serviced by the Palgrave – Caledon East DWS is limited to the extent that the existing facilities and infrastructure are sufficient.

One of the key objectives of the comprehensive review of the municipal water and wastewater systems in the Town of Caledon, completed by the Region in 2020, comprised a capacity assessment of each municipal system to service future population based on the projected and planned growth in the serviced areas. The study concluded that current and projected water demands in the Palgrave – Caledon East DWS can be provided through the existing system; however, limited system redundancy in the security of supply was identified as a potential risk in the system.

The “Limit Community Growth” alternative does not address the limitations identified with the redundancy of supply in the Palgrave – Caledon East DWS.

11.3 Alternative 3 – Reduce Water Demands

The “Reduce Water Demands” through implementation of water conservation and water efficiency measures represents a scenario where improvements in water conservation and water efficiency would reduce water consumption to the extent that the existing facilities and infrastructure are sufficient.

With a population growth rate of approximately 35,000 persons per year, water demands within the Region are expected to increase. These growing demands are expected to be met through both infrastructure expansion and implementation of various water efficiency initiatives and education and outreach programs identified in the 2013 Water Efficiency Strategy (WES), which has been built upon the success of the Region’s 2004 Water Efficiency Plan (WEP).

Key factors that have significantly influenced water demands in the Region comprise the implementation of the Region’s WEP, combined with changes in the water efficiency marketplace and increased public environmental awareness. Although annual average day demands are declining in the Region, peak day water demands are not. Peak day demands often drive the need for infrastructure expansion because many infrastructure elements are designed and sized to meet peak day demands. According to the Region’s 2012 WES Update, the Region’s peak day demand is highly variable, dependant on short- and long-term weather patterns and is essentially following the projected growth rate. Although indoor demands are declining in the Region, outdoor water demands are not and thus, the Region plans to implement water efficiency measures that specifically target irrigation demands reductions to keep the peak day ratio as low as possible. The Region has reduced its future demand forecast in response to lower than projected demands. However, further reductions in water demands through implementation of conservation measures will not address the current limitations identified with the security of supply in the Palgrave – Caledon East DWS.

11.4 Alternative 4 – Improve Operation and Maintenance of Existing Supply System

The “Improve Operation and Maintenance of Existing Supply Wells” represents a scenario where improvements and modifications to the current operational and maintenance practices associated with the municipal supply wells in the Palgrave – Caledon East DWS are undertaken.

The Region currently has a Production Well Management Program in place which reviews the efficiency and sustainability of the municipal supply wells, on a continuous basis. A key component of the program includes the assessment of the performance of the municipal supply wells through well testing. Other key well-related monitoring and maintenance activities are also defined in the program, to maximize the working life of the well equipment, reduce the frequency of equipment breakdown and achieve a cost-efficient operation of the well equipment. In addition, the Region is currently developing a Well Asset Management Program to provide specific strategies for each municipal supply well in relation to maintenance, rehabilitation, replacement, and disposal over the life cycle of each well.

The “Improve Operation and Maintenance of Existing Supply Wells” alternative helps to alleviate some of the limitations identified with the redundancy of supply in the Palgrave – Caledon East DWS through the standard and continuous maintenance, inspection, servicing and testing of the municipal supply wells. However, the alternative on its own cannot fully address, in the long-term, the limitations identified with the redundancy of supply in the Palgrave – Caledon East DWS.

The Region intends to continue with the implementation of the Production Well Management Program and adopt the recommendations of the Well Asset Management Program. The “Improve Operation and Maintenance of Existing Supply Wells” alternative was not recommended as a stand-alone solution but considered in combination with the preferred alternative solution.

11.5 Alternative 5 – Obtain Additional Supply Capacity from Another Source

The “Obtain Additional Supply Capacity from Another Source” alternative, represents a scenario where additional supply capacity is sought from another municipal groundwater source. PAL4 water taking capacity would not be increased and no works at its treatment facility would be necessary.

The Region has identified a new municipal groundwater source for the Palgrave – Caledon East DWS. The new production well, referred to as Caledon East Well #6 (CE6) has been drilled, tested, and developed as a production well, although not yet connected to the system.

A separate Class EA Study is currently underway to plan for additional water supply capacity to the existing Palgrave – Caledon East Drinking Water System. The planning and decision-making process was integrated, as practical as possible, with the development and recommendations of this Class EA study to ensure that any new

infrastructure proposed within the Palgrave – Caledon East DWS addresses the identified needs and/or opportunities of the integrated drinking water system as a whole.

11.6 Alternative 6 – Expand / Retrofit Existing PAL4 Water Treatment Plant

The “Expand / Retrofit Existing PAL4 Water Treatment Plant” alternative represents a scenario where the necessary retrofit / modifications to the existing PAL4 treatment facility are provided to accommodate the increased water supply capacity of 60.6 L/s. As previously documented in CIMA+’s TM No.2- Confirmation of Design Parameters, Hydraulic Analysis and Capacity Assessment (October 2021), the existing PAL4 treatment system has a rated capacity of 30.3 L/s, as per current Municipal Drinking Water License Number 009-105, Issue Number 8.

The existing treatment building, located at 9 Buckstown Trail, in the Town of Caledon, includes treatment for iron removal through a combination of pre-oxidation followed by greensand filtration, and disinfection through chlorination, as well as a waste residue management system, standby power, instrumentation and controls, and associated electrical and mechanical, required for the operation of the plant.

Existing treatment processes for iron removal and disinfection, the process wastewater management system, and the associated process piping, equipment and appurtenances will need to be replaced / modified / retrofitted to provide the increased treatment capacity needed to accommodate an increase in water taking from 30.3 L/s to 66.6 L/s (accounting for the 10% of recycled supernatant, consistent with current operational practices).

Consideration will be given to the need to expand the existing building footprint to accommodate new and/or relocated assets. The existing treatment facility was originally designed and built with provision to install additional equipment, thus, opportunities to accommodate the proposed works within the existing footprint to reduce visual impacts to neighbouring residents would be explored.

This alternative would involve modifications and/or retrofits to the existing treatment processes to achieve a capacity increase beyond the existing rated capacity. The proposed works would be considered beyond an operational and maintenance improvement activity. As such, completion of a Schedule C Class EA study would be required.

11.7 Alternative 7 – Establish / Develop a New Water Treatment Facility

The “Establish / Develop a New Water Treatment Facility” alternative represents a scenario where a new water treatment plant (WTP) would be built to accommodate the capacity increase of PAL4 to 60.6 L/s. There is available space at the existing site to build a new treatment building, or alternatively, a new treatment facility would be built at a new site.

The existing PAL4 WTP was built in 2011 with provision for installation of additional equipment. The treatment building and all equipment are in good condition and performing adequately and should continue to be used for the intended purposes, as much as practically possible.

The significant capital expenditure associated with building a new treatment facility, either at the existing site or at a new site, permitting requirements, need and cost for land acquisition (for a facility at a new site), amongst other costs, would render this option financially and technically prohibited. Short- and long-term impacts to the public, and local resident concerns would also be a major disadvantage of this alternative.

11.8 Preliminary Screening Results

Preliminary screening of the alternative solutions described in **Sections 11.1** through **11.7** was carried out in accordance with the methodology outlined in **Section 10.2**. Available alternative solutions that did not meet any of the “must-meet criteria” in the preliminary screening were not considered a feasible solution for the Class EA study and thus eliminated from further consideration in the study.

Alternative solutions that met all “must-meet criteria” were carried forward for detailed development and evaluation. The screening results of the alternative solutions are summarized in **Table 18**.

Table 18: Preliminary Screening Results

Alternative Solutions	Preliminary Screening Criteria – Key Observations	Recommended to Carry Forward
1. Do Nothing	**Supply Capacity:** Option does not address limitations identified with redundancy and security of water supply in the Palgrave-Caledon East DWS. **Compliance:** Option meets applicable provincial water quality standards/objectives and guidelines. **Technical Feasibility:** Option maximizes the use of existing infrastructure, is compatible with existing operational practices, and ensures no disruptions to operations since no new infrastructure is proposed. **Financial Feasibility:** Option is fiscally responsible since no new infrastructure is proposed.	No. Eliminated from further consideration.
2. Limit Community Growth	**Supply Capacity:** Option does not address limitations identified with redundancy and security of water supply in the Palgrave-Caledon East DWS. **Compliance:** Option meets applicable provincial water quality standards / objectives and guidelines. **Technical Feasibility:** Option maximizes the use of existing infrastructure, is compatible with existing practices, and ensures no disruptions to operations since no new infrastructure is proposed. **Financial Feasibility:** Option is fiscally responsible since no new infrastructure is proposed.	No. Eliminated from further consideration.

Alternative Solutions	Preliminary Screening Criteria – Key Observations	Recommended to Carry Forward
3. Reduce Water Demands	**Supply Capacity:** Option does not address limitations identified with redundancy and security of water supply in the Palgrave-Caledon East DWS. **Compliance:** Option is inconsistent with the long-term sustainability vision of the Region's and Town's Official Plans. **Technical Feasibility:** Option maximizes the use of existing infrastructure, is compatible with existing practices, and ensures no disruptions to operations since no new infrastructure is proposed. **Financial Feasibility:** Option is fiscally responsible since no new infrastructure is proposed.	No. Eliminated from further consideration.
4. Improve Maintenance of Existing System	**Supply Capacity:** Option helps to address limitations identified with redundancy and security of water supply in the Palgrave-Caledon East DWS through continuous implementation of the Region's Production Well Management Program. However, the option cannot fully address on its own, the long-term limitations identified with the redundancy of supply in the system. **Compliance:** Option meets applicable provincial water quality standards/objectives and guidelines. **Technical Feasibility:** Option maximizes the use of existing infrastructure, is compatible with existing practices, and ensures no construction disruptions to operations since no new infrastructure is proposed. **Financial Feasibility:** Option is financially feasible as the Region's Production Well Management Program helps to maintain the performance and condition of the existing assets through proper monitoring, maintenance and service, and thus avoiding major capital expenditures associated with construction of new wells.	Not recommended as a stand-alone solution. Recommended to carry forward in combination with preferred solution.

Alternative Solutions	Preliminary Screening Criteria – Key Observations	Recommended to Carry Forward
5. Obtain Additional Supply Capacity from Another Source	**Supply Capacity:** Option contributes to an increase in system redundancy and security of water supply in the Palgrave-Caledon East DWS. However, the option cannot fully address the long-term limitations identified with the redundancy of supply on its own. **Compliance:** Option meets applicable provincial water quality standards/objectives and guidelines. **Technical Feasibility:** Option is compatible with existing practices and maximizes the use of existing infrastructure. A separate Class EA is currently underway to plan for additional water supply capacity to the existing Palgrave – Caledon East Drinking Water System. **Financial Feasibility:** Option is fiscally responsible as it focuses on maximizing the existing infrastructure for the long-term needs.	Not recommended as a stand-alone solution. Recommended to carry forward in combination with preferred solution.
6. Expand / Retrofit PAL4 Water Treatment Facility	**Supply Capacity:** Option contributes to an increase in system redundancy and security of water supply in the Palgrave-Caledon East DWS. **Compliance:** Option meets applicable provincial water quality standards/objectives and guidelines. **Technical Feasibility:** Option involves modifications and/or retrofits to the existing treatment processes to achieve a capacity increase to provide water supply security. As such, the retrofits maximize the use of existing infrastructure and are compatible with existing practices. Construction complexity that may result in disruptions to operations could be minimized by adequate construction phasing. **Financial Feasibility:** Option is fiscally responsible as it focuses on maximizing the existing infrastructure for long term needs.	Yes. Recommended for further consideration.

Alternative Solutions	Preliminary Screening Criteria – Key Observations	Recommended to Carry Forward
7. Establish / Develop a New Water Treatment Facility	**Supply Capacity:** Option contributes to an increase in system redundancy and security of water supply in the Palgrave-Caledon East DWS. **Compliance:** Option meets applicable provincial water quality standards/objectives and guidelines. **Technical Feasibility:** Option involves the construction of a brand new water treatment facility and does not maximize the use of existing infrastructure. **Financial Feasibility:** Option is financially prohibitive in comparison to other available options due to potential capital expenditure associated with building a new plant and potential for land acquisition.	No. Eliminated from further consideration.

11.9 Summary of Preliminary Screening of Alternative Solutions

Based on the results of the preliminary screening, summarized in **Table 18**, it was concluded that:

- Alternatives 1, 2, 3, and 7 did not meet the preliminary screening criteria, and therefore were eliminated from further evaluation.
- The alternative water servicing solution, which met all the preliminary screening criteria is **Alternative 6: Expand / Retrofit Existing PAL4 Water Treatment Plant**

Based on the results of preliminary screening, Alternative 6 was considered the most viable solution to ensure security of water supply in the Palgrave/Caledon East Drinking Water System and was recommended to be carried forward for further development and assessment in the study.

Alternative 6: Expand / Retrofit Existing PAL4 Water Treatment Plant involves a treatment capacity increase, beyond the existing rated capacity of 30 L/s, through modifications / upgrades / retrofits of the existing treatment and equipment. Consideration will be given to housing new / relocated assets within the existing building footprint; however, other options to be developed and evaluated may entail an expansion of the existing treatment building.

In addition, the following alternatives were not recommended as a standalone solution, but rather recommended for further analysis and implementation in combination with the preferred alternative design concept, to be identified in Phase 3 of the Class EA study:

- Alternative 4 – Improve Operation and Maintenance of Existing Supply Wells. The Region will continue implementing the well monitoring, testing, inspection and servicing activities in accordance with the Region's Production Well Management Program and the recommendations of the Well Asset Management Program to maximize the working life of the well equipment, reduce the frequency of equipment breakdown and achieve a cost-efficient operation of the well equipment.
- Alternative 5 – Obtain Additional Supply Capacity from another Source. As previously noted, the Region has developed a new municipal well, CE6. A separate Class EA study is currently underway to plan for additional water supply capacity to the existing Palgrave – Caledon East Drinking Water System.

12 Class EA Phase 3 – Identification and Evaluation of Alternative Design Concepts

The initial screening step identified the preliminary preferred alternative solution that fully satisfied all the must-meet criteria: **Alternative 6 – Expand / Retrofit Existing PAL4 Water Treatment Plant.**

The preferred alternative solution comprises the following main considerations:

- Existing treatment capacity needs to be increased to accommodate the proposed well water taking supply capacity increase to 60 L/s
- Modifications / replacement/retrofits to the following:
    - Iron control / removal
    - Disinfection
    - Standby power
    - Process wastewater management system

Treatment and/or process upgrades to be accommodated within existing plant footprint or through a plant expansion. The next step in the process entails further development of design concepts available for implementation of the preferred Alternative Solution – Expand / Retrofit Existing Palgrave Well #4 System.

12.1 Design Criteria

12.1.1 Treatment Process

Key design criteria were established to provide the foundation of the alternative design concepts to be developed and evaluated further in the process (CIMA+, May 2022). Key design criteria are shown in **Table 19.**

Table 19: Key Design Criteria

Parameter	Design Criteria	Units
Palgrave Well 4 Capacity[1]	60.6	L/s
Supernatant Recycle Capacity[2]	10%	-
Total Treatment Capacity[3]	66.6	L/s
Treated Water Iron Concentration[4]	0.3	mg/L
Virus Inactivation Required[5]	2	log

Notes:

1. Proposed water taking capacity increase.
2. According to current supernatant recycling practices from filtration backwash water. It is intended to keep the maximum recycling flow to less than 10% of the raw water flow (in accordance with the USEPA Filter Backwash Recycling Rule). The recycling options will vary based on the treatment solution selected.
3. Total treatment flow assuming a 10% of recycled water.
4. Aesthetic Objective as per MECP Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines (MECP, June 2006)
5. MECP Procedure for Disinfection of Drinking Water in Ontario, inactivation of groundwater sources (MECP, 2006).

