JLR No.: 311960-009

April 11, 2025

Caledonia Wastewater Treatment Plant Schedule C Municipal Class Environmental Assessment

Environmental Study Report

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS

Value through service and commitment

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Haldimand County Land Acknowledgment Statement

We humbly acknowledge that Haldimand County sits on the ancestral land of many generations of Indigenous nations, who have been here since time immemorial.

Today, this land continues to be home to many Indigenous peoples, including the Six Nations of the Grand River and the Mississaugas of the Credit First Nation, as well as non-Indigenous settlers from a variety of backgrounds. As a community, we have a shared responsibility for stewardship of the land on which we live and work. We are grateful for the opportunity to work together and to share the land we all call home.

Acknowledging reminds us that our living conditions are directly related to the abundant resources of the Indigenous peoples. We commit to continue learning, reflecting on our past, and working in allyship with Indigenous communities, toward respective community goals and objectives, in peace, respect and friendship.

1.0 Introduction

1.1 Background

Haldimand County (the County) has retained J.L. Richards & Associates Limited (JLR) to complete a Schedule C Municipal Class Environmental Assessment (MCEA) for Caledonia Wastewater Treatment Plant (Study) to determine the preferred alternative to increase Caledonia's wastewater treatment capacity.

In December 2020, J.L. Richards & Associates Limited completed the Draft Caledonia Wastewater Master Servicing Plan (MSP) Update, updating the wastewater servicing components of the 2006 Caledonia MSP (JLR, December 2020a). The Draft MSP Update reflected updated land use and growth forecasts in the study area. As part of the MSP Update, near-term and future wastewater treatment needs were identified, and wastewater treatment alternatives were evaluated to address projected treatment capacity constraints.

As part of this MCEA process, the evaluation of treatment servicing alternatives from the Draft MSP Update is being revisited to confirm the preferred wastewater treatment alternative, including adding a new alternative to pump wastewater flows from Caledonia to neighbouring wastewater treatment plants for treatment (e.g., proposed Lake Erie Industrial Park WWTP in Nanticoke). The goal of the updated evaluation is to re-evaluate treatment alternatives based on updated growth projections in Caledonia and evaluate the new alternative under the MCEA process. After selecting the preferred treatment alternative, the Study proceeded to Phases 3 and 4 to develop and evaluate design concepts and the Environmental Study Report (ESR) will be placed on public record.

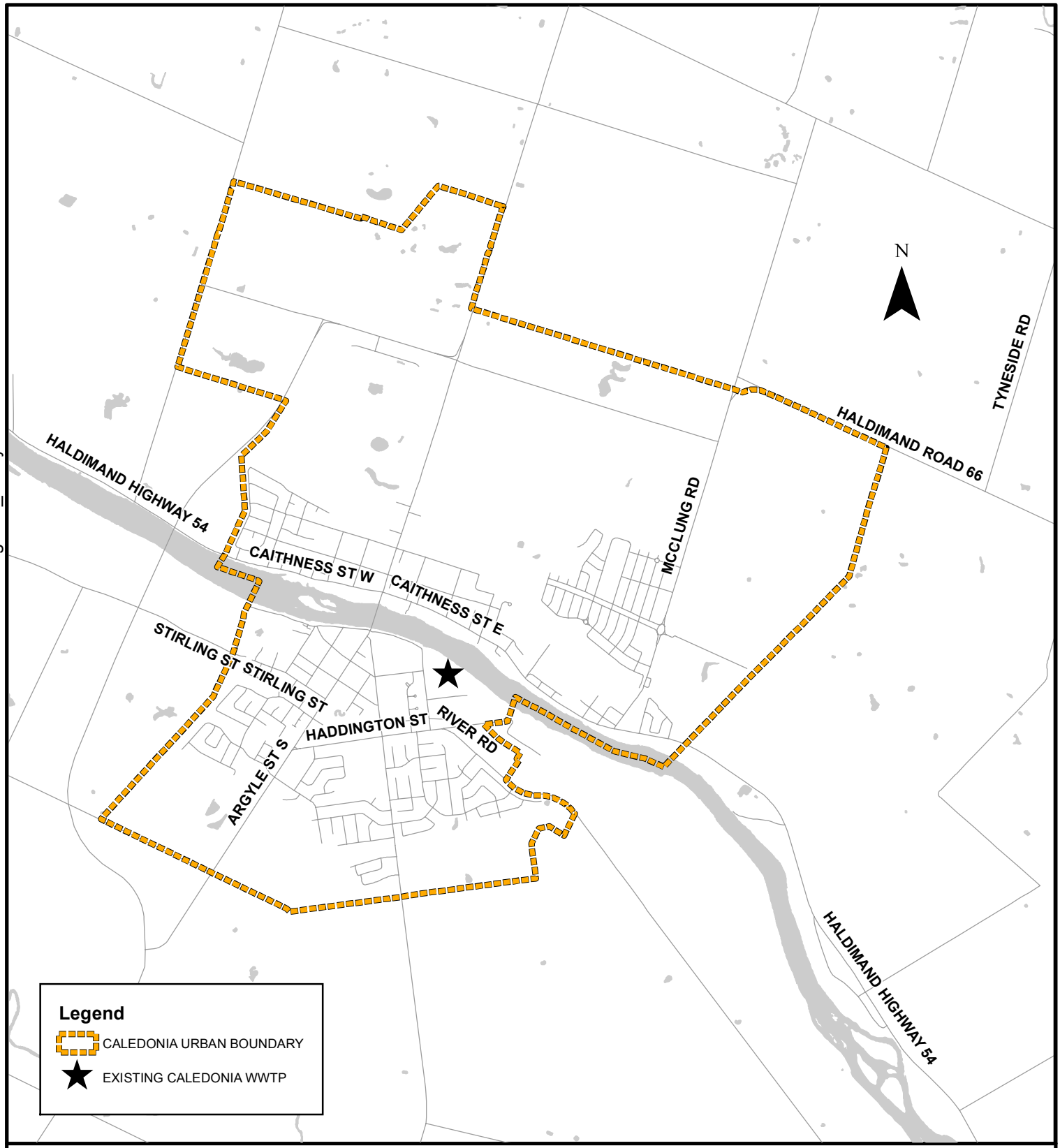
This Study is being conducted in accordance with Phases 1 through 4 of the Municipal Engineers Association (MEA) Municipal Class Environmental Assessment (MCEA) process (Updated March 2023) to fulfill the requirements for Schedule C projects.

1.2 Study Area Overview

The community of Caledonia is located on the Grand River in the northern part of the County at the crossroads of Argyle Street and Haldimand Highway 54. The community has a population of approximately 10,000 residents (Statistics Canada, 2016) and development is predominantly residential. The study area for this MCEA process encompasses the urban boundary of Caledonia, the existing Caledonia WWTP site, and the location for a potential WWTP in or around Caledonia.

In early 2022, Empire Communities proposed developing a new community at the Lake Erie Industrial Park (LEIP) in Nanticoke, ON, including a new proposed LEIP Wastewater Treatment Plant (WWTP). If required, the study area will be expanded to include potential feedermain routes to neighbouring wastewater treatment plants.

Figure 1 illustrates the study area boundary.



PROJECT:

CALEDONIA WASTEWATER TREATMENT PLANT CLASS ENVIRONMENTAL ASSESSMENT

CALEDONIA, ONTARIO

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STUDY AREA

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FIGURE 1

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1.3 Class Environmental Assessment Process

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

The MCEA process is followed for common types of projects to streamline the review process while ensuring that the project meets the requirements of the Act. In 1987, the first-Class EA document prepared by the MEA on behalf of Ontario Municipalities was approved under the Act. Updates and amendments were subsequently made in 1993, 2000, 2007, 2011, 2015, and 2023. The update in 2023 came with many significant changes and updates.

The MCEA process includes the following stages:

- Phase 1: Problem and/or opportunity identification.
- Phase 2: Identification and evaluation of alternative solutions.
- Phase 3: Identification and evaluation of design concepts.
- Phase 4: Complete and place Environmental Study Report on public record.
- Phase 5: Implementation and monitoring.

This MCEA has been initiated as a Schedule C project. Projects categorized as Schedule C undertakings have the potential for significant environmental impacts and are required to follow full phases under the MCEA. This includes consultation with all parties that may potentially be affected by the project and the preparation of a MCEA Environmental Study Report (ESR) that documents the MCEA process.