During pre-consultation with the MECP for virus inactivation requirements, the MECP recommended the owner to meet a future 4-log virus inactivation at the increased well capacity. Communications received directly from the MECP on April 4, 2022, are included in **Appendix F** for further reference. In discussions with the Project Team during the workshop held on August 9, 2022, it was concluded that the upgraded system should continue to meet the current 2-log virus inactivation requirement as the future 4-log virus inactivation is anticipated to apply for new wells only. Consequently, the options presented in this report and the evaluation matrix results reflect a 2-log virus inactivation requirement.

12.1.2 Wastewater Management

The design basis for the process wastewater management upgrade options has been adapted from the original design for the PAL4 treatment system with input from the Region (KMK Consultants Limited, June 2005). The decanting tank should provide sufficient storage for the backwash parameters summarized in **Table 20.**

Table 20: Design Basis for Process Wastewater Management System

Process	Design Basis	Comment
Existing Backwash Flow[1]	14 L/s	Backwash flow for existing 2-filter system
Existing Backwash Duration[1]	10 minutes	Current backwash time
Existing Rinse Flow[1]	25 L/s	Rinse flow for existing 2-filter system
Existing Rinse Duration[1]	3 min	Current rinse time

Process	Design Basis	Comment
Existing Backwash Volume	12.9 m^3	Current volume produced from backwashing one (1) filter
Proposed Backwash Flow[2]	33.4 L/s	Backwash flow for larger, 3-filter system
Proposed Backwash Duration[3]	13 min	Assumed combined backwash and rinse duration for larger, 3-filter system
Proposed Backwash Volume[3]	26.1 m^3	Volume produced from backwashing one (1) filter at a rate of 33.4 L/s for 13 minutes
Backwash Frequency[1]	20 hours	Current and future filter run time
Proposed Supernatant Return Flow Rate[3]	3.03 – 6.06 L/s	10% of well pump capacity, assuming a minimum rate of 30.3 L/s and maximum rate of 60.6 L/s

Notes:

1. Based on input from the Region by email on August 11, 2022.
2. Recommended by filter manufacturer.
3. Developed by CIMA+ for the Palgrave Well No. 4 Class EA.

12.2 Preliminary Screening of Treatment Alternatives / Upgrade Options

A preliminary screening of available treatment technologies / upgrade options was completed to ensure all options were considered, discard the ones that were not feasible and carry the feasible options to the detailed evaluation. Available treatment technologies / upgrade options were identified to address the major process and emergency power modifications and retrofits required at the existing PAL4 system to accommodate the water taking increase from the current 30.3 L/s to the proposed 60.6 L/s.

The technologies were pre-screened based on their ability to meet the Provincial treated water quality standards / objectives and guidelines, compatibility with the existing infrastructure and process, ability to balance benefits and costs, and capital and operating and maintenance costs. The upgrade options that met all criteria were recommended to be further developed. The results, documented in the Preliminary Screening Technical Memo (CIMA+, May 2022), were submitted to the Region. Feedback was received and incorporated into the evaluation.

The following provides a synopsis of the key recommendations in terms of technologies and upgrade options to be reviewed further:

- Iron Removal – Replacement of existing filters with three (3) larger unit(s) with catalytic media and pre-oxidation by sodium hypochlorite, as per current operation. Although capital cost is higher versus addition of two (2) or more filters of same size as existing, key benefits of this option included simplicity of operation and implementation, and lower space requirements.
- Disinfection (Primary and Secondary) – Secondary disinfection to remain as per current system with sodium hypochlorite injection. Options for primary disinfection recommended for further review included:
    - Chlorination (alone): This option consists of twinning the existing chlorine contact pipe.
    - UV / Chlorination: This option involves provision of disinfection through the existing contact pipe with chlorination, in combination with a new UV reactor.
- Emergency Stand-by Power – Options recommended for further review included:
    - Indoor Standby Generator: The existing generator is replaced with a new larger unit located in the existing generator room. Due to the lack of available space in the existing generator room, the new larger fuel tank will need to be located outside within the existing property limits.
    - Permanent / Temporary Outdoor Standby Generator: The existing generator is replaced with a new larger unit located outside of the existing building, or a connection is installed for a portable genset to be brought to site to supply power. The outdoor generator will be installed within the existing property limits within its own dedicated sound attenuated enclosure designed to meet the required noise levels.
- Process Wastewater Management – Options recommended for further review included:
    - Management through existing decanting tank: Backwash water settling is achieved through the existing decanting tank, without any physical modifications to the tank.
    - Process wastewater management through an increased decanting tank volume: Backwash water settling is achieved through an increased volume decanting tank.

12.3 Treatment Alternatives

Potential implementation scenarios have been developed for the preliminary preferred upgrade solution: Alternative 6 – Expand / Retrofit Existing PAL4 Water Treatment Plant.

The recommended short-listed technologies / upgrade options summarized in the previous section have been incorporated into treatment trains for further development and evaluation. The four (4) options are:

- Option 1A: Three (3) Larger Filters + Chlorination (alone) + Indoor Genset
- Option 1B: Three (3) Larger Filters + UV / Chlorination + Indoor Genset
- Option 2A: Three (3) Larger Filters + Chlorination (alone) + Outdoor Genset
- Option 2B: Three (3) Larger Filters + UV / Chlorination + Outdoor Genset

A detailed description, simplified process schematic, and mark-up design concept for each implementation option, inclusive of the major infrastructure / process requirements and key considerations for implementation, is presented in the following sections.

12.3.1 Commonalities in Design Concepts

Some changes are common to all four (4) design concepts as they are necessary to allow an increase in water taking capacity of PAL4 from 30.3 L/s to 60.6 L/s. These commonalities include replacement of existing well pump with a larger pump, replacement of the two (2) existing filters and new process piping.

12.3.1.1 Process Works

- Replacement of existing well pump with a new 125 HP pump motor to operate at 60.6 L/s. No structural modifications required to the existing PAL4 well, casing or screen.
- Replacement of two (2) existing vertical pressure filters with three (3) larger vertical pressure filters to accommodate the increased flow rate.
- Construction of new chemical room with three (3) 600 L chemical bulk storage tanks for a total sodium hypochlorite bulk storage volume of 1,800 L. Installation of new chemical transfer pump to transport the sodium hypochlorite between tanks. Existing sodium hypochlorite dosing pumps will also remain. The new chemical room will be accommodated within the existing building footprint. All chemical equipment will be located in the new chemical room.
- Upgrade of process piping, valves, and fittings inside the treatment facility, for upsized pipes including raw water header and filter discharge header.

- Preferred process wastewater management approach to be used. Various approaches described in Section 12.4.

12.3.1.2 Structural and Civil Works

- Removal and disposal of existing filter access stairs and platform.
- Removal and construction of a section of the filter room structural floor slab to allow for installation of the new filter discharge header.
- Removal of existing walls enclosing the sodium sulphate room, future fluoride room, and vestibule to form one (1) large chemical room.
- Installation of new chemical resistance coating in chemical containment area.

12.3.1.3 Mechanical Works

- Relocation of air ducts to the ceiling as required, such as the duct below the existing filter platform.

12.3.1.4 Electrical and I&C Works

- Installation of new filter control panels.
- Retrofit MCC with new breakers to accommodate additional loads.
- Instrumentation upgrades including level sensors for new chemical bulk storage tanks, and new flow meters for the raw water and filter discharge headers.
- Integration of new process-related field Inputs/Outputs into existing SCADA system ICP-01.

12.3.1.5 Removals

- Existing well pump
- Existing raw water header
- Existing vertical pressure filters and filter piping (inlet header, filtered header, backwash and filter piping)
- Existing generator and fuel tank
- Abandon buried existing filter discharge header
- Existing dehumidifier unit ducts

12.3.2 Option 1A: Three (3) Larger Filters + Chlorination (alone) + Indoor Genset

12.3.2.1 General Description

Option 1A is consists of three (3) filters, twin chlorine contact pipes, and an indoor generator. To implement this design concept, a second chlorine contact pipe should be installed, and the existing genset must be replaced with a larger unit. The new fuel tank must be located outside as there is not enough space in the existing generator room to install both the upsized generator and upsized fuel tank. Operations and maintenance would be comparable to existing requirements with a slight increase for the maintenance of the additional HVAC equipment.

A simplified schematic of the major upgrades associated with Option 1A is shown in **Figure 15.**

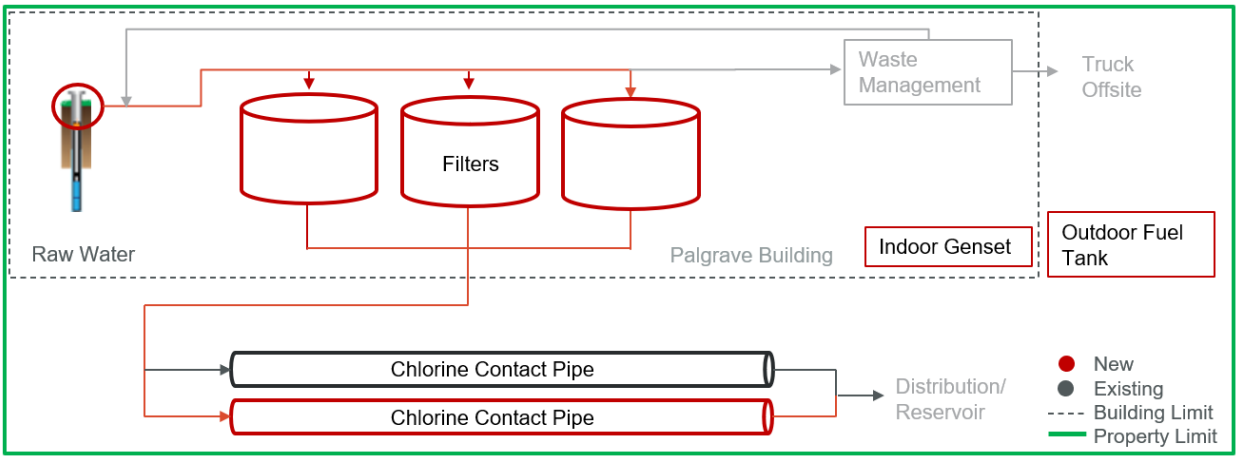

Figure 15: Schematic of Option 1A

12.3.2.2 Major Upgrades / Modifications Requirements

Key upgrades and modifications proposed at the existing PAL4 treatment facility for Option 1A are listed below. Refer to **Appendix L** for a mark-up of the proposed upgrades.

Process Works

- Installation of a second underground chlorine contact pipe parallel to the existing contact pipe, directly south of the existing pipe.

- Under existing regulatory requirements for 2-log virus inactivation, the required CT can be achieved through both pipes with a chlorine residual of 0.52 mg/L.

Structural and Civil Works

- Installation of a new opening on the south exterior wall of the generator room for a new intake louvre. Temporary roof shoring and new steel lintel will be required.
- Height modification of the existing louvre opening on the west wall for a new louvre for the generator room.
- Core opening in existing exterior wall for a fuel connection between the generator and the fuel storage tank.
- Installation of a concrete pad outside for the new outdoor fuel storage tank.
- Clearing of approximately 1200 m^2 and excavation of approximately 900 m^3 to install chlorine contact pipe.

Mechanical Works

- Installation of new air intake and dampers in new opening on southwest exterior wall of the existing generator room.
- Replacement of existing louver on northeast exterior wall of the generator room. New louver should have an equal width and greater height than existing louver.
- Installation of room silencers.

Electrical and I&C Works

- Installation of new 275 kW diesel standby generator in existing generator room.
- Installation of new 4000 L double-walled fuel storage tank on a weatherproof enclosure outside. Tank to be located directly outside generator room.

12.3.2.3 Summary of Upgrades / Modifications

Details for the major upgrades associated with Option 1A are provided in the following sections and summarized in **Table 20.**

Table 21: Summary of Equipment Upgrades to Implement Option 1A

Process Unit	Reuse of Existing	Upgrades
Well Pumping	N/A	New submersible well pump, rated at 60.6 L/s: • 125 HP pump motor capacity
Iron Removal	N/A	Three (3) new vertical pressure filters, 22.2 L/s capacity: • Catalytic media with required support media
Disinfection / Chemical Storage	Existing chlorine contact pipe: • 500 mm diameter, 82 m length Sodium hypochlorite system: • Existing two (2) pre-oxidation pumps, duty/standby • Existing two (2) post-oxidation pumps, duty/standby	Twin chlorine contact pipe: • 500 mm diameter, 82 m length • Sodium hypochlorite system • Three (3) 600 L bulk storage tanks
Standby Power	N/A	• Indoor generator with capacity of 275 kW • Outdoor fuel storage with volume of 4000 L
Piping	• Surge relief piping through floor slab.	• Raw water discharge header • Inlet, outlet, backwash filter piping • Filtered discharge header • Backwash inlet and waste header • Supernatant return

12.3.2.4 Considerations of Implementation

Filter Replacement

For the filter replacement, the weight of each new larger filter is approximately 33% larger than that of the existing filters. It is possible that the existing floor slab could withstand the additional load; however, a detailed structural analysis will be required to

determine the need for additional structural support. The three (3) new larger filters will also encroach on the access walkways along the north wall, so the existing aluminum access stair and platform will need to be removed. The clearance between the new larger filters and the north wall will be less than 1.0m wide, and therefore there will not be sufficient space to accommodate a new code compliant platform. The Region indicated that ladders are used at other Regional facilities for filter media inspection / replacement purposes. It is expected that the same practices will be used at the PAL4 facility after the filter retrofit. Alternatively, other means to access to facilitate media replacement will need to be reviewed.

New Chemical Room with Bulk Storage

Bulk chemical storage has been added to other facilities within the Region to reduce the frequency of chemical deliveries. As such, the Region requested 1,800 L of bulk chemical storage to be added to PAL4. The new system will consist of three (3) 600 L tanks connected in series.

To facilitate installation of new bulk storage tanks within the existing building footprint, the current layout must be reworked. There is space available in the vacant sodium bisulphite room, vestibule, and future fluoride room, which could be combined to form a new larger chemical room. The new chemical room should include an interior door for inside access, as well as exterior double doors to allow the tanks to be installed and to provide access for refilling the bulk storage tanks. The existing sodium hypochlorite room can be removed, expanding the process area and providing a space for process equipment control panels. Details for the proposed layout of the new chemical room are included in **Appendix L.**

Modifications to the existing interior masonry walls will be required. Record drawings show the connection of the interior masonry walls to the roof system uses a proprietary bracket with slotted holes for non-load bearing walls, therefore proposed modifications can be made without structural modification to the roof system. The top of the new non-load bearing masonry walls would require detailing of the top connection to ensure that the roof trusses laterally support the top of wall.

A new opening will be required in the veneer and load bearing masonry wall for the exterior double doors. Roof shoring and new steel lintels will be required to create this opening. The sides of wall should be finished to receive the door.