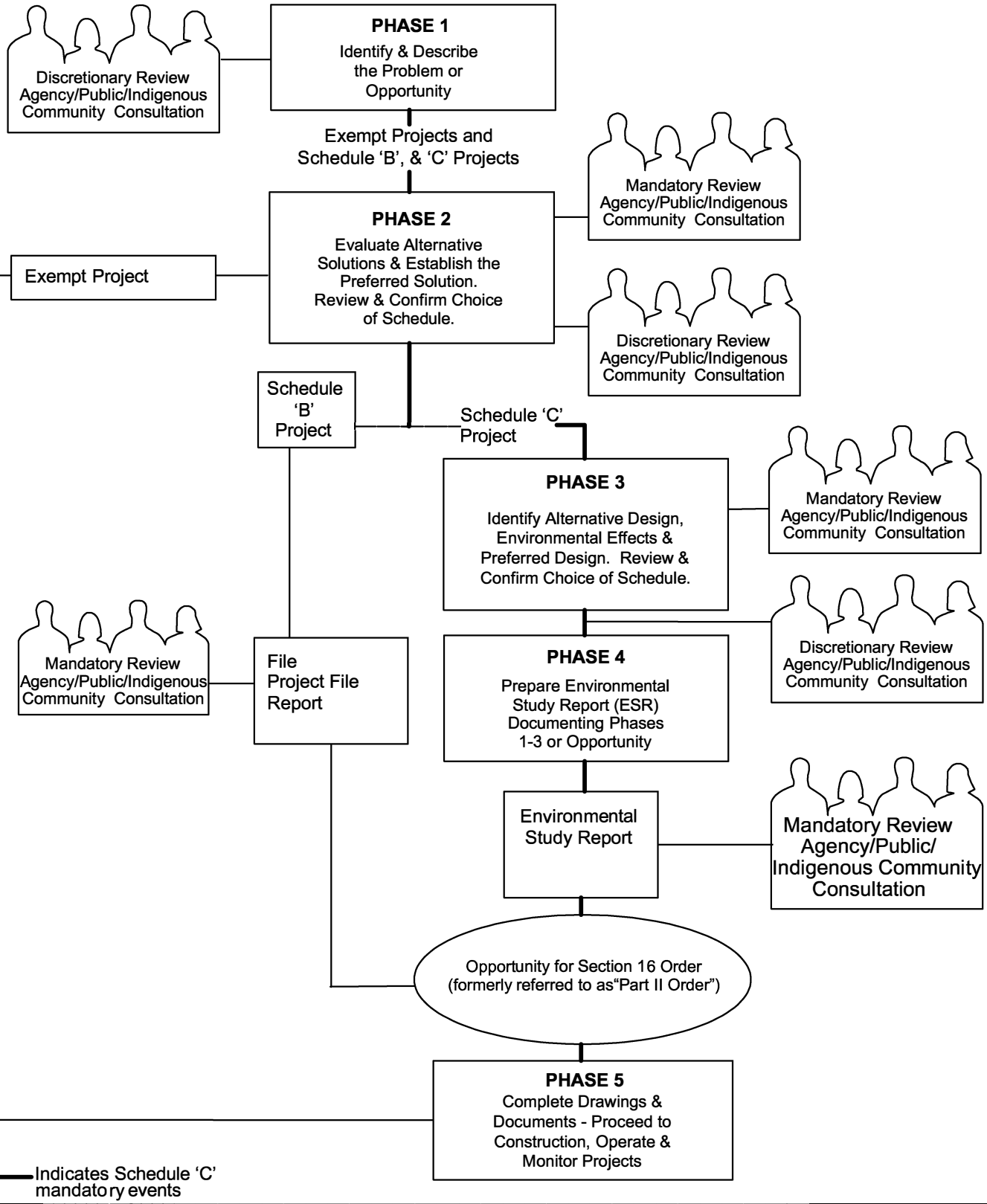
For this MCEA, an ESR will be made available for public and agency review at the completion of the MCEA process for a mandatory 30-day period. If there are no requests to the Minister of the Environment, Conservation and Parks (MECP) for a ‘Section 16 Order’ within the review period, then the project can proceed to implementation (Phase 5). The MCEA process is documented in Figure 2.

1.4 Environmental Study Report Objectives

This Report summarizes the findings of the MCEA process.

The objectives of the Environmental Study Report are to:

- Summarize information related to land use, planning, and the natural environment.
- Provide a description of existing infrastructure.
- Establish the Problem/Opportunity statement.
- Identify alternative solutions to address the problem/opportunity statement.
- Select the preferred servicing alternative.
- Document stakeholder consultation



PROJECT:

CALEDONIA WASTEWATER TREATMENT PLANT
CLASS ENVIRONMENTAL ASSESSMENT
CALEDONIA, ONTARIO

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CLASS ENVIRONMENTAL ASSESSMENT PROCESS

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FIGURE 2

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1.5 System History and Previous Studies

Table 1 summarizes a brief chronological summary of the history and relevant studies completed regarding the Caledonia Wastewater Treatment Plant.

Table 1 History of the Caledonia Wastewater System

Year	Activity/ Study Description
2006	In 2006, a Master Servicing Plan (MSP) for Caledonia was prepared (Phillips Engineering Ltd., 2006) to help guide the development of water, wastewater, storm, and transportation services. The report recommended a wastewater improvement plan to allow for new development in the community. Key recommended improvements for the wastewater system included: • Upgrade the Paisley Wastewater Pump Station. • Construct a new McClung Road Wastewater Pump Station. • Construct a new Southeast Wastewater Pump Station. • Upgrade or replace various existing wastewater mains. • Construct new wastewater mains. The 2006 MSP acknowledged the Caledonia Wastewater Treatment Plant would need upgrades to treat additional flow in the future. The actual capacity of the plant was assessed in a separate study and necessary upgrades would be determined based on the results. Since the completion of the 2006 MSP additional wastewater collection infrastructure has been constructed to accommodate new development.
2016	Wood Group, formerly Amec Foster Wheeler, was retained in 2015 to update the 2006 MSP. Some components of the MSP were updated between 2015 and 2018 (Amec Foster Wheeler, 2016); however, the update was not finalized. Updates were made to Caledonia's water and wastewater models, and a Public Information Centre (PIC) hosted by Amec Foster Wheeler was held in June 2016 to inform the public of the study and existing conditions. A series of Technical Memoranda were completed including: • Draft Final Storm Drainage Report, 5 October 2019. Wood. • Caledonia Master Servicing Plan – Transportation Final Draft, October 2019. CIMA +. • Public Information Centre #2 Presentation, 26 February 2019. Wood and CIMA +. • Capacity Evaluation of Main and Paisley Sewage Pumping Stations, 29 June 2018. Wood. • Future Options Evaluation – Caledonia WWTP, 23 June 2018. Wood. • Caledonia Wastewater Supply System – Constraints and Opportunities Workshop, 25 September 2017. Amec Foster Wheeler. • Public Information Centre #1 Presentation, 23 June 2016. Amec Foster Wheeler. • Caledonia Water and Wastewater Master Plan Update – Existing Conditions, May 2016. Amec Foster Wheeler.
2020	In 2020, the Draft Caledonia Wastewater Master Servicing Plan Update was completed (JLR, 2020a) to finalize the wastewater servicing components from the partially completed 2006 MSP update. The scope of work included the

Year	Activity/ Study Description
	development and calibration of the Caledonia wastewater model as well as the development of future servicing assumptions. The recommendation from this study was to complete a Schedule C Class Environmental Assessment for a New or Expanded Wastewater Treatment Plant. This work forms the basis of Phases 3 and 4 of the current MCEA.
2020	In 2020, the County proposed expanding Caledonia's urban boundary to accommodate future development and completed the Draft Caledonia Urban Boundary Expansion Servicing Review. JLR reviewed the impacts of future development in Caledonia on water, wastewater, stormwater, and transportation infrastructure needs identified by the Draft MSP Update (JLR, December 2022b). This review included an assessment of a revised growth scenario and preparing an updated opinion of probable cost (OPC) for the alternatives identified in the Draft MSP Update. Under the revised growth scenario, this review identified that McClung SPS would need to be upgraded, in addition to the other upgrades/ expansions identified in the Draft MSP Update.
2021	In 2021, the Highway 6 Corridor Servicing Study was updated (WSP, October 2021) to reflect a new regional wastewater treatment servicing option to address long-term wastewater infrastructure needs for communities within the Highway 6 corridor. The new option includes conveying all wastewater from Townsend, Jarvis, Hagersville, Caledonia, and Cayuga to a new wastewater treatment plant (WWTP) in Nanticoke for treatment and decommissioning the existing treatment systems in those five communities. The updated study recommended a servicing strategy, which included a combined network of gravity sewers and pumping stations and forcemains to convey flows from each of the five communities to the WWTP in Nanticoke. Due to unfavourable topography, it was recommended to use a forcemain from Caledonia to Hagersville and then use a gravity sewer from Hagersville to Nanticoke, where topography is better suited. Each community will require a pumping station and forcemain to convey flows to the central forcemain/sewer. Re-use of existing pumping infrastructure may be possible in some communities, and other communities will require new pumping stations.
2022	In January 2022, a Caledonia to Nanticoke Wastewater Conveyance Evaluation was prepared (WT Infrastructure Solutions Inc., January 2022). The WT infrastructure report evaluates the feasibility of conveying wastewater from Caledonia to Nanticoke as part of a regional wastewater treatment system. The evaluation concluded that it is feasible to convey wastewater from Caledonia to Nanticoke, however the existing Nanticoke wastewater treatment plant needs to be upgraded to accommodate increased flows. The evaluated alternatives included single and double forcemain options and different routes, such as a direct connection from Caledonia to Nanticoke or a route via Hagersville WWTP to Nanticoke. Four main alternatives were considered, and the preferred alternative is to construct a single forcemain on a direct route from Caledonia to Nanticoke with a large volume of equalization storage at the Caledonia WWTP. The main components of the preferred alternative include:

Year	Activity/ Study Description
	• Single forcemain • Two in-line pumping stations • On-site pumping station at Caledonia WWTP • 10,000 m^3 of equalization storage at Caledonia WWTP • Required headworks upgrades at the Caledonia WWTP The preferred alternative will require a Schedule C Class EA for implementation.
2022	In September 2022, an updated Caledonia to Nanticoke Wastewater Study was prepared (WT Infrastructure, September 2022) to review the impact of flow change on the design of the Caledonia WWTP to Nanticoke WWTP single forcemain – via Hagersville alternative. WT Infrastructure identified changes to the design related to the forcemain size, volume of the equalization tank and pumping station capacity. Along with this study, in February of 2022 WSP completed an addendum to the ESR to evaluate expanding the Nanticoke WWTP
2022	In December 2022, WSP conducted a high-level feasibility review of conveying flows from the northern new development lands in Caledonia to Hamilton (WSP, 2022). It was found to be technically viable to convey flows to Mt. Hope via a combination of forcemain and gravity sewer.

1.6 Problem and Opportunity Statement

Haldimand County operates a municipal wastewater treatment system in the community of Caledonia that consists of the Caledonia Wastewater Treatment Plant (WWTP), seven sewage pump stations (SPSs), and a wastewater collection system. The Caledonia WWTP is located on the south side of Caledonia and treats all flow from north and south Caledonia. The WWTP provides tertiary treatment and disinfection of wastewater prior to discharge to the Grand River.

Growth within the community of Caledonia has been steady and there are vacant lands allocated to accommodate future growth. Servicing future growth creates an opportunity to evaluate and select a long-term wastewater treatment alternative that will support sustainable growth and development within the community. To achieve this, this Study is being conducted in accordance with Phases 1 through 4 of the Municipal Engineers Association (MEA) Municipal Class Environmental Assessment (MCEA) process (Updated March 2023) to fulfill the requirements for Schedule C projects.