The existing floor supporting the proposed bulk storage tanks is rated for a live load of 7.2 kPa. The final bulk storage tank selection needs to be reviewed to not exceed this allowable load. New chemical resistance coating will be required in the chemical containment area.

Generator Replacement and HVAC Upgrades

The new standby generator has been conceptually designed to 275 kW to accommodate loads from the building utility, water treatment system, and wastewater management system for any of the design concepts. There is approximately 10% capacity available for additional loads before the next size generator would be required.

The existing generator room is approximately 3.8m wide and 6.4m long, and accessible by a 2.0m wide and 2.2m tall exterior double door. The current generator footprint is 1.25m x 3.0m and can be removed through the existing doors. Based on a preliminary selection of the new standby generator with an approximate size of 1.27m x 3.03m, it is expected that it can be fit through the existing double doors. If the new generator cannot be installed through the existing door, then the new louvre opening will be designed to allow for the installation.

The existing floor slab of the generator room is rated for a live load of 12.0kPa, which is the loading usually associated with these types of rooms. The final generator selection needs to be reviewed to not exceed this allowable load.

A new opening will be required in the veneer and load bearing masonry wall for the intake louvre, as illustrated in **Figure 16**. Roof shoring and new steel lintels will be required to create this opening. To simplify the structural retrofit and the new ductwork, the existing exhaust air louvre on the west wall can be increased by replacing it with a taller louvre without increasing the width of the opening, as shown below, **Figure 17**. This opening will not require roof shoring or additional lintel.

It is important to note that the selected unit is the largest generator that can fit within the existing generator room with adequate clearance. If additional loads were required or some equipment must be upsized, it is possible a larger unit may be required. To keep the generator inside in this case, it would likely involve further modification to the building layout to expand the generator room, or a building extension to expand the generator room.

Due to restricted space in the building, fuel storage cannot be accommodated inside the existing generator room. Diesel genset options considered in the Class EA study will need to provide fuel storage outside the building. Due to proximity to the production well and the Wellhead Protection Areas (WHPAs), certain restrictions may apply to diesel genset components and implementation of appropriate mitigation measures.

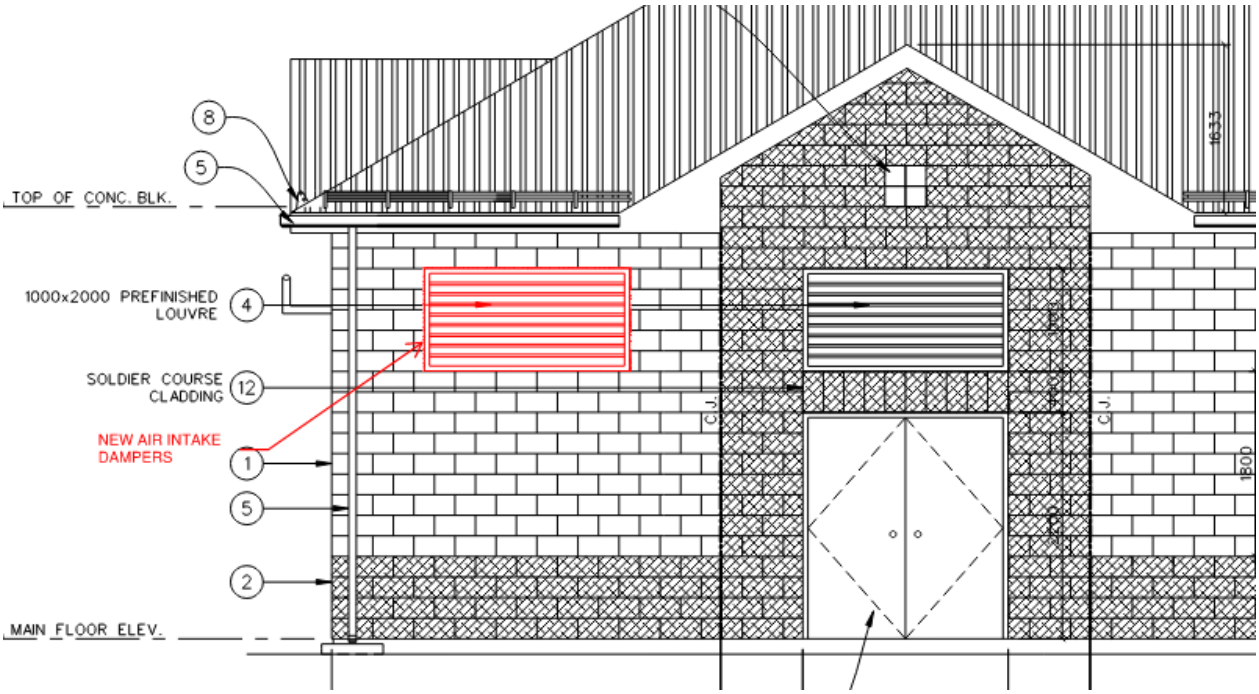

Figure 16: New Intake Louvre on the South Wall

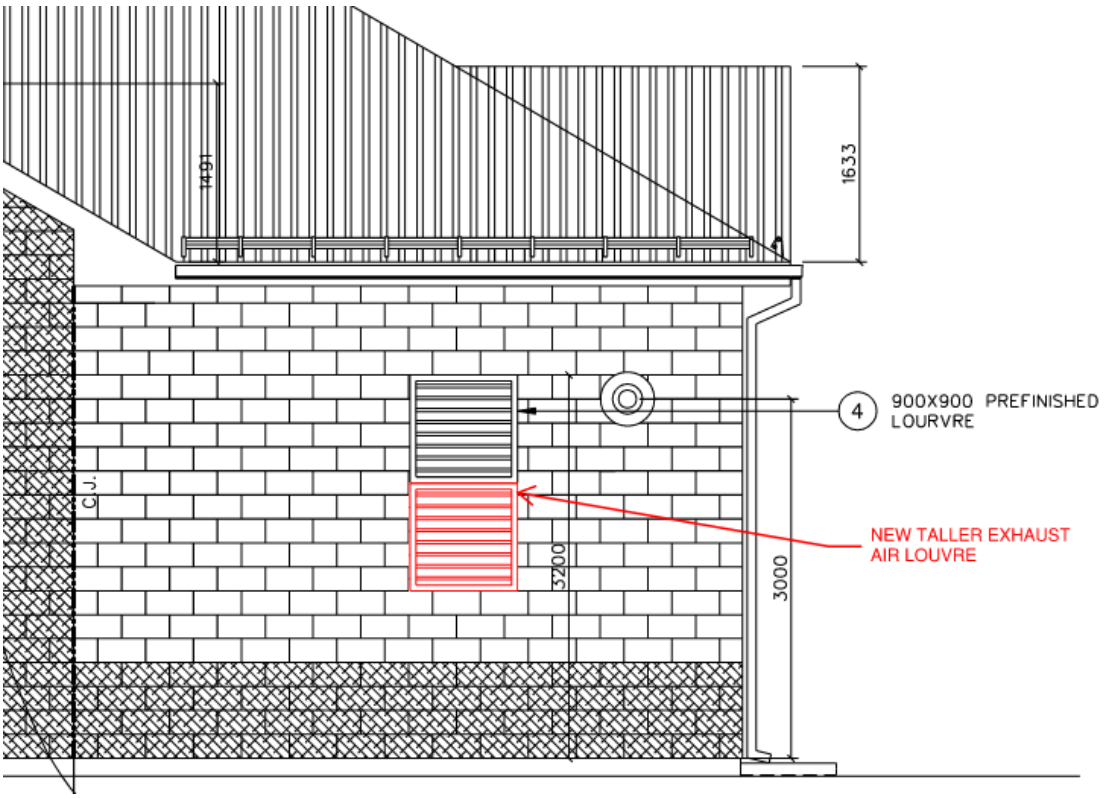

Figure 17: Modification of Existing Louvre on the West Wall

Structural Slab Modification for Piping Upgrades

The existing 150mm filter discharge header will be replaced with a 250mm discharge header. Record drawings show the existing concrete encased discharge header passing through and running beneath the structural floor slab and existing building at the footing level of the west wall. The scope of work will include saw-cutting and removing the portion of the existing floor slab over top of the discharge header. It is recommended that the new piping be installed above the existing so that it can pass through the foundation wall above the strip footing. Trench shoring should be utilized to limit loss of subgrade material below the portion of floor slab that is not removed, and consideration should be given to backfilling with U-fill to ensure proper compaction. The floor of the filter room is designed as a structural suspended slab; therefore, care will need to be taken when detailing the reconstruction of the floor slab to reinstate its structural integrity. This may include salvaging some existing rebar, use of rebar couplers, and/or use of epoxy dowels.

Construction Period

The construction period is expected to be approximately one (1) year duration. The plant should be offline for a total of six (6) months during the construction period. Equipment removals should be undertaken first, then other upgrades can occur in parallel.

12.3.3 Option 1B: Three (3) Larger Filters + UV / Chlorination + Indoor Genset

12.3.3.1 General Description

Option 1B consists of three (3) filters, two (2) UV reactors, a chlorine contact pipe, and an indoor generator. To implement this design concept a new UV system and associated piping should be installed, and the genset must be replaced with a larger unit. The fuel tank must be located outside as there is not enough space in the existing generator room to provide adequate clearance. It is assumed that wastewater produced during the start-up of the UV reactors is dechlorinated and sent to the stormwater collection system. Operations and maintenance would be greater than existing requirements due to the addition of UV as a third treatment technology and the additional HVAC equipment.

A simplified schematic of the major upgrades associated with Option 1B is shown in **Figure 18.**

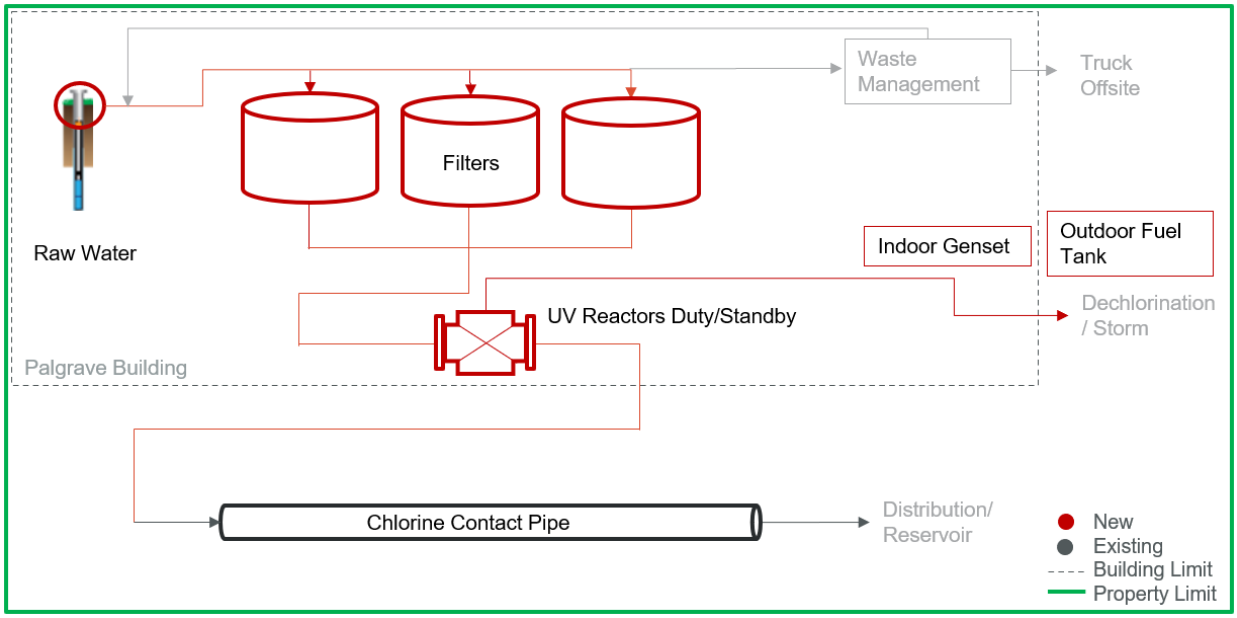

Figure 18: Schematic of Option 1B

12.3.3.2 Major Upgrades / Modifications Requirements

Key upgrades and modifications proposed at the existing PAL4 treatment facility for Option 1B are listed below. Refer to **Appendix L** for a mark-up of the proposed upgrades. Common components and works listed under **Section 12.3.1** apply to this option in addition of the following:

Process Works

- Installation of two (2) 13 kW UV reactors capable of meeting 2-log virus inactivation requirement. Stacked duty/standby configuration to be used. UV reactors to be installed in the process area:
    - Under existing regulatory requirements for 2-log virus inactivation, the required CT can be achieved through the one (1) UV reactor. UV dosage to be determined if selected as preferred design concept.
- Upgrade process piping, valves, and fittings inside the treatment facility, to include 300 mm UV system header.

Structural and Civil Works

- New pipe supports for UV piping.

Mechanical Works

As per **Section 12.3.1**.

Electrical and I&C Works

- Installation of UV control panel in new expanded process area (existing chemical room).
- Retrofit of MCC to accommodate additional UV reactor load.
- Installation of a UV Transmittance instruments for UV reactor monitoring and control.

Summary of Upgrades / Modifications

Details for the major upgrades are provided in the following sections and summarized in **Table 22**.

Table 22: Summary of Equipment Upgrades to Implement Option 1B

Process Unit	Reuse of Existing	Upgrades
Well Pumping	N/A	New submersible well pump, rated at 60.6 L/s: • 125 HP pump motor capacity
Iron Removal	N/A	Three (3) new vertical pressure filters, 22.2 L/s capacity: • Catalytic media with required support media New process piping of 100 mm diameter
Disinfection / Chemical Storage	Existing chlorine contact pipe: 500 mm diameter, 82 m length Sodium hypochlorite system: • Existing two (2) pre-oxidation pumps, duty/standby • Existing two (2) post-oxidation pumps, duty/standby	Two (2) new stacked in-line UV reactors, rated at 60.6 L/s with 10% supernatant: • Approximately 13 kW capacity • Duty/standby Sodium hypochlorite system: • Three (3) 600 L bulk storage tanks
Standby Power	N/A	• Indoor generator with capacity of 275 kW

Process Unit	Reuse of Existing	Upgrades
		• Outdoor fuel storage with volume of 4000 L
Piping	• Surge relief piping through floor slab.	• Raw water discharge header • Inlet, outlet, backwash filter piping • Filtered discharge header • Backwash inlet and waste header • Supernatant return

12.3.3.3 Considerations of Implementation

Refer to Section **12.3.2.4** for considerations of implementing Option 1B.

UV Reactor

The UV reactors do not add a significant electrical load and can be powered by a 275 kW generator. With the duty/standby configuration, only one (1) UV reactor will be operating and drawing power at any given time.

The UV reactors do not add significant weight to the floor slab. It is expected that the existing floor slab can withstand the additional load; however, a detailed structural analysis will be required to confirm. The key structural consideration for the UV reactors is the provision of piping supports.

The UV system requires water cooling during start-up. The water can be provided from the distribution system and discharged to the storm sewer. The UV reactors require lamp replacement maintenance as well as maintenance to the UV sensors and UV Transmittance instruments.

Operations and maintenance for the UV system consists of monitoring of the UV Transmittance and routine lamp replacements. UV reactors are constructed with an automatic wiping system for the quartz sleeves, so no chemicals must be stored on site for the UV reactor operation.

12.3.4 Option 2A: Three (3) Larger Filters + Chlorination (alone) + Outdoor / Temporary Genset

12.3.4.1 General Description

Option 2A consists of three (3) filters, twin chlorine contact pipes, and an outdoor generator. To implement this design concept, a second chlorine contact pipe should be installed, and the genset must be replaced with a larger unit. All standby power equipment is located outside, avoiding major HVAC upgrades. Operations and maintenance would be comparable to existing requirements as the technologies remain the same.

A simplified schematic of the major upgrades associated with Option 2A is shown in **Figure 19.**

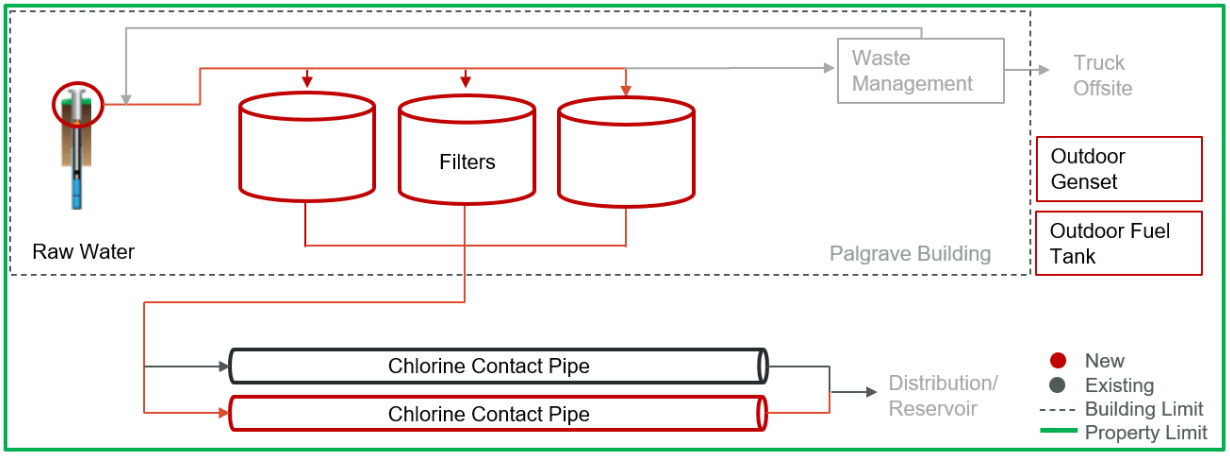

Figure 19: Schematic of Option 2A

12.3.4.2 Major Upgrades / Modifications Requirements

Key upgrades and modifications proposed at the existing PAL4 treatment facility for Option 2A are listed below. Refer to **Appendix L** for a mark-up of the proposed upgrades. Common components and works listed under **Section 12.3.1** apply to this option in addition of the following:

12.3.4.2.1 Process Works

As per **Section 12.3.2**.

12.3.4.2.2 Structural and Civil Works

- Installation of a concrete pad for permanent outdoor generator or no concrete pad if temporary outdoor generator option is adopted.
- Clear approximately 1200 m^2 for excavation of approximately 900 m^3 to install chlorine contact pipe.

12.3.4.2.3 Mechanical Works

As per **Section 12.3.1**.

12.3.4.2.4 Electrical and I&C Works

- Installation of new 275 kW diesel generator weatherproof and sound-attenuating behind facility for a permanent outdoor genset or install a connection on the exterior wall of the electrical room for a portable outdoor genset (applicable to Option 2A).
- Installation of new 4000 L double-walled fuel storage tank in a weatherproof enclosure outside. Tank to be located beside or under generator.

12.3.4.3 Summary of Upgrades / Modifications

Details for the major upgrades are provided in the following sections and summarized in **Table 23**.

Table 23: Summary of Equipment Upgrades to Implement Option 2A

Process Unit	Reuse of Existing	Upgrades
Well Pumping	N/A	New submersible well pump, rated at 60.6 L/s: • 125 HP pump motor capacity
Iron Removal	N/A	Three (3) new vertical pressure filters, 22.2 L/s capacity: • Catalytic media with required support media • New process piping of 100 mm diameter
Disinfection / Chemical Storage	Existing chlorine contact pipe: • 500 mm diameter, 82 m length Sodium hypochlorite system:	Twin chlorine contact pipe: • 500 mm diameter, 82 m length Sodium hypochlorite system:

Process Unit	Reuse of Existing	Upgrades
	• Existing two (2) pre-oxidation pumps, duty/standby • Existing two (2) post-oxidation pumps, duty/standby	• Three (3) 600 L bulk storage tanks
Standby Power	N/A	• Outdoor generator with capacity of 275 kW • Outdoor fuel storage with volume of 4000 L
Piping	• Surge relief piping through floor slab	• Raw water discharge header • Inlet, outlet, backwash filter piping • Filtered discharge header • Backwash inlet and waste header • Supernatant return

12.3.4.4 Considerations of Implementation

Refer to **Section 12.3.2.4** for considerations of implementing Option 2A.

Outdoor Generator Pad

The proposed location for the outdoor generator and fuel tank is behind the building on the lawn east of the driveway. The exact location should be confirmed with consideration to clearance from the trees bordering the property and the buried storm sewer piping. A soil investigation at this location will need to be undertaken to confirm solid conditions and pad construction characteristics. The generator enclosure may be founded on a slab on engineered fill, a slab on frost walls and footings, or a slab on piles. Since the existing structure is founded on shallow foundations, it is likely that frost walls on strip footings would be sufficient to support the new exterior generator.

12.3.5 Option 2B: Three (3) Larger Filters + UV / Chlorination + Outdoor / Temporary Genset

12.3.5.1 General Description

Option 2B consists of three (3) filters, two (2) UV reactors, a chlorine contact pipe, and an outdoor generator. To implement this design concept, a new UV system and associated piping should be installed, and the genset must be replaced with a larger unit. All standby power equipment is located outside, avoiding major HVAC upgrades. Operations and maintenance would be greater than existing requirements due to the addition of UV as a third treatment technology which would require monitoring of the UV Transmittance and routine lamp replacements.

A simplified diagram of the major upgrades associated with Option 2B is shown in **Figure 20**.

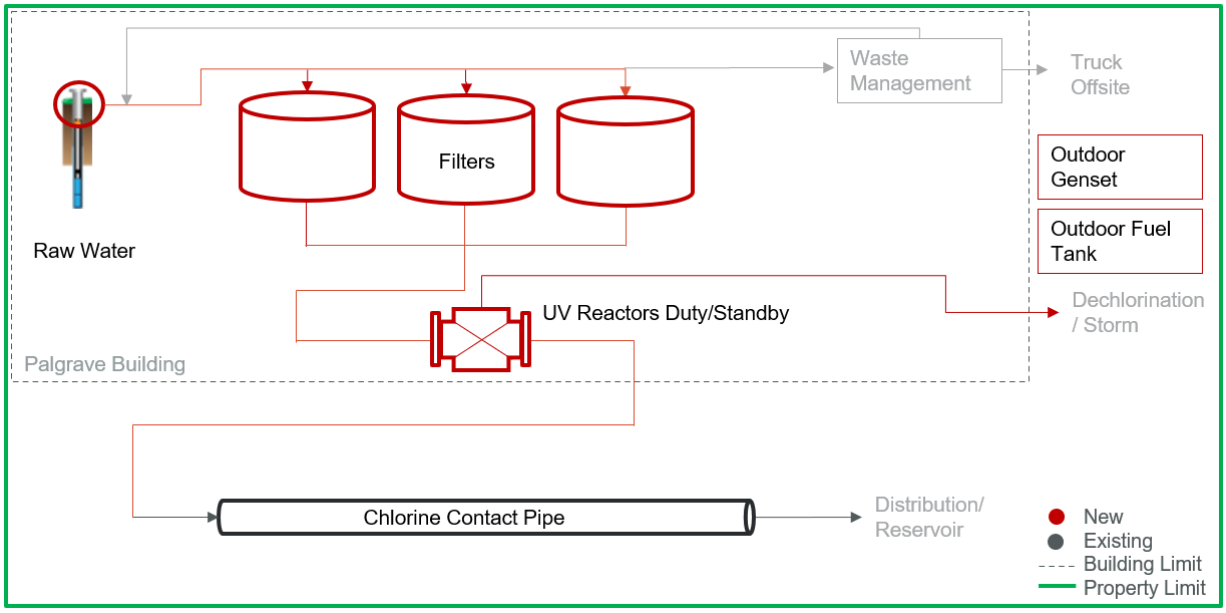

Figure 20: Schematic of Option 2B

12.3.5.2 Major Upgrades / Modifications Required

Key upgrades and modifications proposed at the existing PAL4 treatment facility for Option 2B are listed below. Refer to **Appendix L** for a mark-up of the proposed upgrades. Common components and works listed under **Section 12.3.1** apply to this option in addition of the following.

Process Works

As per **Section 12.3.3.**

Structural and Civil Works

As per **Section 12.3.3.**

Mechanical Works

As per **Section 12.3.1.**

Electrical and I&C Works

- Installation of UV control panels.
- MCC retrofit with additional UV reactor load.
- Installation of new 275 kW diesel generator in a weatherproof and sound-attenuating enclosure behind facility for a permanent outdoor genset or install a connection on the exterior wall of the electrical room for a portable outdoor genset.
- Installation of new 4000 L double-walled fuel storage tank in a weatherproof enclosure outside. Tank to be located beside generator.

12.3.5.3 Summary of Upgrades / Modifications

Details for the major upgrades are summarized in **Table 24**.

Table 24: Summary of Equipment Upgrades to Implement Option 2B

Process Unit	Reuse of Existing	Upgrades
Well Pumping	N/A	New submersible well pump, rated at 60.6 L/s**:** • 125 HP pump motor capacity
Iron Removal	N/A	Three (3) new vertical pressure filters, 22.2 L/s capacity**:** • Catalytic media with required support media • New process piping of 100 mm diameter
Disinfection / Chemical Storage	Existing chlorine contact pipe**:** • 500 mm diameter, 82 m length	Two (2) new stacked in-line UV reactors, rated at 60.6 L/s with 10% supernatant**:** • Approximately 13 kW capacity

Process Unit	Reuse of Existing	Upgrades
	Sodium hypochlorite system: • Existing two (2) pre-oxidation pumps, duty/standby • Existing two (2) post-oxidation pumps, duty/standby	• Duty/standby Sodium hypochlorite system: • Three (3) 600 L bulk storage tanks
Standby Power	N/A	• Outdoor generator with capacity of 275 kW • Outdoor fuel storage with volume of 4000 L
Piping	• Surge relief piping through floor slab.	• Raw water discharge header • Inlet, outlet, backwash filter piping • Filtered discharge header • Backwash inlet and waste header • Supernatant return

12.3.5.4 Considerations of Implementation

Refer to **Sections 12.3.2.4, 12.3.3.3** and **12.3.4.4** for considerations of implementing Option 2B.

12.4 Process Wastewater Management Alternatives

In terms of wastewater management, potential implementation options have also been developed for the preliminary preferred upgrade solution:

- Alternative 6 – Expand / Retrofit Existing PAL4 Water Treatment Plant.

As such, the following implementation options were developed and evaluated in detail:

- Option WM1: Existing Process Wastewater Decanting Tank
- Option WM2: Additional Volume of Wastewater Decanting Tank

A detailed description, simplified schematic, and mark-up design concept for each implementation option, inclusive of the major infrastructure / process requirements and key considerations for implementation, is presented in the following sections.

12.4.1 Commonalities in Design Concepts

Some changes are common to all design concepts as they are necessary to manage the backwash water from the new filter system. These commonalities are listed below. Markups for removals are provided in **Appendix L.**

12.4.1.1 Process Works

- Replace supernatant return pumping with pumps rated up to 6.06 L/s. Pumping should be equipped with VFD to ramp up and down with well operation.

12.4.1.2 Structural and Civil Works

There are no outstanding structural or civil works common to both options.

12.4.1.3 Mechanical Works

There are no outstanding mechanical works common to both options.

12.4.1.4 Electrical and I&C Works

- Replace decanting tank level sensor and transmitter.
- Replace supernatant return control panels.
- Retrofit MCC to accommodate increased loads from larger supernatant return system.

12.4.1.5 Removals

- Remove existing two (2) supernatant return pumps.
- Remove existing supernatant pump control panel.

12.4.2 Option WM1: Existing Process Wastewater Decanting Tank

12.4.2.1 General Description

Option WM1 uses the existing decanting tank volume. With the existing volume, the tank would be able to store one (1) filter backwash before draining is required. The facility must be operating for the supernatant pumps to be able to drain the tank and return the water. Therefore, this option would require increased facility operation in addition to more frequent sludge hauling, a modified backwash sequence, and constant monitoring will all be required to ensure the tank is operating effectively. New, larger supernatant return pumps will be required but the existing sludge pumps can be reused.

A simplified diagram of the major upgrades associated with Option WM1 is shown in **Figure 21**.

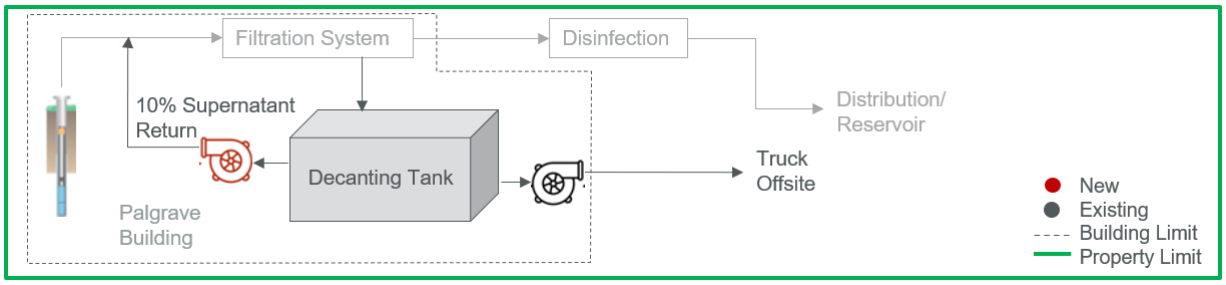

Figure 21: Schematic of Option WM1

12.4.2.2 Major Upgrades / Modifications Required

Key upgrades and modifications proposed at the existing PAL4 treatment facility for Option WM1 are listed below. Refer to **Appendix L** for a mark-up of the proposed upgrades.

All works related to process, structural, civil, mechanical, electrical and I&C as per described in Section 12.4.1.

12.4.2.3 Summary of Upgrades / Modifications

Details for the major upgrades are summarized in **Table 25.**

Table 25: Summary of Equipment Upgrades to Implement Option WM1

Process Unit	Reuse of Existing	Upgrades
Decanting Tank	Existing decanting tank: • Total volume of 80 m^3 • 40 m^3 supernatant volume, 20 m^3 sludge volume, 60% buffer zone • Available volume for one (1) filter backwash of 26.1 m^3	N/A
Supernatant Return Pumping	N/A	Two (2) new 20 HP supernatant return pumps, rated at 6.1 L/s: • 1 duty/1 standby • Draining time to return one (1) backwash is approximately 6 hours • Supernatant must be drained before next filter can be backwashed
Sludge Pumping	Existing two (2) 5 HP sludge pumps: • 1 duty/1 standby • Rated at 0.7 m^3/min, sludge pumping is approximately to 30 minutes • Review sludge trucking and sludge pump operation frequency	N/A

12.4.2.4 Considerations of Implementation

Supernatant Return

The supernatant return pumps must be increased in capacity to continue to return 10% of the well flow, or 6.06 L/s. PAL4 currently operates at a constant flow at 30.3 L/s allowing constant supernatant return. The supernatant return pipe may also need to be upsized to accommodate the increased flow rate.