2.0 Overview of Existing Infrastructure

2.1 System Overview

The Caledonia wastewater system includes one Wastewater Treatment Plant (WWTP), seven sewage pump stations (SPSs), and a wastewater collection system. Some industrial facilities located in the northwest area of Caledonia are not serviced by the municipal wastewater system. Pipe diameters range from 50 mm diameter to 675 mm diameter, and range in age from less than 20 years to greater than 60 years. The oldest pipes tend to be concentrated close to the Grand River along Argyle St., along the river, and around older SPSs, including Domtar SPS, Kincardine SPS, Nairne SPS, and Paisley SPS. Figure 3, Figure 4, and Figure 5 provide an overview of the Caledonia Wastewater System.

2.2 Wastewater Treatment Plant

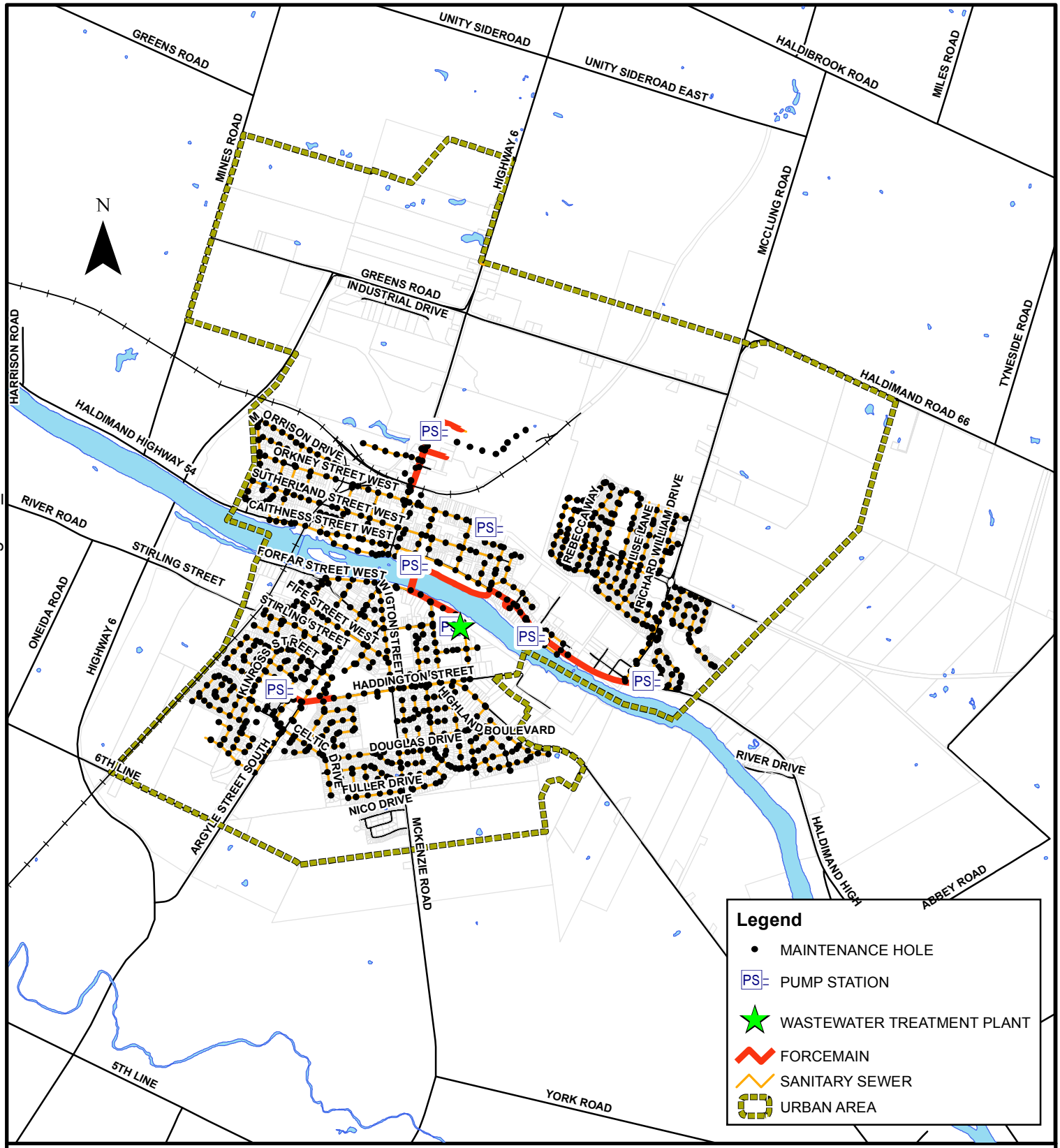
Caledonia WWTP is located on the south side of Caledonia and treats all flow from north and south Caledonia. The plant receives flow from Nairne SPS and the Main SPS (located on site). The WWTP discharges treated effluent to the Grand River, and biosolids are used for land application or stored at the Townsend lagoon until land application is allowed. The existing Caledonia WWTP is a conventional activated sludge system that consists of the following unit processes:

- Pumping station (Main SPS)
- Storm equalization
- Mechanical screens
- Primary clarifiers
- Aeration tanks
- Secondary clarifiers
- Tertiary filters
- Disinfection
- Sludge digestion, thickening and storage.

The treatment facility has a rated capacity of 7,200 m^3/day and operates under the MECP Environmental Compliance Approval (ECA) Number 0329-9LUNE8, issued by the Ontario MECP August 13, 2014. The plant is owned by the County and operated by Veolia Water (Haldimand County, 2019).

2.3 River Crossing

The Nairne SPS pumps sewage across the Grand River directly to the WWTP via twin 200 mm diameter forcemains that join into a singular 300 mm diameter forcemain. The original forcemain was constructed in 1954 and was relined in approximately 1998 during the construction of the twin forcemain. Based on a maximum pipe flow velocity of 2.5 m/s from the 2015 Haldimand County Design Criteria, the design capacity of each 200 mm diameter forcemain is 78.5 L/s. The original forcemain has an actual capacity of 83 L/s. The new forcemain collapsed, and as a result the forcemain has a reduced capacity of 7 L/s. The County constructed a new river crossing (commissioned in May 2024) with a new 300 mm diameter forcemain pipe inside a larger 1200 mm diameter casing. The 1200 mm diameter casing has been designed to accommodate additional linear infrastructure in the future.



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CALEDONIA WASTEWATER TREATMENT PLANT CLASS ENVIRONMENTAL ASSESSMENT

CALEDONIA, ONTARIO

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EXISTING CALEDONIA WASTEWATER SYSTEM - OVERVIEW

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FIGURE 3

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GREENS ROAD
HIGHWAY 6
MCCLUNG ROAD
HALDIMAND ROAD 66
GREENS ROAD
HIGHWAY 6
GREENS ROAD
HIGHWAY 6
HALDIMAND ROAD 66
INDUSTRIAL DRIVE
N
GATEWAY SPS
MINES ROAD
MCCLUNG ROAD
MACLACHLAN AVENUE
THOMPSON ROAD
MORRISON DRIVE
ARGYLE STREET NORTH
ORKNEY PS
ORKNEY STREET EAST
FLEMING CRESCENT
ARNOLD MARSHALL BOULEVARD
KELSO DRIVE
LARRY CRESCENT
BURK DRIVE
ORKNEY STREET WEST
WILLIAMSON DRIVE
ROSS STREET
DUMFRIES STREET
INVERNESS STREET
SHETLAND STREET
BANFF STREET
ABERDEEN STREET
HALLER CRESCENT
SUTHERLAND STREET WEST
SUTHERLAND STREET EAST
PARK LANE
NAIRNE PS
CAITHNESS STREET WEST
CAITHNESS STREET EAST
KINCARDINE STREET
WINNIETT STREET
KING WILLIAM STREET
KINKARDINE PS
McCLUNG PS
HARRISON ROAD
HALDIMAND HIGHWAY 54
Grand River
Grand River
HALDIMAND HIGHWAY 54
RIVER DRIVE

SANITARY MANHOLE
SANITARY PUMPING STATION
WASTEWATER TREATMENT PLANT
SANITARY SEWER
SANITARY FORCEMAIN

SEWER CATCHMENT AREAS
- Kincardine
- Avalon
- Caledonia WWTP
- McClung
- Beattie
- Nairne
- North
- Orkney
- Paisley