The supernatant pumps will be replaced with larger 20 HP pumps to provide 10% supernatant return. These pumps would be installed in the existing location, following

the original design, and maintaining the existing buffer zone and available supernatant volume.

Sludge Removal

It is expected to produce double the volume of sludge with the increased capacity of 60.6 L/s compared with the 30.3 L/s. The frequency of sludge trucking can be increased from current 6 times a year to 12 times a year to maintain the current maximum sludge level.

Backwash Sequence

Table 20 of **Section 12.1.2** describes the design basis for the decanting tank with an anticipated backwash rate of 33.4 L/s, backwash duration of 13 minutes (for a total backwash volume of 26.1 m^3 per filter). Draining is completed at 10% of the well pumping rate (6.06 L/s for a well flow of 60.6 L/s). Based on current operation, backwash frequency is 20 hours.

To use the existing decanting tank, the backwash sequence must be modified to allow for larger backwash volume from each filter and accommodate for three (3) filter backwashes within 20 hours. Since the existing decanting tank has an available supernatant volume of 40 m^3, it holds one (1) filter backwash reaching 65% of the total supernatant storage volume.

Figure 22 presents a pre-view of a possible backwash sequence to show the feasibility of this Option. The backwash sequence would involve backwash duration of 13 minutes, settling for a minimum of three (3) hours, drainage (supernatant pumping) for approximately 2.5 hours. In total, this process would take approximately six (6) hours per filter. One filter must complete this backwash cycle before the next filter can backwash. Given the filter run time of 20 hours, there is just over one (1) hour available during each filter backwash cycle to allow for additional settling if necessary.

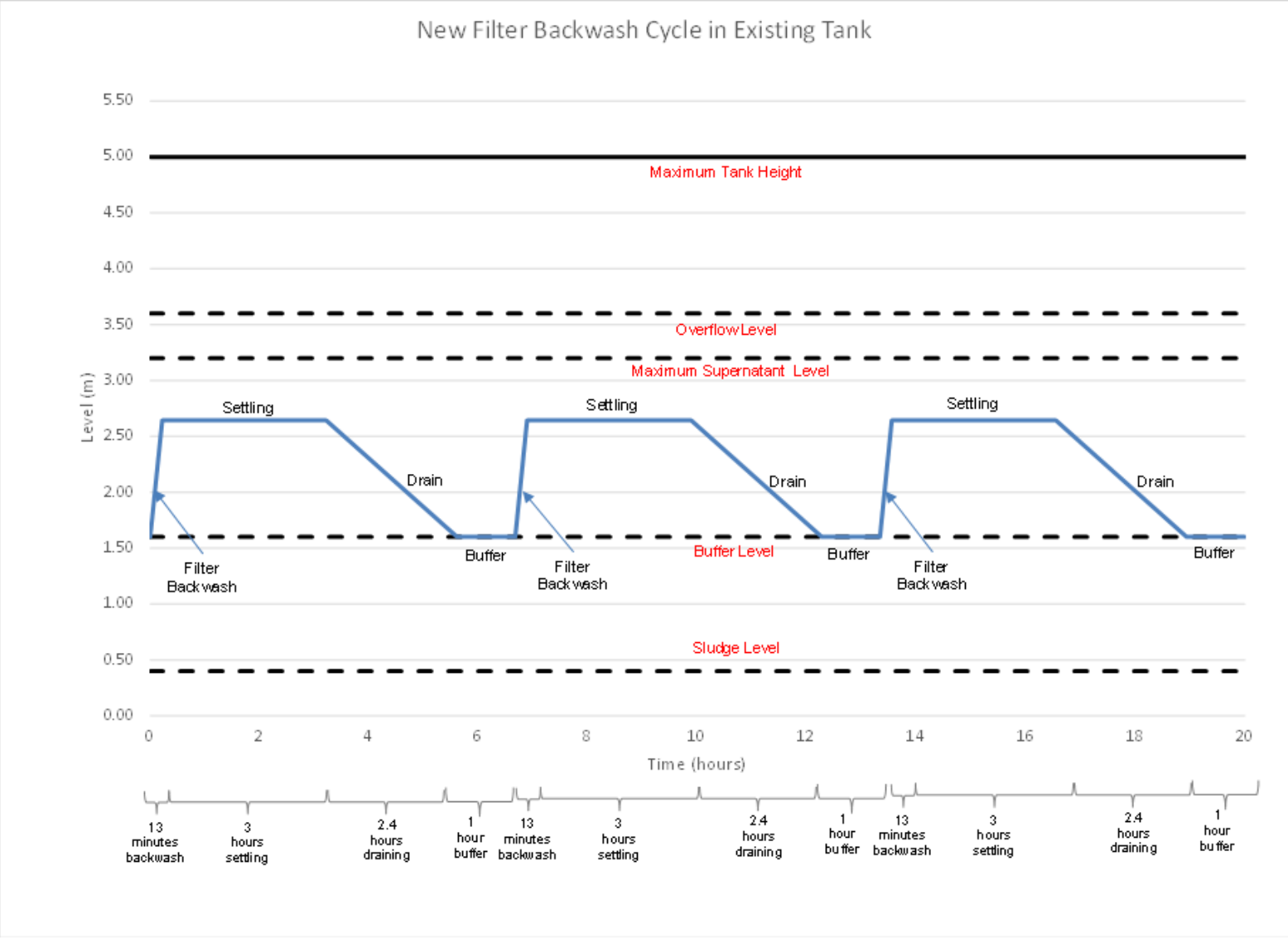

Figure 22: Backwash Sequence for New Filter System with Existing Decanting Tank

12.4.3 Option WM2: Additional Volume of Wastewater Decanting Tank

12.4.3.1 General Description

Option WM2 doubles the volume of the process wastewater decanting tank from 80 m^3 to 160 m^3. With the additional volume, the tank would be able to store three (3) filter backwashes. The tank volume would be increased by either installing a second decanting tank to add more usable volume or extending the existing tank. The additional volume must be hydraulically connected to the existing volume to ensure they work together to effectively manage backwash flows. New, larger supernatant return pumps will be required but the existing sludge pumps can be reused.

A simplified diagram of the major upgrades associated with Option WM2 is shown in **Figure 23**, New equipment is shown in red and existing equipment is shown in black.

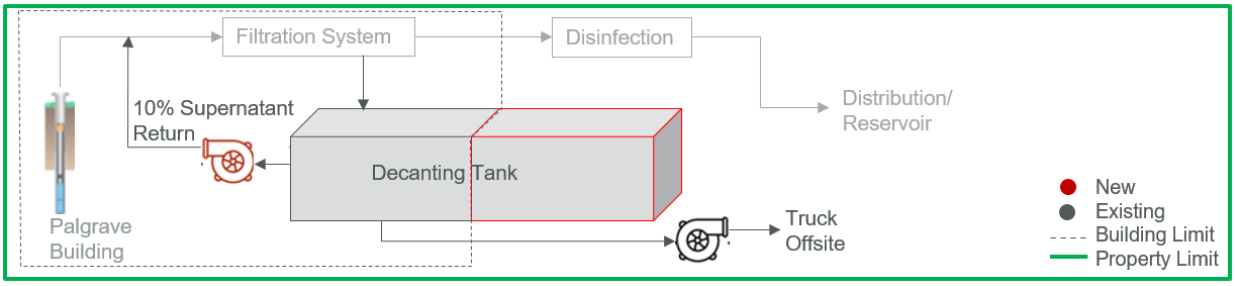

Figure 23: Schematic of Option WM2

12.4.3.2 Major Upgrades / Modifications Required

Key upgrades and modifications proposed at the existing PAL4 treatment facility for Option A include the following, in addition to the common elements described in Section 12.4.1:

Process Works

- Install second decanting tank or extend existing tank by 80 m^3, for a total volume of 160 m^3. Backwash, supernatant, and sludge piping.

Structural and Civil Works

- Clear approximately 150 m^2 and excavate approximately 1200 m^3 to install or expand subgrade decanting tank. Construction for 80 m^3 tank.

Mechanical Works

As per Section 12.4.1.

Electrical and I&C Works

- Integrate second or expanded decanting tank into SCADA.

12.4.3.3 Summary of Upgrades / Modifications

Details for the major upgrades are summarized in **Table 26**.

Table 26: Summary of Equipment Upgrades to Implement Option WM2

Process Unit	Reuse of Existing	Upgrades
Decanting Tank	N/A	Increased volume of decanting tank**:** • Total volume of 160 m^3 • 80 m^3 supernatant volume, 20 m^3 sludge volume, 60% buffer zone • Available volume for three (3) filter backwashes of 26.1 m^3
Supernatant Return Pumping	N/A	20 HP supernatant return pumps, rated at 6.1 L/s**:** • Two (2) pumps, duty/standby • Draining time to return one (1) backwash is approximately 6 hours • Review draining frequency
Sludge Pumping	Existing two (2) 5 HP sludge pumps**:** • 1 duty/1 standby • Rated at 0.7 m^3/min, sludge pumping is approximately to 30 minutes • Review sludge trucking and sludge pump operation frequency	• Sludge piping reconfiguration.

12.4.3.4 Considerations of Implementation

Refer to **Section 12.4.2.4** for considerations of supernatant return.

Structural Considerations

The proposed new decanting tank will consist of similar geometry to the existing decanting tank and located immediately south of the existing tank outside the building footprint.

The proposed tank location will be directly below the driveway. The operating water level in the new tank will be too high to permit a buried roof slab. Therefore, the roof slab will be directly exposed to weather, salt and wear and tear from vehicles and snow removal equipment. All access and equipment hatches will need to be traffic-rated. To reduce the likelihood of damage from snowplows, ductile iron access covers are recommended. Penetrations through the existing exterior decanting tank wall will need to be reviewed to ensure capacity of the existing wall is maintained. If large openings are required, structural strengthening may be required.

The overall footprint for the tank base slab will be dependent on the findings from the geotechnical investigation. The founding elevation of the new tank base slab should match existing to avoid undermining the existing structure. It is likely that a larger base slab extension will be required to provide floatation resistance. The overall foundation design would need to be reviewed at the detailed design stage when geotechnical information is available to ensure that the bearing capacity of the soil is sufficient to limit differential settlement without the need for deep foundations. If high groundwater is encountered, dewatering or watertight shoring system will be required for the construction of the new proposed tank.

Process Considerations

If a separate tank is constructed, backwash flow and sludge removal piping will need to be split between the two (2) tanks. In addition, the supernatant zone will need to be connected hydraulically to allow the supernatant return from both tanks. An additional hydraulic review of the pipe connections will be required to ensure adequate operation of the decanting tank.

Backwash Sequence

Up to three (3) filter backwash can be stored using the total volume of the decanting tanks. For this Option, a rigorous backwash sequence is not critical since the filters could be backwashed consecutively due to larger total tank volume. Figure 24 presents a pre-view of a possible backwash sequence to show the flexibility of this Option.

Construction Period

It is anticipated that the construction of the decanting tank can be completed in parallel with some other construction activities. However, this option involves higher construction staging and adds significant complexity to the project.

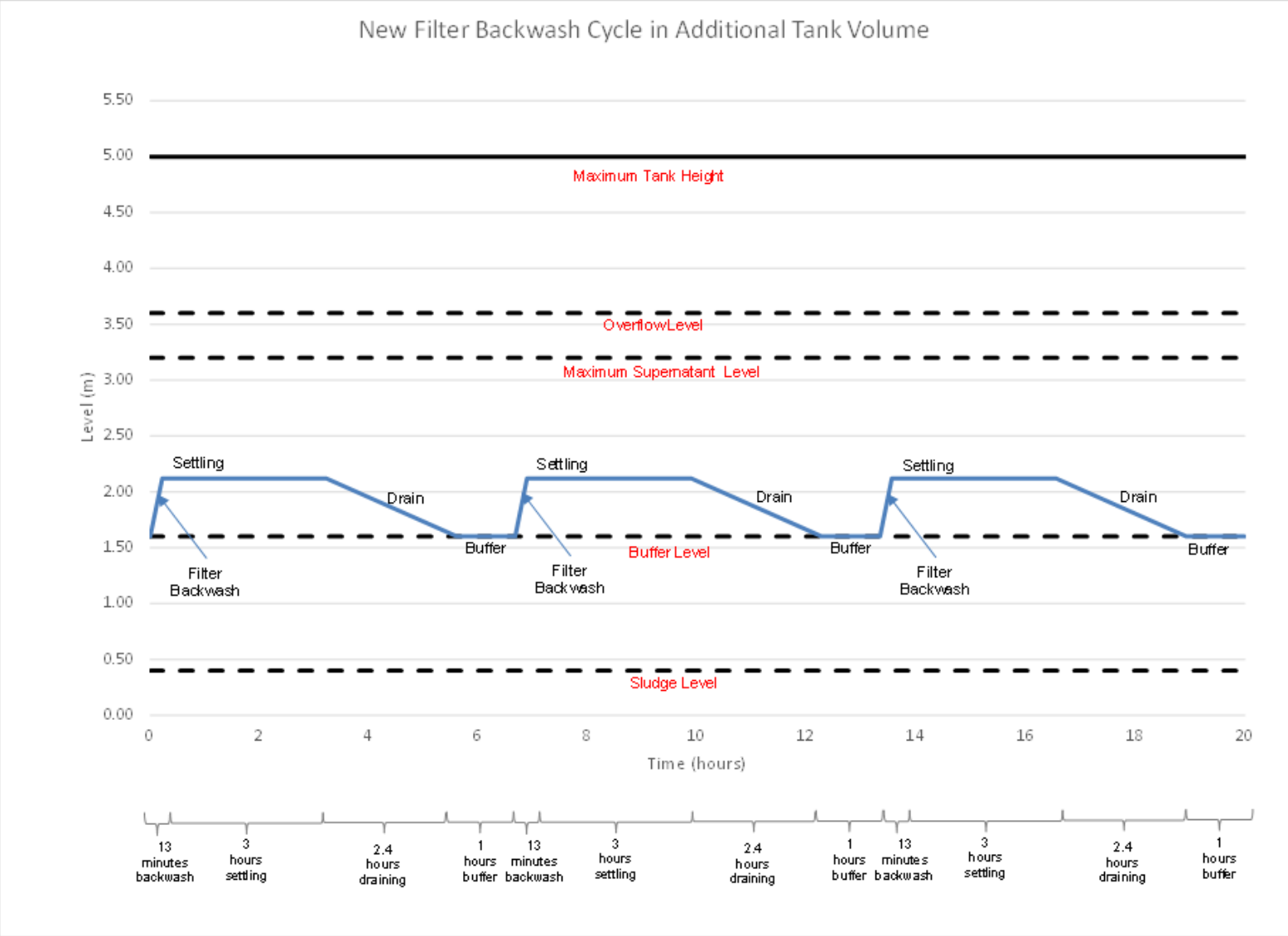

Figure 24: Backwash for New Filter System with Additional Decanting Volume

12.5 Cost Estimates

Opinion of probable capital, operating and maintenance costs, and lifecycle costs were developed for each implementation option. Detail cost estimates are provided in **Appendix M.**

12.5.1 Capital Costs

Capital costs generally included the following:

- Costs of upgrades to the existing treatment facility, specific to the requirement of each design concept developed under this study.
- Costs of new infrastructure, such as construction of new rooms, construction of new subgrade tank or pipe, installation of new standby generator.
- Costs of major process equipment such as pumps, filters, UV reactors, chemical systems and instrumentation equipment.
- Demolition costs of existing infrastructure, specific to the requirement of each design concept.