PROJECT:
CALEDONIA WASTEWATER TREATMENT PLANT CLASS ENVIRONMENTAL ASSESSMENT
CALEDONIA, ONTARIO

DRAWING:
EXISTING CALEDONIA WASTEWATER SYSTEM - NORTH

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FIGURE 4

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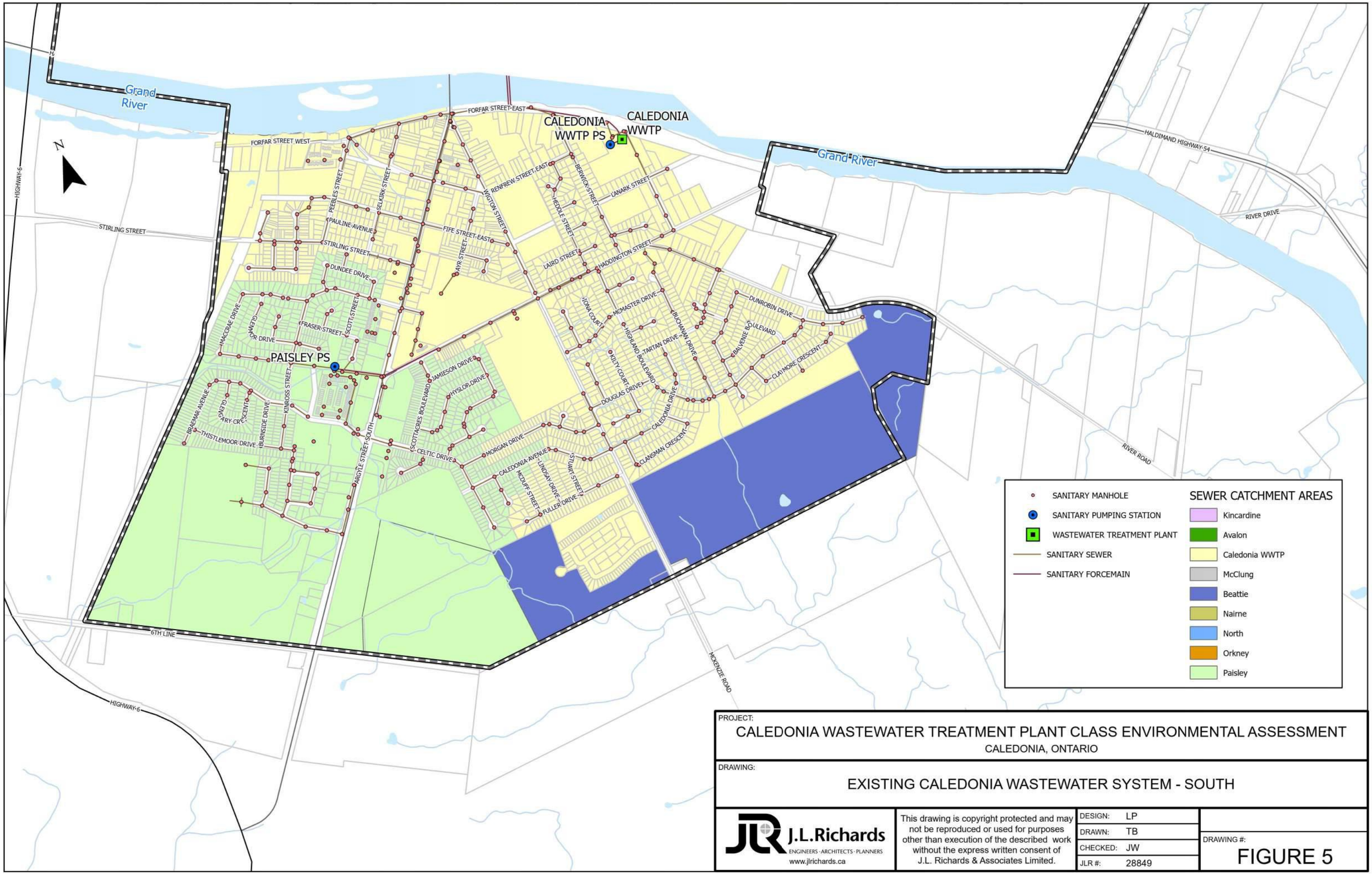

PROJECT:

CALEDONIA WASTEWATER TREATMENT PLANT CLASS ENVIRONMENTAL ASSESSMENT

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EXISTING CALEDONIA WASTEWATER SYSTEM - SOUTH

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FIGURE 5

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2.4 Pumping Stations Overview

The Caledonia Wastewater Collection system has seven sewage pumping stations, which are owned by the County and operated by Veolia Water. Table 2 summarizes relevant information for each SPS.

Table 2 Sewage Pumping Station Inventory

Facility	Construction	Address	Description	Rated Capacity (L/s)	Firm Capacity (L/s)
North					
Nairne SPS	1990	66 Moray Street	3 pumps with a capacity of 69 L/s each	207	138
McClung SPS	2017	695 Caithness Rd. Hwy 54	2 pumps each rated at a flow capacity of 115 L/s (1)	230	115 (2)
Orkney SPS	1975	200 Orkney Street East	2 pumps salser ABB, capacity unknown	Capacity unknown	Capacity unknown
Kincardine SPS	1960, Upgraded in 2009	413 Caithness Street East	2 pumps with a capacity of 14 L/s each	27	14
Domtar SPS (replaced by Gateway SPS)	Approximately 1975	320 Argyle Street North	2 pumps with a capacity of 9 L/s each	18	9
Gateway SPS (Caledonia North)	2023	350 Argyle Street North	2 pumps with capacity of 105 L/s each	210	105 (3)
South					
Main SPS	Unknown	Unknown	3 pumps with a capacity of 97.5 L/s	293	114 (4)
Paisley SPS	1975	341 Argyle Street South	2 pumps with a total flow capacity of 104 L/s	104	50 (5)

Table 2 Notes:

(1) Design report states pumps will have 80 L/s capacity (MMM Group Limited, July 2014), County provided table states pump capacity is 115 L/s. Verification is required.

(2) McClung SPS was designed for an ultimate firm capacity of 160 L/s (MMM Group Limited, July 2014).

(3) Gateway SPS (Caledonia North) was designed for an ultimate rated capacity of 150 L/s (WSP, March 2020).

(4) Based on the Capacity Evaluation of the Main SPS completed by Wood in 2018. The capacity does not include upstream flow equalization from the equalization tank at the WWTP (Wood, 29 June 2018).

(5) Firm capacity from ECA # 9571-7DCMJ4. Based on the Capacity Evaluation of the Paisley SPS completed by Wood in 2018, the Paisley SPS firm capacity is 54 L/s (Wood, 29 June 2018).

There are five sewage pumping stations on the north side of Caledonia. Nairne SPS collects all flow from north of the Grand River and pumps directly to the WWTP via 200 mm diameter twin forcemains that join into a singular 300 mm diameter forcemain across the river. Nairne SPS receives flow from Domtar SPS, Orkney SPS, Kincardine SPS, and McClung SPS. At some point, a collapse occurred in one of the 200 mm diameter forcemains heavily restricting the flow capacity. To fix this issue, the County installed a new 300mm forcemain (completed in June 2023) to work along side the still functioning 200 mm diameter forcemain.

There are two pump stations on the south side of Caledonia. Paisley SPS collects flow from the southwest area of Caledonia and pumps to the east gravity system along Haddington St via forcemain. Main SPS collects all flow from south of the Grand River, including from Paisley SPS. Main SPS pumps directly to the WWTP and is located on the WWTP site.

In March 2020, WSP completed the Caledonia Gateway Sewage Pumping Station (also called Caledonia North SPS) 100% Design Report (WSP, March 2020). The Gateway SPS was designed for an ultimate rated capacity of 150 L/s and is currently operational and it is expected to eventually replace the Domtar SPS. At full expansion, the SPS will have four pumps each with approximately 105 L/s capacity. The SPS will operate with two pumps in each wet well (three duty pumps and one standby pump).

In July 2014, MMM Group Limited completed the McClung South Sewage Pumping Station Pre-Design Report (MMM Group Limited, July 2014). The McClung SPS was designed for an ultimate firm capacity of 160 L/s. At full expansion, the SPS will have three pumps. The SPS will operate with two pumps in one wet well, and one pump in the other wet well.

2.5 Collection System

The Caledonia wastewater collection system consists of 64 km of pipe network. Pipe sizes range from 50 mm diameter to 675 mm diameter. Pipe ages range from less than 20 years to greater than 60 years. The existing wastewater collection system was shown in Figure 3, Figure 4, and Figure 5, earlier in the report.

3.0 Planning Policies and Land Use

3.1 Provincial Planning Statement

The study area was formerly subject to the 2020 Provincial Policy Statement and the Growth Plan for the Greater Golden Horseshoe, which provided general policy guidance on matters related to land use planning and development. Both documents were revoked and replaced by the new Provincial Planning Statement (PPS), which came into effect October 20, 2024.

The Provincial Planning Statement (PPS) is a streamlined framework that builds upon housing-supportive policies from the Provincial Policy Statement and the Growth Plan for the Greater Golden Horseshoe (Government of Ontario, 2020, 2024). The PPS was issued under section 3 of the *Planning Act*, and recognizes the complex relationships between the environmental, economic, health, and social factors in land use planning and supports a comprehensive, integrated and long-term approach to planning, recognizing linkages among policy areas. Alternatives in this MCEA will be assessed based on conformance with the 2024 Provincial Planning Statement.

3.2 Haldimand County Official Plan

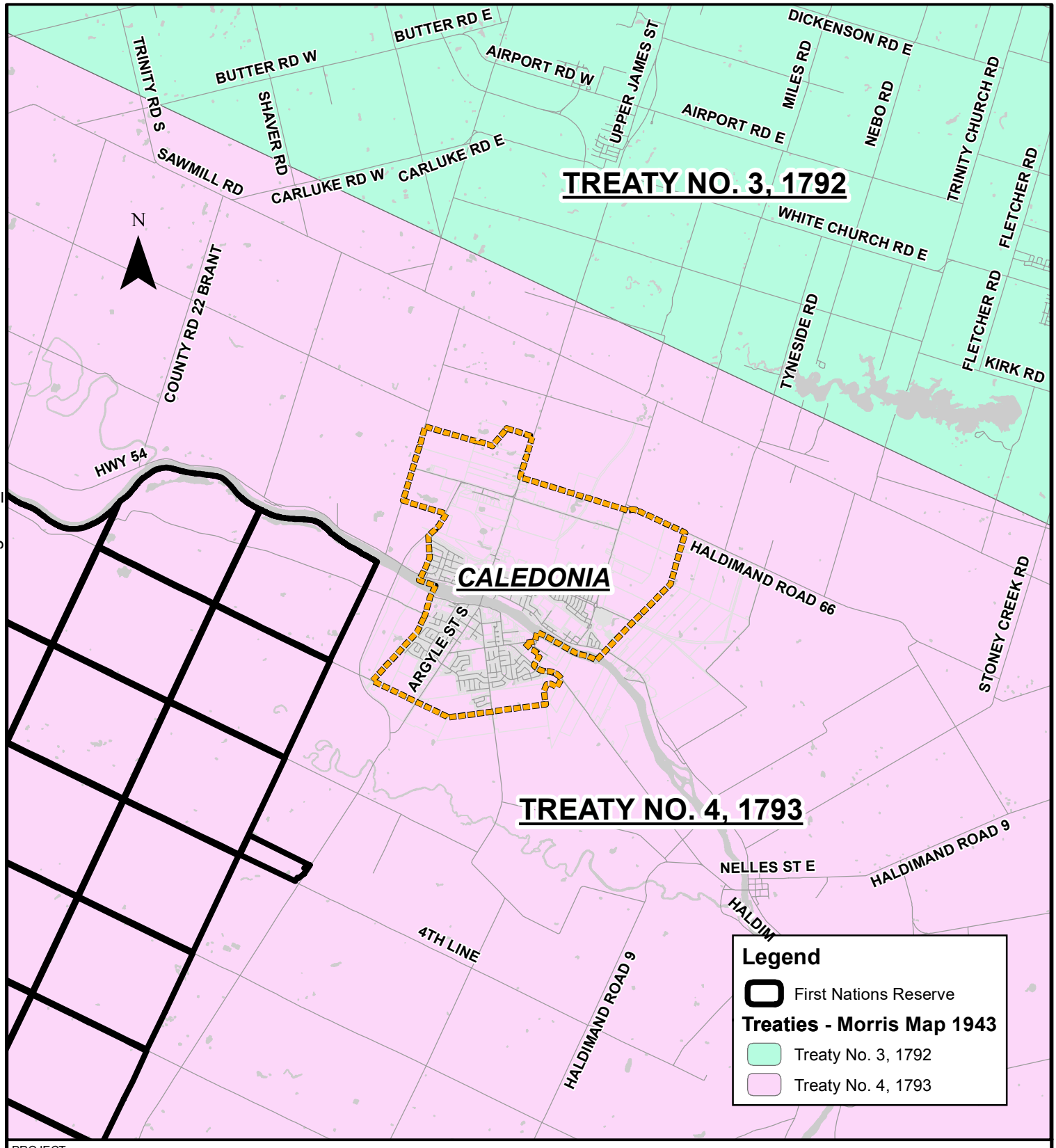
The Official Plan for Haldimand County has its basis in the Planning Act, the Provincial Policy Statement, and the Growth Plan for the Greater Golden Horseshoe. The Official Plan permits wastewater treatment plants in all land use designations in the County, subject to certain conditions. Section 5.E.1 of the Official Plan states:

"Utilities and services necessary for the provision of municipal water and sanitary sewage, storm services, public roads, railway lines, hydro, gas, and facilities for the detention, retention, or discharge of storm water are permitted in all land use designations provided that such development satisfies the provisions of the Environmental Assessment Act, the Environmental Protection Act, and any other relevant legislation except where any of these facilities would promote a development pattern that is contrary to the Official Plan."

Further, the Zoning By-law for Haldimand County, under Section 4.62, permits water or sewage treatment plants including any accessory public utility yard in all zones.

3.3 Rights of Indigenous Peoples and Treaty Lands

As documented in Appendix A (Lickers, 2022) when considering the impacts on Rights within the study area, it is important to consider, not only Aboriginal Rights, as defined by Section 35 of the Constitution Act (1982), but also these inherent rights as recognized by the United Nations Declaration on the Rights of Indigenous Peoples and Canada’s commitment to implement them under UNDRIP Act (UNDRIPA).These inherent rights were recognized through treaties signed between the Nations and the Crown. Treaties in the study area are highlighted in Figure 6.



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CALEDONIA WASTEWATER TREATMENT PLANT CLASS ENVIRONMENTAL ASSESSMENT

CALEDONIA, ONTARIO

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PROVINCIAL FIRST NATIONS AND TREATIES

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FIGURE 6

Relevant treaties in and around the study include:

- Nanfan Treaty (1701)
- Between the Lakes Treaty No. 3 (1792)
- Haldimand Proclamation (1784)
- Simcoe Patent (1793)

Other Treaties, include:

- The Royal Proclamation (1763)
- The Treaty of Niagara (1764)

In addition to treaties, there have been several foundational court decisions that have further refined Canada's recognition of "Aboriginal Rights". It is important to consider that these rights are not frozen in time but evolve with the socio-economic and socio-political influences of the time.

In addition to the above, it is noted that there has been a moratorium on development in the Haldimand Tract announced on April 20, 2021, by the Haudenosaunee Confederacy Chiefs Council (HCCC). This moratorium may have an impact on development in Caledonia including the siting of the WWTP for Caledonia.

3.4 Adjacent Property Uses

The study area for the proposed new WWTP consists of two sites located on the north and south sides of the Grand River. The northern site is located north of Highway 54 to the east of the urban boundary of Caledonia. The southern site is located north of River Road to the east of the urban boundary of Caledonia. Both sites are located on agricultural land. A house and farm complex are located on the northern site. The northern site is surrounded by agricultural and residential land, as well as a trail. The southern site is surrounded by agricultural and residential land, as well as the Grand River to its north.

The minimum separation distance for WWTPs with a capacity greater than 500 m^3/day but less than 25,000 m^3/day is 100 m according to *the D-2 Compatibility between Sewage Treatment and Sensitive Land Use* guidelines for Ontario. There may be residences within the 100 m distance on both sites, therefore a buffer acquisition or odor and noise control strategies may be required. Additional information on site selection can be found in Section 8.0.

3.5 Other Provincial Planning Considerations

The study area is not subject to the Oak Ridges Moraine Conservation Plan, Niagara Escarpment Plan, Greenbelt Plan, or Lake Simcoe Protection Plan.

3.6 Development and Growth Forecast

The existing population of Caledonia is 12,179 from the 2021 Canadian Census (Statistics Canada, 2021). Existing land use in Caledonia consists of residential, industrial, commercial, and institutional (ICI) uses.

Haldimand County Planning department provided residential projections in residential units and industrial, commercial, and institutional (ICI) projections in units of area (hectares) in March 2022 (included in Appendix B). The County also assigned each development a timeline for construction in 0-5 years, 5-10 years, 10-15 years, 15-20 years, 20-25 years, and 30+ years.

Residential and ICI growth was summarized by timeframe. As noted in Section 3.3, development potential of certain lands in Caledonia has been impacted by ongoing land claim disputes between First Nations and the Government of Canada. This should continue to be monitored as development plans advance.

Anticipated growth in Caledonia for the build-out horizon (30+ years) is approximately 8,892 residential units, 174.40 hectares of industrial land, and 9.90 hectares of commercial land (excluding additional commercial land in the Marz Homes Lands). Refer to Table 3 for a summary of equivalent population. See Figure 7 build-out distribution of residential and ICI growth. Equivalent population calculations are described further in Section 5.2.

Table 3 Distribution of Future Development to Build-Out

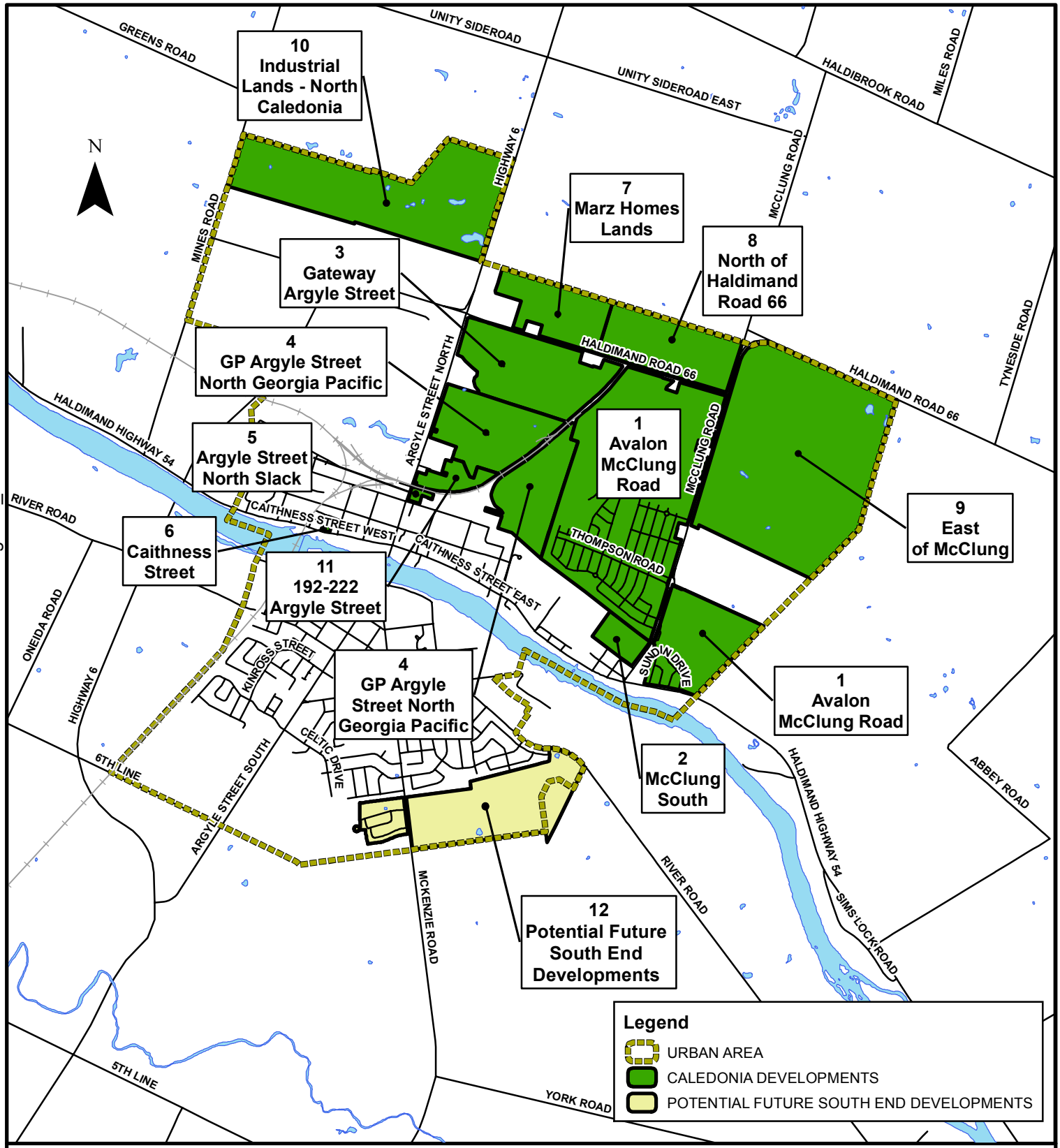
Parcel Number	Development	Type (Residential, Commercial, or Industrial)	Build-out Equivalent Population (persons) (1)
1	Avalon McClung Road (Phases 3B, 4, 5, 5B, 6-16)	R	6775
2	McClung South	R	403
3	Gateway Argyle Street (Phases 1-3)	R/C	1508
4	GP Argyle Street North Georgia Pacific	R	1097
5	Argyle Street North Slack	R	44
6	Caithness Street	R	59
7	Marz Homes Lands	R/C (2)	1214
8	North of Haldimand Road 66	R (2)	1512
9	East of McClung	R (2)	7064
10	Industrial Lands – North Caledonia	I (2)	8612
11	192-222 Argyle Street North	C (2)	348
12	Potential Future South End Developments (3)	R (2)	2,334

Table 3 Notes:

(1) The County provided the future development in units. The equivalent population was estimated using persons per unit from the Design Criteria in Section 5.1.