The following general assumptions were made when developing the capital costs for the five (5) different implementation options:

- Cost estimates are based on 2022 construction costs. Inflation and escalation for the actual expected prices at the time of construction cannot be accounted for at this time.
- Estimates of probable capital costs provided by CIMA+ have been developed on a conceptual design level and based on prices and data in CIMA's possession, as well as previous experience from projects of similar nature and scope.
- In accordance with ASTM E 2516-06 (Standard Classification for Cost Estimate Classification System) the preliminary opinion of total project costs is anticipated to be within a range of -30% and +50%, based on a Class 5 level of accuracy.
- All taxes (including the 13% HST) have been excluded.
- Any costs associated with necessary updates to the source water protection plan and pertinent hydraulic modeling have been excluded.
- Additional mitigation measures required to address potential for fuel spills are excluded from the cost estimate.

12.5.2 Operating & Maintenance Costs

The operating and maintenance costs accounted for include electricity, chemical usage, and other general operating and maintenance costs such as labour and lab analysis.

12.5.3 Lifecycle Costs

Life cycle costs were calculated based on a 20-year life expectancy. Life cycle costs have been estimated based on:

- A 20-year amortization period
- An inflation rate of 7.7% (Statistics Canada, June 2022) and an assumed interest rate of 4%.

Estimates for the 20-year life cycle costs for the four (4) different water supply implementation options and two (2) different process wastewater management implementation options are summarized in **Table 27**. Detailed life cycle cost calculations are included in **Appendix M.**

Table 27: Costs for Implementing Each Option

Implementation Options	2022 Capital Cost	O&M Costs	20-year Life Cycle Costs
Water Supply Solutions			
Option 1A – 3 Larger Filters + Chlorination (alone) + Indoor Genset	$6,030,000	$119,000	$10,795,000
Option 1B – 3 Larger Filters + UV / Chlorination + Indoor Genset	$6,499,000	$138,000	$11,912,000
Option 2A – 3 Larger Filters + Chlorination (alone) + Outdoor / Temporary Genset	$5,844,000	$118,000	$10,562,000
Option 2B – 3 Larger Filters + UV / Chlorination + Outdoor / Temporary Genset	$6,347,000	$136,000	$11,690,000
Process Wastewater Management Solutions			
Option WM1 – Existing Process Wastewater Decanting Tank	$621,000	$14,000	$1,121,000
Option WM2 – Additional Volume of Wastewater Decanting Tank	$1,116,000	$14,000	$1,634,000

12.6 Detailed Evaluation Results of Short-Listed Alternatives

12.6.1 Evaluation Criteria

A detailed evaluation methodology was used to compare key features of each design concept, relative to each other, and their ability to perform under each detailed evaluation criterion. The evaluation methodology, summarized below, was developed in Technical Memorandum No. 3 – Evaluation Framework and Preliminary Screening (TM-3) (CIMA+ , 2021).

The evaluation was carried out using the Reasoned Argument Method, comparing differences in impacts, and establishing a clear rationale for the selection of the design concept that provides the most overall benefits to this project. To do so, an evaluation matrix was prepared to reflect the specific advantages and disadvantages that each design concept offers for each criterion under consideration. Impacts were determined relative to the detailed criteria, summarized in

Table 28, and each other.

Each design concept was assigned a preliminary score (score from 1 to 5) relating to the potential net impact, which intends to reflect the impact that remains, or is predicted to remain, after mitigation measures are in place. A score of 5 is preferred as it reflects negligible potential impacts and no mitigation measures to be implemented. A score of 1 is least preferred as it reflects significant potential impacts and substantial mitigation measured to be implemented.

A weighted scoring method was used, where the criteria identified as more important to the project were allocated a greater weight in scoring. The result is a single weighted score for each option, which is used to indicate and compare the overall performance of the options in non-monetary terms.

Lastly, a sensitivity analysis was performed on the decision-making model to check that the results would not change if changes to the weighting factors are made. This effectively verifies that any decisions are robust and defensible.

Table 28: Summary of Evaluation Categories and Detailed Criteria

Evaluation Category	Criteria	Weighting
Natural / Environmental	**Natural Environmental Features** – Potential impacts to existing natural environment **Water Resources and Source Water Protection** – Potential temporary and permanent effects on surface water and groundwater quantity / quality **Climate Change** – Resiliency to extreme conditions and ability to minimize greenhouse gas emissions	10%
Socio-Cultural	**Healthy and Safety** – Potential impact of health and safety of operation staff **Nuisance (short-term) Impacts** – Potential short-term disruption during construction (i.e., noise, dust, visual, truck traffic, access to property) **Aesthetic and Operational (long-term) Impacts** – Potential long-term visual, noise and air quality impacts on adjacent residents and local users from new infrastructure and activities related to operation of facilities	20%
Technical / Operational	**Constructability** – Ease of construction and integration with existing system(s) **Water Quality Considerations** – Ability to meet water quality considerations as per provincial and federal guidelines **Operational Complexity** – Improve operational efficiencies and operational and monitoring requirements	40%
Financial / Economic	**Life Cycle Cost** – 20-year life cycle cost	30%
	Total Overall Maximum Score	100%

12.6.2 Summary of Results

A detailed comparative evaluation of the potential implementation options was completed based on the evaluation methodology developed in TM-3 (CIMA+ , 2021).

Each option has been assessed relative to the others and assigned a score relating to the potential net impact, which intends to reflect the impact that remains, or is predicted to remain, after mitigation measures are in place.

The detailed evaluation matrices, included in **Appendix N**, describe the rationale and preliminary scoring assigned to each implementation option for water treatment and wastewater management. Individual scores, as shown in **Appendix N**, were reviewed and confirmed in consultation with the Region, during the workshop held on August 9, 2022.

Table 29 summarizes the detailed evaluation of the water treatment options with the ranking based on the scores obtained.

Table 29: Summary of Water Treatment Detailed Evaluation

Water Treatment Options	Total Score	Ranking
Option 1A – Three (3) Filters + Chlorination (alone) + Indoor Genset	87.7	1
Option 1B – Three (3) Filters + UV / Chlorination + Indoor Genset	83.5	3
Option 2A – Three (3) Filters + Chlorination (alone) + Outdoor / Temporary Genset	85.7	2
Option 2B – Three (3) Filters + UV / Chlorination + Outdoor / Temporary Genset	81.6	4

There are several advantages of Option 1A relative to the other options. The existing treatment technologies will continue to be used and therefore, operational complexity, operation and maintenance, and training requirements remain the same. Operational flexibility is provided within each process unit by installing multiple filters and contact pipes, which eases future maintenance or repairs. The indoor genset results in minimal long-term visual impacts, easy maintenance all year round, and spill containment is provided by the building instead of additional equipment. Option 1A also has a lower 20-year lifecycle cost than other options, due to its lower capital and energy requirements. The main drawback of Option A is the impacts of construction activities, such as excavation to install the chlorine contact pipe and modification of the building architecture for the indoor genset. However, these impacts are short-term and can be minimized through the implementation of standard mitigation measures. Once

construction is complete, these features will allow the infrastructure to operate with minimal disturbances.

Advantages of Option 1B include fewer short-term or long-term impacts, due to the use of UV. The UV reactors also increase redundancy, reliability, and operational flexibility for disinfection. However, disadvantages include Option 1B having the highest 20-year life cycle cost, increased operational complexity, operation and maintenance, and training requirements due to the UV reactors, and construction impacts due to modification of the building architecture for the indoor genset.

The key advantages of Option 2A is that an outdoor genset minimizes building modifications and reduces construction effort, leaves space inside the facility for future upgrades, and has the lowest 20-year life cycle cost. Additionally, the use of the existing two (2) treatment technologies maintains the current operational complexity, operation and maintenance, and training requirements. However, there are many disadvantages to an outdoor genset, such as long-term visual impacts and increased complexity for potential repairs during winter conditions. The outdoor genset also increases the risk associated with spills during maintenance activities, compared to an indoor genset where any spill is easily contained to the building. Option 2A also has construction impacts associated with excavation for the chlorine contact pipe, and additional excavation required for the genset's concrete pad.

Due to the use of UV disinfection, Option 2B has advantages including minimal short-term impacts, added redundancy, reliability, and operational flexibility. Placing the genset outside also reduces construction duration and effort. However, disadvantages include high 20-year life cycle costs, increased operational complexity, and increased operation and maintenance, and training requirements due to the addition of the UV reactors. With the outdoor genset, there are concerns with long-term visual impacts, winter maintenance, and spill containment.

The main differentiators between the options were the construction required to install the generator indoors, the long-term visual impacts from the outdoor generator, and the lifecycle costs for UV. Overall, Option 1A scored the highest against the detailed evaluation criteria, indicating that this option best meets the project goals and provided the most benefit to the Region. As such, Option 1A is the recommended water treatment design concept.

Table 30 summarizes the detailed evaluation of the wastewater management options.

Table 30: Summary of Wastewater Management Detailed Evaluation

Wastewater Management Options	Total Score	Ranking
Option WM1 – Existing Process Wastewater Decanting Tank	90.3	1
Option WM2 – Additional Volume of Wastewater Decanting Tank	74.9	2

Option WM1 and Option WM2 are very comparable, however there are a few key advantages of Option WM1. First, Option WM1 is compatible with existing operation as few upgrades are required for this option. Second, construction is not required. This reduces climate change impacts, short-term impacts, and life cycle cost. However, the main constraints for Option WM1 are operational complexity and flexibility. The available volume is only enough for backwashing one (1) filter at a time, and the volume may be limited for extended periods of backwashing during filter commissioning. Therefore, careful monitoring is required to operate the existing tank effectively.

Option WM2 would provide plenty of additional volume for operational flexibility, thereby reducing operational complexity. However, it has a higher life cycle cost due to construction and increased climate change and short-term impacts.

The main differentiators between the options were construction required to install the additional tank volume, life cycle cost, and operational complexity. Overall, Option WM1 scored the highest against the detailed evaluation criteria, indicating that this option best meets the project goals and provided the most benefit to the Region. As such, Option WM2 is the recommended wastewater management design concept.

12.6.3 Sensitivity Analysis

A sensitivity analysis was conducted to determine if the recommended option remained the highest or near highest scoring option under modified evaluation conditions. This is done by changing the criteria weightings so that their relative importance is representative of different scenarios.

Two (2) scenarios were tested. The modified weightings and resultant scores are presented in **Table 30** for water treatment and **Table 31** for wastewater management.

Table 31: Sensitivity Analysis – Water Treatment Results

	Criteria/Modified Weightings	Option 1A Chlorination (alone) + Indoor Genset	Option 1B UV/ Chlorination + Indoor Genset	Option 2A Chlorination (alone) + Outdoor/ Temporary Genset	Option 2B UV/ Chlorination + Outdoor/ Temporary Genset
Scenario 1	Natural / Environmental – 20% Socio-Cultural – 40% Technical / Operational – 40% Financial / Economic – 0%	84.7	84.0	78.0	77.3
Scenario 2	Natural / Environmental – 10% Socio-Cultural – 30% Technical / Operational – 30% Financial / Economic – 30%	88.3	84.8	84.3	81.0

As shown in **Table 30,** under Scenario 1, when the financial/economic category is removed from the evaluation process and more emphasis is assigned to the technical/operational and socio-cultural categories (basically assessment non-cost factors in the project) options Option 1A – Chlorination (alone) + Indoor Genset continues to score the highest, but Option 1B becomes a close second. Scenario 1 indicates that Option 1A continues to be highly beneficial even when having a relatively low life cycle cost is no longer considered. Scenario 2 equally weighs the socio-cultural, technical / operational, and financial / economic criteria and produces the exact same result as the original weightings. This shows that Option 1A best balances the impacts and benefits between socio-cultural, technical / operational, and financial / economic criteria.

Table 32: Sensitivity Analysis - Wastewater Management Results

	Criteria/Modified Weightings	Option WM1 Existing Process Wastewater Decanting Tank	Option WM2 Additional Volume of Wastewater Decanting Tank
Scenario 1	Natural / Environmental – 20% Socio-Cultural – 40% Technical / Operational – 40% Financial / Economic – 0%	92.7	90.0
Scenario 2	Natural / Environmental – 10% Socio-Cultural – 30% Technical / Operational – 30% Financial / Economic – 30%	85.3	75.9

For wastewater management, the scores from the sensitivity analyses as shown in **Table 31** indicate that Option WM1 – Existing Process Wastewater Decanting Tank is the best overall option as it remains the highest scoring in both scenarios. In Scenario 1, Option WM1 continues to be the highest scoring even when its low life cycle cost is not considered. Scenario 2 equally weighs the socio-cultural, technical / operational, and financial / economic criteria and results in the same ranking as the original weightings. This indicates that when socio-cultural criteria are more heavily weighted, Option WM1 continues to be the most beneficial due to limited construction activities required for implementation.

13 Preferred Recommended Alternative Design Concept

13.1 Description

The preferred water treatment and residuals management upgrade solution recommended for implementation has been selected with consideration to the results of the evaluation process and feedback obtained from the public throughout the Class EA study.

The results of the decision-making process followed in this Class EA study support the selection of Option 1A – Three (3) Filters + Chlorination (alone) + Indoor Genset for water treatment and Option WM1 – Existing Process Wastewater Decanting Tank for wastewater management. These options were recommended to be carried forward as the Preliminary Preferred Design Concept in the Class EA study, and consist of expansion / retrofit of the Palgrave Well No. 4 (PAL4) Water Treatment Plant through the following major components:

- Replacement of existing greensand filters with three (3) new larger units. This has the advantage of low space requirements and being easy to implement and operate.
- Twinning the existing chlorine contact chamber to meet the required disinfection requirements. This has no significant additional operation and maintenance requirements and is simple to operate. As directed by the Region, disinfection requirements at the upgraded PAL4 treatment facility will continue to meet the current 2-log virus inactivation.
- Replacement of existing indoor genset unit with a new larger unit. The new genset unit will also require installation of a new fuel tank. Due to constraints with available area in the genset room, the fuel tank will be housed outdoors.
- No retrofits would be made to the existing process wastewater decanting tank. Operational modifications would be implemented, as necessary, to accommodate new filtration backwash needs. This has the benefit of no requirement for construction and no capital expenditure.

The schematic of the preferred water treatment design concept to Expand / Retrofit Palgrave Well No. 4 Water Treatment Plant is given in **Figure 25**. The key advantages of this design concept are its compatibility with existing processes which reduces overall complexity and minimal long term nuisance impacts on adjacent neighbours since the standby generator will be located indoors.