(2) The County provided area of development in hectares. The number of residential or ICI units was estimated using density (persons per hectare) and persons per unit from the Design Criteria in Section 5.1.

(3) At this stage, the development timeline of the South End Developments is unknown, therefore the population numbers of the South End Developments were not included in the flow projections.



PROJECT:

CALEDONIA WASTEWATER TREATMENT PLANT CLASS ENVIRONMENTAL ASSESSMENT

CALEDONIA, ONTARIO

DRAWING:

CALEDONIA DEVELOPMENT AREAS TO BUILD-OUT

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS
www.jlrichards.ca

DESIGN:	TB
DRAWN:	TB
CHECKED:	JW
JLR #:	31196-009

DRAWING #:

FIGURE 7

File Location: P:\31000\31196-009 - Caledonia WWTP Class EA\3-Production\1-Civil\GIS\31196-009 Figure7_Buildout.mxd

Plot Date: December 5, 2023 8:50:03 AM

4.0 Environmental and Land Use Considerations

4.1 Natural Environment

The study area consists of two sites located on the north and south sides of the Grand River, as shown in Figures 12 and 13 (Figures 8 and 9 of the Detritus Stage 1 Archaeological Assessment). Both sites contain tributaries of the Grand River. For this Class EA, Hutchinson Environmental Services Limited (HESL) conducted a background review and corresponded with regulators prior to conducting field surveys in the spring and summer of 2022 to prepare a Natural Heritage Assessment (Appendix C). Terrastory Environmental Consulting Inc. conducted vegetation and wetland surveys. Notably, the southern site was identified in the summer of 2022 and was therefore not included in the surveys made earlier in the spring. The study location was chosen for general representation. Further studies, if required, should be concentrated within the proposed footprint of the plant and associated infrastructure once a preferred alternative is selected. The HESL report characterized natural heritage features and functions in the new potential WWTP sites, indicated potential impacts of the new proposed WWTP on these areas, and recommended measures to mitigate the impacts.

The HESL study concluded that:

- No provincially significant wetlands, woodlands or Areas of Natural and Scientific Interest (ANSIs) were identified in the study area.
- The southern site contained possible habitat for Species at Risk.
- Both sites contained Significant Wildlife Habitat.

After reviewing both site options HESL determined they are equally suitable for a new WWTP once appropriate mitigation measures are undertaken. The northern site has a provincially rare species of significance, and the south site has potential habitat for an endangered species, the Gray Ratsnake. Both properties may provide Significant Wildlife Habitat for Monarch Butterfly and Grasshopper Sparrow and fall under Grand River Conservation Authority (GRCA) regulated areas.

Upon reviewing the report, the MECP requested an Information Gathering Form (IGF) be completed to determine if the proposed WWTP will contravene the Endangered Species Act, and whether an overall benefit permit is needed to proceed. The IGF will need to be initiated once a site is selected. The existing Terrestrial Natural Heritage Ecological Land Classification (ELC) conditions are illustrated in Figure 8 and Figure 9 (Figures 6 and 7 of the HESL Natural Heritage Assessment). The existing Aquatic Natural Heritage ELC conditions are illustrated in Figure 10 and Figure 11 (Figures 8 and 9 of the HESL Natural Heritage Assessment).

4.1.1 Vegetation Communities and Significant Wildlife Habitat

HESL found that the north site had seven vegetation communities and the south site had eleven (11). The north site mainly consists of agricultural land with a house and some structures. The south site is also mainly agricultural with some meadow and forested communities near the Grand River. A provincially rare vegetation community of significance, Fresh – Moist Black Walnut Lowland Deciduous Forest, was identified on the south site.

At the north site, 72 vascular plant species were identified, including a provincially rare species of significance in good condition, the Northern Pin Oak. At the south site, 158 vascular plant species were identified. Five candidates for Significant Wildlife Habitat were identified by HESL.

Monarch Butterfly and Grasshopper Sparrow habitat was identified as being susceptible to impact from construction. HESL recommended any development in the northern site be shifted to avoid the Pin Oak tree. The tree is too large to be transplanted, so if avoiding it is not possible a restoration plan located in an adjacent natural area must be developed by a qualified botanist.

4.1.2 Aquatic Habitat

HESL assessed watercourses on both sites, excluding the Grand River. The north site contains two tributaries of the Grand River, labelled A and B on Figure 10 (Figure 8 of the HESL Natural Heritage Assessment). Tributary B falls within the proposed WWTP area. Both were dry at the time of the survey. Tributary A had steep defined banks with signs of erosion and likely has ephemeral flows during the spring and rain events. Tributary B has no defined banks and was planted over with soybeans.

The Grand River is located on the northern border of the southern site. Once an outfall location for the WWTP is selected a background review, aquatic habitat assessment, and impact assessment will need to be conducted for the Grand River. The south site also contains two tributaries of the Grand River, labelled C and D on Figure 11 (Figure 9 of the HESL Natural Heritage Assessment). Both had no flow in the swale but had standing water in the culvert and likely have ephemeral flow during rain events. Neither are key hydrologic features. Tributary C overlaps with the proposed WWTP footprint. Consultation with the GRCA will be required regarding site preparation and construction of the WWTP to determine if permitting is necessary.

4.1.3 Breeding Amphibians and Birds

Calls from three amphibian species at the north site and one species at the south site were recorded by HESL. No species at risk were recorded, and there is no amphibian habitat in the proposed WWTP footprint.

There were 45 bird species recorded in the study area, and most were typical to the vegetation communities. This includes two species at risk which were the Eastern Wood-pewee and the Barn Swallow. Three area-sensitive species were found including the Hairy Woodpecker, White-breasted Nuthatch, and Savannah Sparrow. Two introduced bird species were identified but are considered naturalized in Ontario.

4.1.4 Species at Risk and Species of Conservation Concern

HESL identified 40 species at risk in the region through a desktop study. Nine were considered not likely after site investigations. Fifteen were aquatic species with potential to occur in the Grand River and will be addressed in later studies. The remaining 16 species at risk were determined as having possible habitat in the southern site, while five of the 16 had possible habitat at the north site. Eight of the 16 species at risk are designated as Special Concern and are not protected by the ESA or SARA.

Of the 16 species at risk identified, three were observed at the northern site. The Eastern Wood-pewee, the Monarch Butterfly and the Barn Swallow are species of Special Concern. The Barn Swallow was observed foraging, but potential nesting habitat was not identified in the site. Two of these three species were also observed at the southern site. In addition, along the western and northern boundary of the south site, deciduous forest is present which is the potential habitat for the Grey Ratsnake, Although the proposed WWTP does not encroach on this area, agricultural fields can be a hunting ground for this species, so mitigation measures should be considered.

Figure 8 Existing Terrestrial Natural Heritage Conditions at the North Site

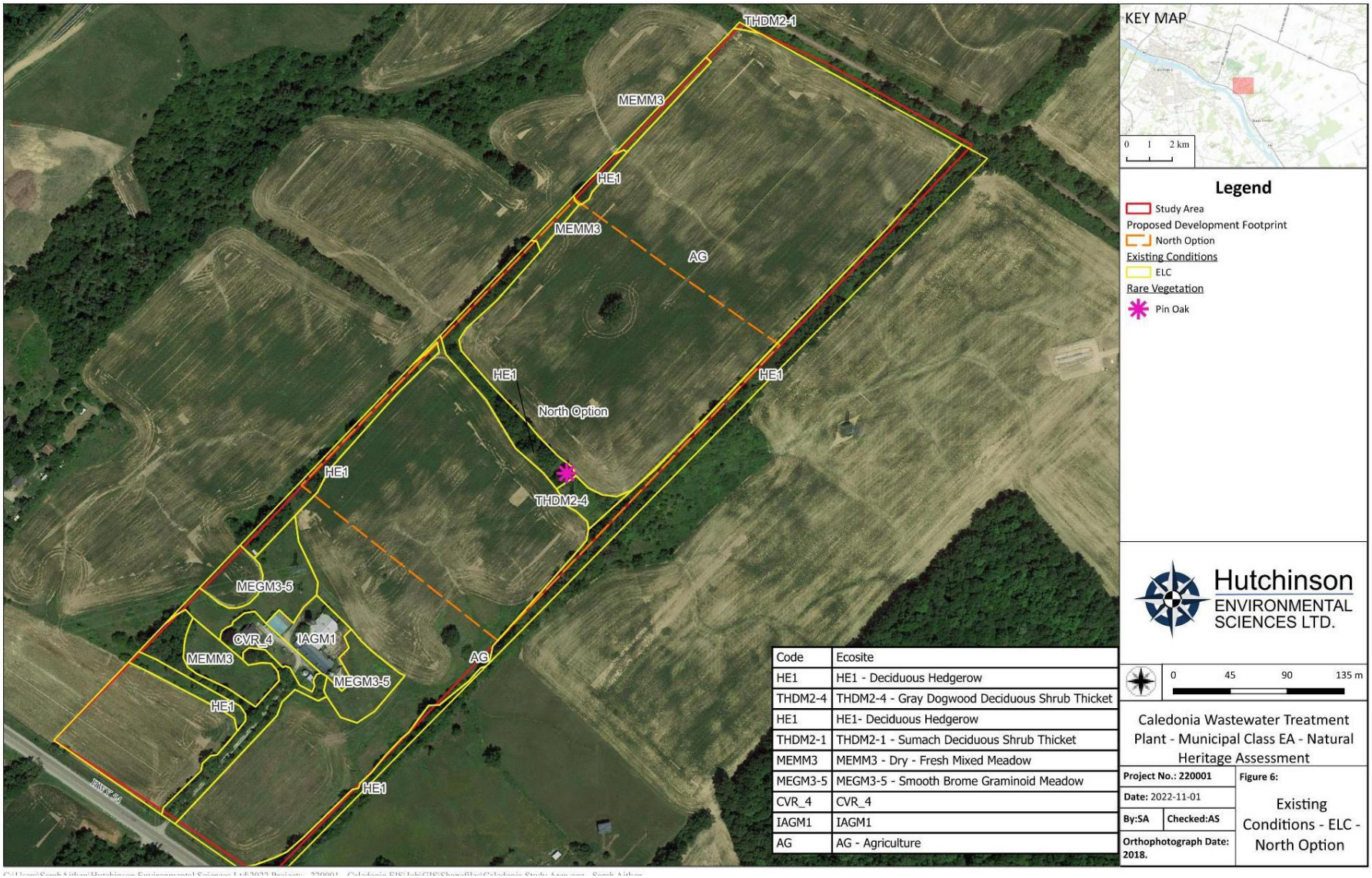
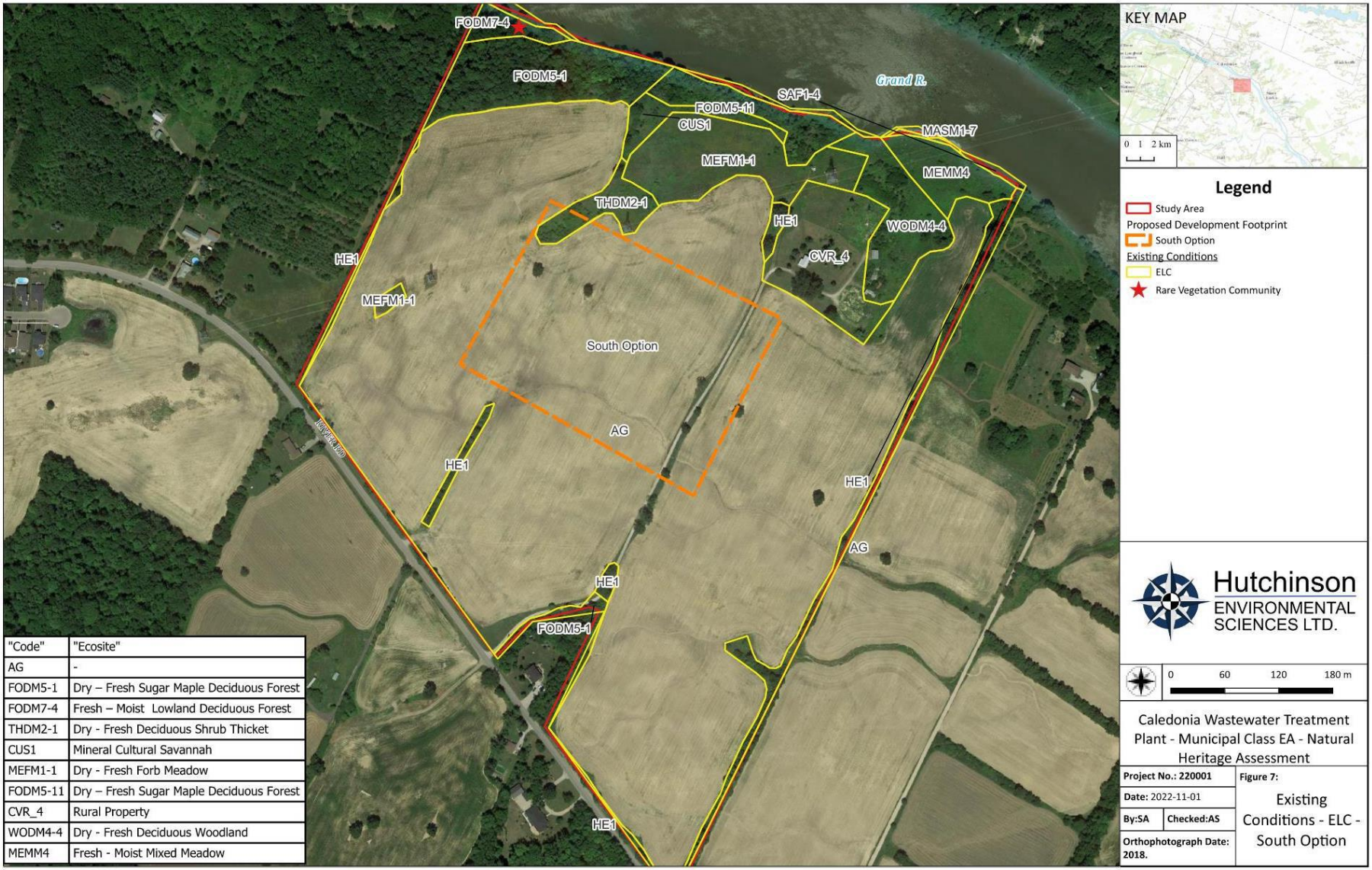


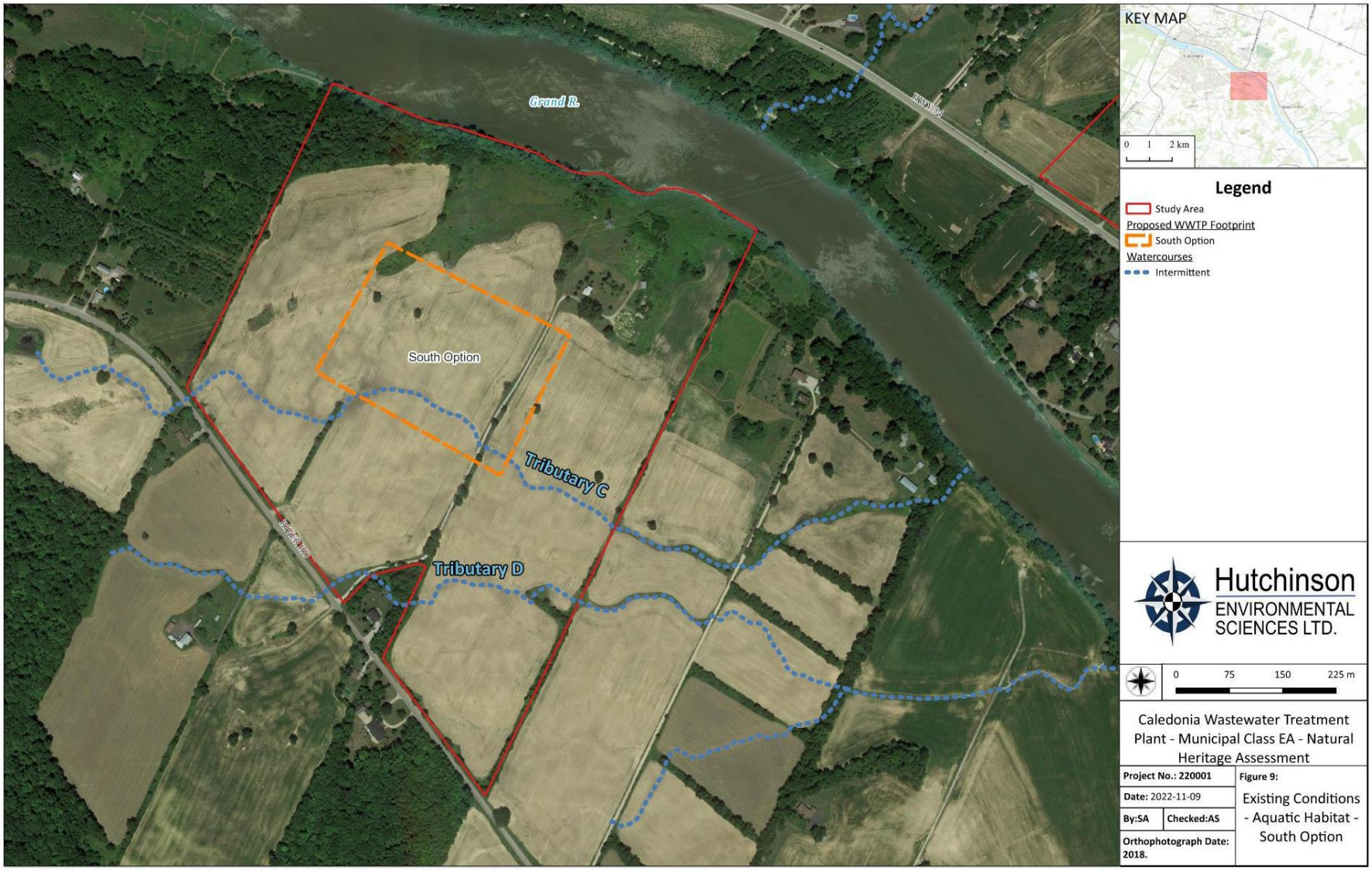
Figure 9 Existing Terrestrial Natural Heritage Conditions at the South Site



"Code"	"Ecosite"
AG	-
FODM5-1	Dry – Fresh Sugar Maple Deciduous Forest
FODM7-4	Fresh – Moist Lowland Deciduous Forest
THDM2-1	Dry - Fresh Deciduous Shrub Thicket
CUS1	Mineral Cultural Savannah
MEFM1-1	Dry - Fresh Forb Meadow
FODM5-11	Dry – Fresh Sugar Maple Deciduous Forest
CVR_4	Rural Property
WODM4-4	Dry - Fresh Deciduous Woodland
MEMM4	Fresh - Moist Mixed Meadow

Figure 10 Existing Aquatic Natural Heritage Conditions at the North Site

Figure 11 Existing Aquatic Natural Heritage Conditions at the South Site



4.1.5 Geology and Hydrogeology

Caledonia is in the Salina Formation (Ontario Geological Survey). This region is comprised of limestone, dolostone, shale, sandstone, gypsum, and salt. The study area is in the vicinity of the closed Georgia Pacific (GP) Mine #3 and there are extraction zones throughout the area. If development of a wastewater water treatment plant were to proceed over a former extraction zone, site rehabilitation is likely to be required. In January 2021, Golder Associates Limited completed Phase 1 of a mine hazard review on lands over the closed Georgia Pacific (GP) Mine #3 in Caledonia (Golder, January 2021). Readers are referred to that report for additional information.