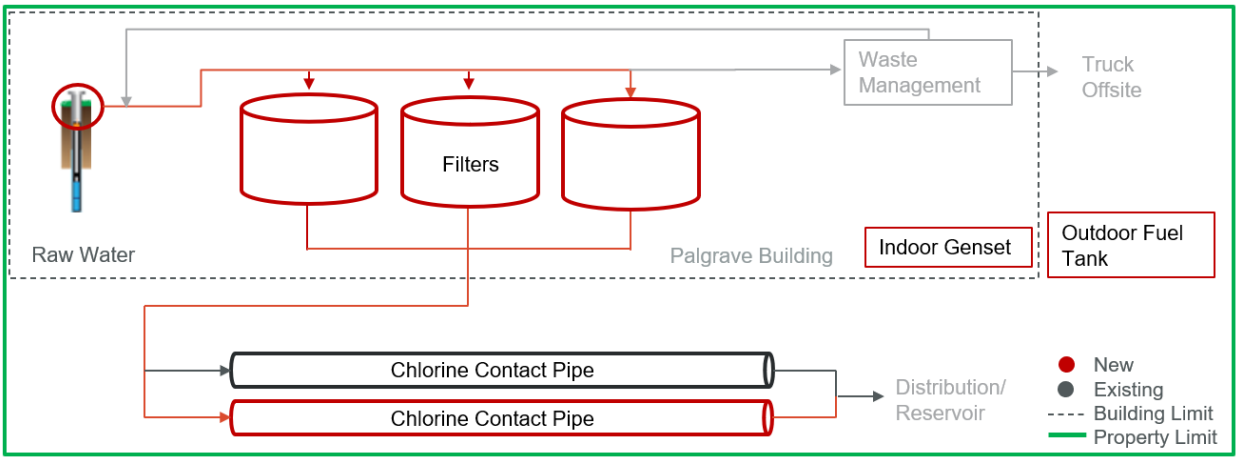

Figure 25: Schematic of Preferred Water Treatment Design Concept (Option 1A)

The schematic of the preferred design concept for residuals treatment to Expand / Retrofit Palgrave Well No. 4 Water Treatment Plant is given in **Figure 26**. The key advantages of this design concept are that it maximizes the existing infrastructure, and no excavation is required due to minimal construction. Moreover, it can be easily implemented through operational modifications.

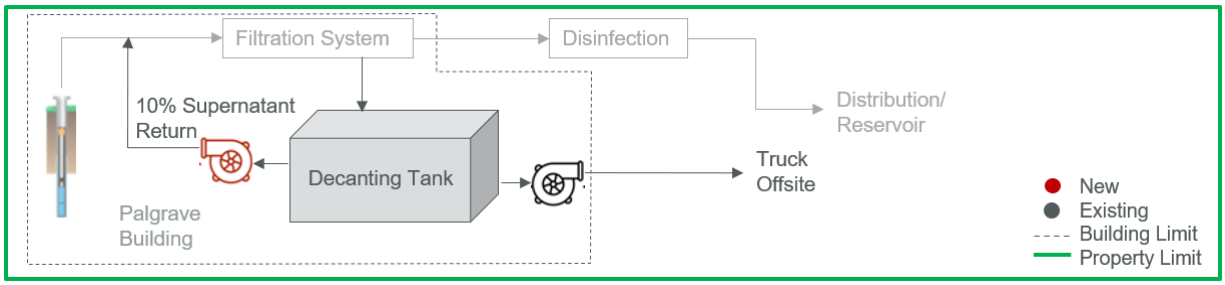

Figure 26: Schematic of Preferred Residuals Treatment Design Concept (Option WM1)

The results of the detailed comparative evaluation of alternatives as well as the preferred water treatment and residuals management concepts were presented to the public at the Public Information Centre (PIC #2) on October 27, 2022. Option 1A was presented as the first recommended choice for the reasons highlighted above. No concerns with the recommended design concepts were raised during or after PIC #2.

Subsequent to PIC #2, the Region identified a preference to have all the equipment associated with the emergency standby power, including both genset unit and fuel source, indoors to reduce operational challenges, especially during the winter months. As such, the option of a natural gas generator, which eliminated the need for a fuel tank,

was explored further and selected instead of the diesel emergency standby power. This change was not formally presented to the public since it was considered a minor modification to the preferred design treatment concept, and in general, is deemed to have lesser short- and long-term impacts to the neighbouring residents since all equipment will be confined within the existing building footprint. A diesel fuel tank is no longer required for a natural gas generator. The newly proposed natural gas generator will comply with all TSSA and ESA requirements.

13.2 Implementation Schedule

The construction period is expected to last for a duration of approximately twelve (12) months during which the plant would be offline about half of the construction duration.

13.3 Permits and Approvals

Permits, approvals, and completion of additional studies, anticipated in association with the proposed works at the Palgrave Well No.4 (PAL4) Water Treatment Plant are shown in **Table 33**. Consultation with regulatory agencies will continue during the design stages of the project to confirm the need for any additional permits and/or approvals.

Table 33: Required Permits and Approvals

Approval Agency	Permit/Approval Required
Ministry of the Environment, Conservation and Parks (MECP)	• Amendment to Municipal Drinking Water Works Permit • Amendment to Municipal Drinking Water License • Amendment to PTTW for increase in maximum permitted rate from 30.3 L/s to 60 L/s.
Town of Caledon	• Site Plan Approval • Building Permit
Enbridge	• Coordination for Natural Gas Connection
Electrical Safety Authority (ESA)	• Approval for Emergency Standby Generator

14 Anticipated Potential Impacts and Mitigation Measures

The following section provides a description of the potential impacts anticipated as a result of the implementation of the preferred alternative design concept, as outlined in this report, as well as some mitigation measures proposed to minimize or avoid such anticipated impacts.

The project involves the establishment of a temporary construction area adjacent to Buckstown Trail and excavation for a new chlorine contact pipe within the manicured lawn area. Furthermore, additional works will take place within and in proximity to the existing structure on 9 Buckstown Trail. A temporary construction area will also be situated on the south-west part of the property.

Implementation of the preferred alternative design concept is not expected to have significant impacts on the existing natural and economic environments, and cultural heritage resources; however, as with any other construction project, there will be some temporary potential impacts to the public and environment during construction in areas such as noise, dust, vibration and visuals during the construction period; however, these will be of short-term duration and expected to occur only during construction.

In general, public health and safety is a priority to the Region and as such, all design and construction related to the project will adhere to strict safety guidelines and all applicable codes and standards. All construction work must be carried out in accordance with the Occupational Health and Safety Act (OHSA) and other local regulations.

Specific mitigation measures, as described below, are recommended for implementation to reduce anticipated potential impacts.

14.1 Socio-Cultural

14.1.1 Cultural Heritage and Archaeological Assessment

The construction disturbance activities related to the Project within the project area are not expected to cause any archaeological impacts and cultural impacts. However, if the project boundary is revised and extends beyond the study area limits, additional archaeological assessment may be necessary due to the possibility of submerged archaeological resources in the surrounding vicinity. Additionally, if any deeply buried archaeological resources are discovered during ground disturbance associated with the proposed developments in the Study Area, all ground disturbance activities should be

stopped immediately, and the Archaeology Division of the Culture Programs Unit within the Ministry of Heritage, Sports, Tourism, and Culture Industries should be notified.

14.1.2 Noise / Vibrations

Construction and operational activities associated with the increased well capacity and water treatment plant capacity may generate noise and vibrations, which could potentially affect the surrounding socio-cultural environment, including nearby residences.

Most of the construction activities associated with enhancing the capacity of PAL 4 and the water treatment plant will be localized within the existing plant premises, affecting the few neighbouring property owners. The private residences in the vicinity are anticipated to have a low impact from potential disturbances from operations and maintenance activities. However, some temporary noise effects may occur due to construction traffic and equipment. Noise during operation of the well and treatment facility is not expected to be significantly different from the existing conditions. The proposed mitigation measures include the following:

- Noise and Vibration Monitoring: Conduct regular monitoring of noise and vibration levels during construction and operation to ensure compliance with applicable noise regulations and guidelines. This monitoring should be carried out using appropriate equipment and methodologies.
- Noise Control Measures: Implement noise control measures, such as the use of noise barriers, equipment insulation, or mufflers, to minimize the potential impact of construction and operational noise on nearby receptors. These measures should be implemented in accordance with local noise control bylaws and regulations.
- Construction Scheduling: Schedule construction activities during daytime hours and avoid or minimize construction activities during sensitive periods, such as early mornings, evenings, and weekends, to minimize the disturbance caused by noise and vibrations.

14.1.3 Dust / Mud

Construction traffic and activities, particularly excavation and earthmoving, can generate dust and mud, which may cause nuisances to nearby residents and other receptors. These nuisances may include reduced air quality, visual impacts, and increased risks of slips and falls. The proposed mitigation measures include the following:

- Dust and Mud Control Measures: Implement dust and mud control measures, such as water spraying, dust suppression techniques, and temporary sediment control

measures, to minimize the generation and spread of dust and mud during construction activities. These measures should be applied in accordance with relevant regulations and guidelines.

- Construction Site Maintenance: Regularly clean and maintain the construction site to prevent the accumulation of dust and mud on public roads, sidewalks, and neighboring properties. This maintenance should include street sweeping, site drainage management, and prompt removal of excess mud or dirt.
- Public Communication: Inform nearby residents and businesses about the construction activities and associated dust and mud control measures through public notifications, signage, or community meetings. This communication will help manage expectations and address any concerns raised by the local community.

14.1.4 Traffic

The increased construction activities may lead to an increase in traffic volume and congestion in the project area. Increased truck traffic on Highway 50 and Buckstown Trail will be experienced during the duration of construction from the delivery of construction equipment, construction materials and potential removal of excavated material from the site. This could potentially disrupt regular traffic patterns and impact the overall safety and convenience for road users. The proposed mitigation measures include the following:

- Traffic Management: This includes measures such as temporary traffic control signage, road closures, detour routes, and coordination with local authorities and emergency services. Any lane closures will be completed in accordance with best practices to protect safety to the workers and to the general public. All standard best practices for vehicle and pedestrian safety will be employed throughout the construction areas. All construction will adhere to strict safety guidelines.
- Construction Phasing: Plan and schedule construction activities in phases to minimize traffic disruptions and ensure the smooth flow of vehicles. Consider implementing off-peak construction hours or alternate routes to further reduce impacts on traffic congestion.
- Public Awareness: Communicate the construction schedule, traffic management plan, and any potential disruptions to the local community through various channels, such as website postings, social media updates, and local news outlets. Encourage the use of alternative transportation modes where possible and provide clear directions to minimize inconvenience for road users.

14.2 Disturbance to Natural Environmental Features

The groundwater assessment conducted by Geo Kamp Limited (**Appendix G)** indicated that the proposed well improvements would double the groundwater extraction rate without causing drawdown or interference with shallow depth wells or surface water features. No anticipated impacts on fisheries resources or base flow reductions were identified.

Regarding aquatic habitat and communities, there are no watercourses within 120m of the study area, resulting in no expected impacts from the proposed improvements. Erosion and Sediment Control (ESC) measures are recommended along the southwest border of the construction area to prevent sediment migration into regulated areas or adjacent vegetation communities.

The proposed works are situated within an open manicured lawn area, avoiding vegetation communities adjacent to the Subject Property. No vegetation removals are planned for the cultural meadow or nearby plantations. The site plan design prioritizes the preservation of the largest tree resources in the southeast corner of the Subject Property, with detailed tree protection measures outlined.

No species at risk habitat or individuals were identified within the Subject Property, indicating a low potential for impacts. Similarly, no sensitive wildlife functions or habitats were found in the areas designated for construction. Potential disturbances or incidental take can be minimized by limiting the construction footprint to the manicured lands, complying with regulations such as the Migratory Birds Convention Act to avoid disturbing breeding birds from April to August, and using fencing to isolate construction activities from adjacent lands.

In summary, the proposed improvements to Palgrave Well #4 are expected to have minimal impacts on natural heritage features, as the plant site footprint avoids such features, and groundwater impacts are not anticipated. The outlined mitigation measures effectively address potential impacts and provide adequate protection for the environment. The detailed impacts assessment and mitigation measures can be found in LGL's Draft Natural Features Impact Assessment Report for Palgrave 4 Supply Well, April 2023, attached in **Appendix I.**

14.3 Geotechnical and Hydrogeological Conditions

A detailed assessment of potential impacts and mitigation measures to the ecological and hydrogeological conditions can be found in Geo Kamp's memo to TRCA (March 2023), attached in **Appendix O**, and the hydrogeologic reports by Watermark Environmental, attached in **Appendix B.**

The impacts and mitigation measures related to the PAL 4 groundwater supply well and its effect on shallow groundwater and surface water can be summarized as follows:

- The aquifer performance of PAL 4 was tested at different rates, including 30.3 L/sec and 60.6 L/sec. The tests showed that PAL 4 has the capacity to yield more than 60.6 L/sec for extended periods.
- A distance-drawdown curve based on the 60.6 L/sec test indicated that the cone of influence may extend up to 1000 meters.
- Interference from pumping was observed in deep and intermediate depth wells but did not extend to shallow depth wells or surface water features. The drawdown in the intermediate zone only reached a distance of approximately 30 meters from PAL 4.
- Aquifer vulnerability assessments concluded that PAL 4 is not susceptible to surface contamination or contamination by protozoa. It is classified as Non-GUDI (Category 1) based on the Groundwater Under the Direct Influence (GUDI) evaluation.
- The monitoring of shallow wells during the pumping tests did not show any significant interference or impacts on fisheries resources. No cumulative impacts related to base flow reductions, fish habitat, water temperature, pollutant dilution, or water availability were anticipated.
- Based on the observed data, no mitigation plan regarding natural resources is considered necessary at the monitored locations.

Overall, the assessment indicates that the operation of PAL 4 at an increased pumping rate is not expected to cause significant interference or negative impacts on shallow groundwater, surface water, or fisheries resources in the monitored areas.

14.4 Source Water Protection

14.4.1 Impacts on Existing Groundwater Users and Surface Water Features

A hydrogeological investigation of PAL4 was completed in 2019 (Watermark Environmental and Well Initiatives) to assess the feasibility of increasing the pumping rate of PAL4 from its current maximum water taking of 30.3 L/s to 60.6 L/s. A review of the cumulative impacts to groundwater and surface water resources from both the existing and the proposed increased water takings at PAL4 was carried out as part of the 2019 hydrogeological investigation. The impact assessment included the following key activities:

- A 72-hour constant rate pumping test to assess feasibility of water taking increase and to evaluate the sustainability of this rate over the long-term. Monitoring of PAL4 and surrounding observation wells, piezometers, and streamflow stations for groundwater and surface water elevations, respectively.
- Identification of potential groundwater receptors including domestic or permitted water supplies in the area that could reasonably be impact by water takings of all Palgrave wells, inclusive of PAL4. Groundwater usage was obtained through the MECP Water Well Information Systems Query and identifying permitted water takers, within 500m radius of each production well. The search results identified a total of 24 drilled or dug wells within the search radius. A breakdown of the local private groundwater usage within 500 m radius of PAL4 is show in the table below.

Table 34: Water Well Records within 500 m radius of PAL4

Primary Well Use	Number of Wells within 500 m radius	Percentage of Total
Water Supply – Domestic	7	29.2
Water Supply – Municipal	2	8.3
Water Supply – Industrial	1	4.2
Monitoring/Observation/Test Hole	8	33.3
Abandoned/Unknown	6	25.0
Total	**24**	**100%**

Key findings and recommendations of the impact assessment included:

- At a sustained pumping rate of 60.6 L/s at PAL4, the stabilized Radius of Influence (ROI) is approximately 1 km for PAL4. Within the 1 km ROI, pumping of PAL4 was observed to result in only minor drawdowns in wells screened at a depth of 40 m and no attributable drawdowns in wells screened above a depth of 30m. In addition, the measured drawdowns are believed to be confined to the immediate area of PAL4. Based on the conceptual understanding of the shallow and semi-confined groundwater system, long-term impacts to existing groundwater users from an increase in water taking of PAL4 to 60.6 L/s are not expected.
- Water takings at PAL4 have not been the cause for any private well complaints in the area related to either quality or quantity of groundwater.

- The results of water level monitoring in a piezometer and surface water monitoring station (located approximately 365 m to the southwest of PAL4 along the east bank of the Humber River) during the pumping test of PAL4, suggest that pumping at PAL4 has no influence on the surface water features (Humber River) where the stations were instrumented. Additionally, based on the conceptual hydrogeological model for PAL4, all surface water features within the estimated ROI of PAL4 are believed to be hydraulically disconnected from the production aquifer by more than 50 m of fine-grained soils.
- Considering the presence of a significant depth of confining material and no observed drawdown at the surface water monitoring stations during the pumping period of PAL4, it was concluded that long-term impacts to surface water from an increase in water taking of PAL4 to 60.6 L/s are not expected.
- The study also recommended that the current monitoring program for the Palgrave Drinking Water System be maintained. The current monitoring program managed and executed by the Region has been effective in identifying potential impacts related to water takings in the area and therefore no changes are recommended at this time.
- As noted above, long-term impacts to other groundwater and surface water features are not expected under the proposed pumping conditions for PAL4. However, if an unacceptable impact is reported and believed to be caused directly from municipal water takings, a contingency plan, including the following key actions are recommended:
    - Temporarily stall water takings at the well until it is proven that the unacceptable impact is unrelated to the operation of the well.
    - Prepare a detailed report on the unacceptable impact, including information on the reporter, location and damages incurred.
    - Validate the claims against the operation of the well using historical pumping test evaluations to assess the likelihood of the impact being a direct result of the well.
    - If the impact is confirmed as a direct result of the well operation and affects groundwater quantity or quality in a private well, implement a plan to mitigate damages and prevent future occurrences.
    - If the impact is confirmed and affects the natural functions of the surrounding ecosystem, establish a plan to mitigate further impacts to the ecosystem.
    - If the impact is determined to be unrelated to the well's operation, reinstate the well, and resume pumping. Maintain a record of the impact report for three (3) years.

14.4.2 Wellhead Protection Areas and Groundwater Vulnerability Assessment

An increase in water taking from an existing municipal supply well results in new Wellhead Protection Areas (WHPAs). The delineation of these new WHPAs was carried out as a separate assignment in parallel to this Class EA project. DRAFT limits of WHPAs have been delineated to reflect the proposed water taking increase to 60.6 L/s. The WHPA delineations will remain in draft form until the next stage of consultation process with the public, stakeholders and Source Protection Committee prior to submission and final approval by the MECP.

The new WHPAs were delineated and groundwater vulnerability, issues evaluation and threats assessment were completed by Aqua Insight. The study provided the following findings:

- There were no particles that were simulated to travel from the water table to Palgrave Well 4 in less than 25 years as the production aquifer is deep and confined. Many of the particles released on the water table in the WHPA-D for Palgrave Well 4 do not reach the municipal well, as many discharge to the local streams and wetlands instead. Some particles located west of the well within the WHPA-D are simulated to travel from the water table to the well in greater than 40 years, but most of the source water pumped by Palgrave Well 4 is recharged outside the WHPA-D area.
- In terms of Surface to Well Advective Travel Time (SWAT), PAL 4 is considered to have predominately low vulnerability.
- A set of vulnerability scores were assigned to the WHPA polygons using the updated vulnerability rating categories that consider transport pathways. Most of the WHPA-C and -D areas have a score of 2, due to the low vulnerability category rating, and the WHPA-B is primarily assigned a score of 6. Scores of 10 are limited to the WHPA-A.
- The area around Palgrave Well 4 has a Managed Land percentage of 40 to 80% due to the presence of the residential areas around the well.
- Based on the areas of the barns and the interpreted livestock contained within the barns, the WHPA-A to -D polygons were estimated to have less than 0.5 nutrient units per acre.
- Road salt application on all roads within the WHPAs were classified using the Circumstance Tables in the Technical Rules (MECP, 2021) as Low Drinking Water Threats.

14.4.3 Drinking Water Vulnerability Analysis and Threats Evaluation

As per the Clean Water Act, 2006, a drinking water threat is defined as an activity or condition that adversely affects or has the potential to adversely affect the quality or quantity of any water that is or may be used as a source of drinking water.

Ontario Regulation O. Reg. 287/07 under the 2006 Clean Water Act, has prescribed 22 threats for which policies must be written in areas where these threats could be significant. The Region recently conducted, as a separate assignment to the Class EA study, a Significant Drinking Water Threat (SDWT) enumeration exercise in accordance with the 2021 Director's Technical Rules.

The SDWT exercise identified Threat #2. The establishment, operation or maintenance of a system that collects, stores, transmits, treats, or disposes of sewage as the only prescribed SDWT associated with PAL4. The sources for the identified SDWT are associated with existing residential land uses in the vicinity of the PAL4 area. Specific actions related to septic systems governed under the Building Code Act and the Ontario Building Code, are to be implemented by the local Municipality. The responsible authority for policy implementation in this specific case is the Town, which addressed septic system through the Town’s Septic Re-inspection Program for on-site sewage disposal systems that discharge 10,000 litres and less.

In addition to the above, Threat #15. The handling and storage of fuel, is currently a SDWT for PAL4, based on the existing system configuration. The preferred recommended design concept, identified in this Class EA study and outlined in this report, includes the replacement of the existing emergency standby diesel generator with a new larger natural gas generator unit. The new generator unit will be supplied by natural gas delivered to the site, eliminating the need for a separate fuel tank, and therefore, removing the existing threat for standby fuel handling/storage.

The Source Protection Updates for the Communities of Palgrave, Caledon East, and Caledon Village, completed by Aqua Insight, December 2022, included an assessment of the potential threats related to winter road salt application. Consideration to the percentage of impervious surface area (e.g., roads, parking lots) was part of the impervious cover assessment exercise. Within the Palgrave area, road salt application on all roads within the WHPAs were classified as Low Drinking Water Threats, using the Circumstance Tables in the Technical Rules (MECP, 20221). The report Source Protection Updates for the Communities of Palgrave, Caledon East, and Caledon Village by Aqua Insight (December 2022) has been attached as **Appendix H**.

The following policies in the CTC Source Protection Plan apply to Low/Moderate drinking water threats related to the application, handling, and storage of road salt:

- SAL-12: Encourages municipalities to mandate a salt management plan for unassumed roads and private parking lots exceeding 200 square meters in specified Wellhead Protection Areas (WHPAs) and Highly Vulnerable Areas (HVA), where road salt application poses a moderate or low drinking water threat. The plan should focus on minimizing salt usage through alternative measures while ensuring public safety, and it should involve the requirement for trained individuals in road salt application, potentially including technicians, technologists, winter maintenance supervisors, patrollers, equipment operators, mechanics, and contract employees.
- SAL-13: Encourages municipalities to annually report sodium and chloride monitoring results to the Source Protection Authority in areas where the application, handling, and storage of road salt pose a moderate or low drinking water threat. The Source Protection Authority shall assess the information for trends and advise the Source Protection Committee on the need for development of new source protection plan policies to prevent potential drinking water issues.

As noted previously, activities related to winter road salt application were identified as a low threat; however, the Region is implementing a winter maintenance pilot project with best management practices (BMPs) to minimize salt usage and its impact on municipal wells. BMPs include adhering to Site Plans for snow pile locations and salt instructions, removing snow before applying de-icing products, having Smart About Salt certified contractors, sweeping and removing excess salt or de-icing products, considering temperature and conditions before application, and requiring monthly tracking of salt usage at each well facility by contractors.

Threat #16. The handling and storage of a dense non-aqueous phase liquid (DNAPL) has not been identified as a significant threat resulting from the operation of the Palgrave Drinking Water System, following the proposed upgrades identified in the Class E study. However, construction activities associated with the project may introduce potential risks related to fuel and DNAPL. Heavy machinery and construction equipment, powered by fuels like diesel, pose a risk of fuel spills through accidental leaks or improper handling. Additionally, the use of DNAPLs, such as degreasers and industrial chemicals during construction, can contribute to soil and water contamination. Stormwater runoff from construction sites may carry pollutants, including residues of fuel and DNAPL, into nearby water bodies.

To address potential risks during construction, the following mitigation measures are proposed:

- Implement erosion and sediment control measures to prevent contaminated runoff. This includes installing silt fences, sediment basins, and other Best Management Practices (BMPs) to minimize the transport of pollutants to water bodies.
- Conduct regular inspections of the construction site to identify and address potential sources of fuel spills and DNAPL contamination promptly.
- Implement monitoring programs to assess the quality of soil, groundwater, and surface water during and after construction to detect any signs of contamination.
- Implement proper storage and handling practices for fuel and chemicals used in construction to minimize the risk of spills. This includes ensuring equipment maintenance and proper disposal procedures for contaminated materials.
- Obtain all necessary permits for construction activities and promptly report incidents to relevant environmental authorities.
- Develop comprehensive spill response plans outlining procedures for containing and cleaning up fuel spills and DNAPL releases. This includes having appropriate spill response kits and equipment on-site.
- Ensure that construction personnel are adequately trained in spill response and emergency procedures. This includes understanding the hazards associated with fuel and DNAPL and knowing how to use personal protective equipment.

No other activities or prescribed threats were identified as a SDWT for PAL4 based on 2021 Technical Rules criteria.

14.5 Climate Change

Increasing the capacity of the Palgrave supply Well #4 and treatment plant may result in higher energy requirements and additional greenhouse gas emissions due to heating, lighting, electrical requirements as well as chemical delivery needs. In addition, the existing landscape of the area would need to be altered to accommodate new infrastructure.

Implementation of the following climate mitigation measures should be considered to reduce the long-term generation of carbon emissions arising mainly from operation of the new treatment facility and to enhance carbon storage due to proposed changes in the landscape:

- Construction equipment should be appropriately maintained to ensure that exhaust emissions meet industry standards.
- Use of energy efficiency features within the treatment facility such as LED lighting features and insulation to reduce the energy needs. Moreover, using energy-

efficient pumps and equipment and optimizing system design would also contribute to the mitigation of climate change impacts.

- Chemical delivery is expected to be minimal; however, delivery could be scheduled on a monthly/bi-monthly basis in order to reduce the number of delivery trucks to/from the new reservoirs and new facilities.
- Implementation of an adequate landscape plan, comprising planting of new trees and local non-invasive vegetation species within the new site.

15 Class EA Phase 4 – Conclusions and Recommendations of the Environmental Study Report

Through completion of a Municipal Class EA study, the expansion/retrofit of the Palgrave Well No. 4 (PAL4) Water Treatment Plant has been identified as the preferred recommended design concept for the supply capacity increase for the existing Palgrave Well #4 required to meet the long-term servicing needs of the serviced area. Individual assessments of the natural, socio-cultural, technical environments were conducted to inventory and evaluate the existing conditions of the project area.

Through the consultation process, concerns were raised by HDI regarding the project and potential impacts to Haudenosaunee heritage sites and their rights. The Region had separate consultation with HDI representatives in July 2023. The Region and HDI agreed to review individual project concerns on as needed basis.

Potential impacts associated with the implementation of the design concept were identified as well as available mitigation measures. Due to the nature of this project, some inevitable short-term effects in terms of dust, noise, and truck traffic will be felt around the construction areas and during construction only. However, potential social effects can be further reduced by implementation of mitigation measures outlined in this report. Therefore, no significant environmental, socio-cultural, archaeological or heritage resource impacts are anticipated as a result of this project.

It is recommended that the Region proceed with the detailed design and construction of the preferred design concept, as outlined in this report, subject to receiving the necessary approvals. This Environmental Study Report is being filed for a 30-day public review period. Given that no major objections or Section 16 Orders are received during the review period, the proposed works will proceed as planned.

16 References

AECOM. (April 2012). Palgrave Well No. 4 OPERATIONS MANUAL. Brampton: Region of Peel.

CIMA+ . (2021). TM-3 Evaluation Framework and Preliminary Screening. Brampton: Region of Peel.

CIMA+. (May 2022). MEMO - Palgrave Well 4 Preliminary Treatment Alternative Evaluation Technical Memorandum 4. Brampton: Region of Peel.

CTC Source Protection Region (February 2022). Approved Source Protection Plan: CTC Source Protection Region

GeoKamp. (April 2021). Technical Memorandum PAL4 Hydrogeologic Review.

KMK Consultants Limited. (June 2005). Palgrave Well No. 4 Design Report. Brampton: Region of Peel.

Lotowater. (June 2018). Palgrave Well 4 Inspection, Rehabilitation & Testing.

MECP. (2006). Procedure for Disinfection of Drinking Water in Ontario. Toronto: Ontario Ministry of the Environment.

MECP. (2008). Design Guidelines for Drinkin-Water Systems. Toronto: Government of Ontario.

MECP. (2019). DRAFT TOR for Determination of Minimum Treatment for Municipal Residential Drinking Water Systems Using Subsurface Raw Water Supplies. Ottawa: Government of Canada.

MECP. (December 2018). Procedure for Disinfection of Drinking Water in Ontario. Toronto: Government of Ontario.

MECP. (June 2006). Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines.

Statistics Canada. (June 2022). Consumer Price Index, May 2022.

Watermark Environmental. (April 2021). Palgrave Well No. 4 Stage 1 Report on Assessment of Vulnerability to Contamination by Protozoa. Brampton: Region of Peel.

A

Appendix A: Palgrave Drinking Water System, Category 3 Permit to Take Water Application Report (Watermarks Environmental, 2020)

B

Appendix B: Palgrave Well No. 4, Stage 1 Report on Assessment of Vulnerability to Contamination by Protozoa (Watermarks Environmental, 2021)

C

Appendix C: Master Project Mailing List

D

Appendix D: Project Notices

E

Appendix E: Public Consultation

F

Appendix F: Agency Consultation

G

Appendix G: Hydrogeologic Review Report, Geo Kamp Limited, 2021

H

Appendix H: Source Protection Updates for the Communities of Palgrave, Caledon East and Caledon Village, Aqua Insight, 2022

Appendix I: Draft Natural Features Impact Assessment Report for Palgrave 4 Supply Well, LGL Limited, April 2023

J

Appendix J: Project Screening Checklists (MHSTCI)

K

Appendix K: Indigenous Communities Consultation

L

Appendix L: Mark-ups

M

Appendix M: Cost Estimates

N

Appendix N: Detailed Evaluation Matrix

O

Appendix O: Memorandum to TRCA, Geo Kamp Limited, March 2023


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