4.2 Ground and Surface Water

4.2.1 Source Water Protection

Ontario's Clean Water Act provides the mandate for a provincial drinking water source protection program in Ontario. Its focus is on the protection of water sources for municipal drinking water systems, with additional attention to surface water and groundwater sources on the broader landscape.

The applicable Source Protection Plan (SPP) is the Grand River Source Protection Plan which was updated by the Grand River Conservation Authority (GRCA) in February 2022 and recently amended in September 2024. The Grand River Assessment Report provides the technical basis for the SPP and was published in February 2022.

There are no Intake Protection Zones or Wellhead Protection Areas in Caledonia. Consultation with the GRCA will be undertaken prior to project implementation to ensure the proposed projects do not negatively impact water supplies within the area.

4.2.2 Groundwater

There are no groundwater Permits to Take Water (PTTW) within the study area. The closest PTTW is in the east end of Caledonia near McClung SPS, at the intersection of Haldimand Highway 54 and Sundin Dr. right across the river from the proposed site (approximately 600 m away). Properties adjacent to the north and south sites are serviced by private wells. A PTTW will be required from the MECP if dewatering exceeding 50,000 L/day takes place during construction. A hydrogeological investigation will be required prior to construction.

4.2.3 Surface Water

The Grand River runs through the study area and will be the receiver of discharge from the outfall of the new WWTP. It runs north of the southern site and south of the northern site. The river is over 300 km long and terminates in Lake Erie, making it the largest river entirely within Southern Ontario (HESL, Dec 2022). It provides spawning and foraging for a variety of fish species as well as habitat for various mussels including Species at Risk (HESL, Dec 2022).

The Grand River watershed drains an area of nearly seven thousand square kilometers including 39 municipalities and 30 WWTPs (HESL, Dec 2022). The study area drains 6000 km^2 of mainly agricultural lands in addition to some swamp and developed areas.

HESL completed an Assimilative Capacity Study (ACS) of the Grand River for this Class EA to determine effluent criteria for a new and re-rated WWTP (Appendix D). It also identified a potentially preferred discharge location for a new WWTP. Analysis included desktop studies, tracer tests, and water modelling. The ACS was completed prior to finalizing the updated Caledonia Urban Boundary, the buildout flows considered at this stage were 15,200 m^3/day. The future South End Developments were not accounted for as part of this Class EA as the timing of the South End developments has not been determined. The future Caledonia flows were determined to be 13,400 m^3/day excluding the South End developments.

4.2.4 Wastewater Optimization Program

The Grand River is a significant contributor of Lake Erie's phosphorous loading due to its large watershed area (Government of Canada, 2018). This loading is believed to be a contributor to the formation of algal blooms in Lake Erie's eastern basin.

To reduce these loads, the MECP and the GRCA implemented the Grand River Watershed Management Plan. Part of this plan includes working with municipalities such as Haldimand County to deliver the Grand River Watershed-wide Wastewater Optimization Program (WWOP). Participants in this program volunteer to achieve phosphorous and ammonia targets which in some cases are more stringent than regulatory requirements, as outlined in the Water Management Plan. Haldimand County participates in the GRCA WWOP and continues to support the program's strategic planning and submit annual data for the WWTPs within the GRCA watershed. Further, the County has implemented an internal optimization program to apply the concepts of data-based decision making and targeted performance improvement for its WWTP which includes practices such as monthly performance review meetings, wastewater workshops and training, and optimization studies.

4.3 Cultural Heritage

A Cultural Heritage Existing Conditions and Preliminary Impact Assessment of both potential wastewater treatment plant sites was completed by Detritus Consulting Ltd. (Detritus) in September 2022 for this Class EA. It is included in Appendix E. For the northern site a 6.2 hectare footprint within the proposed parcel was used for the assessment, and similarly a 6.25 hectare footprint was used for the southern parcel. The study area is in a region that has been occupied for 11,000 years and inhabited by Iroquoian speaking groups prior to European settlement.

Both footprints contain no structure and therefore have no Built Heritage Resources. They also do not fall within a defined geographical area and do not have qualities that differentiate them from generic farmland, which means they do not contain or exist within a Cultural Heritage Landscape. Neither parcel has Design, Physical, Historical, Associative, or Contextual Value as defined in O.Reg 9/06. As there were no impacts identified, Detritus did not recommend mitigation measures.

4.4 Archaeological Resources

4.4.1 Terrestrial Archaeology

A Stage 1 Archaeological Assessment of both potential wastewater treatment plant sites was completed by Detritus Consulting Ltd. (Detritus) in September 2022 for this Class EA and is included in Appendix F. For the northern site a 6.2 hectare footprint within the proposed parcel was used for the assessment, and similarly a 6.25 hectare footprint was used for the southern parcel. Stage 1 and 2 Archaeological Assessments have previously been conducted within 1 km of the study area for other proposed developments.

In the Stage 1 report, 426 archaeological sites were identified within 1 km of both footprints through a desktop study. Only one site was identified within 50 m of the footprint under consideration on the south side of the Grand River.

The field study determined that both footprints had some areas with moderate to high archaeological potential due to soil quality, proximity to the Grand River, length of occupation, and proximity to the aforementioned archaeological sites. These areas are pictured in Figure 12 and Figure 13 (Figures 8 and 9 of the Detritus Stage 1 Archaeological Assessment).

Subsequent to the Stage 1 Archaeological Assessment, it was determined that additional lands would be required for the project that were not included in the 2022 Stage 1 Archaeological Assessment. As such, ARA began a Stage 1 and Stage 2 Archaeological Assessments for these lands in 2024. The Marine Archaeological Assessment has been completed for the preferred site, revealing no archaeological concerns in the area (see full report in Appendix F). Stage 2 land archaeological assessment are currently ongoing.

Figure 12 Further Archaeological Recommendations for Parcel #1

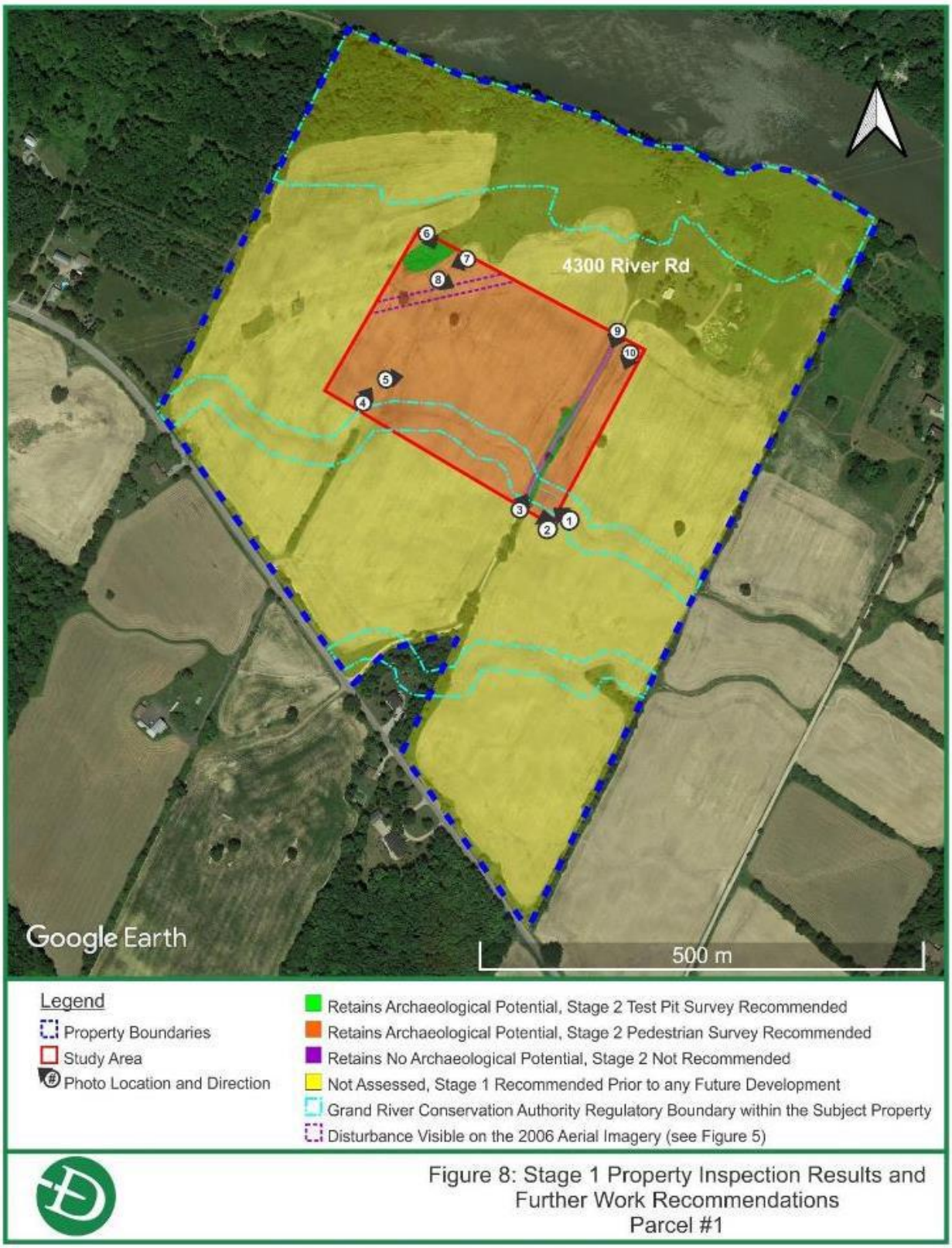
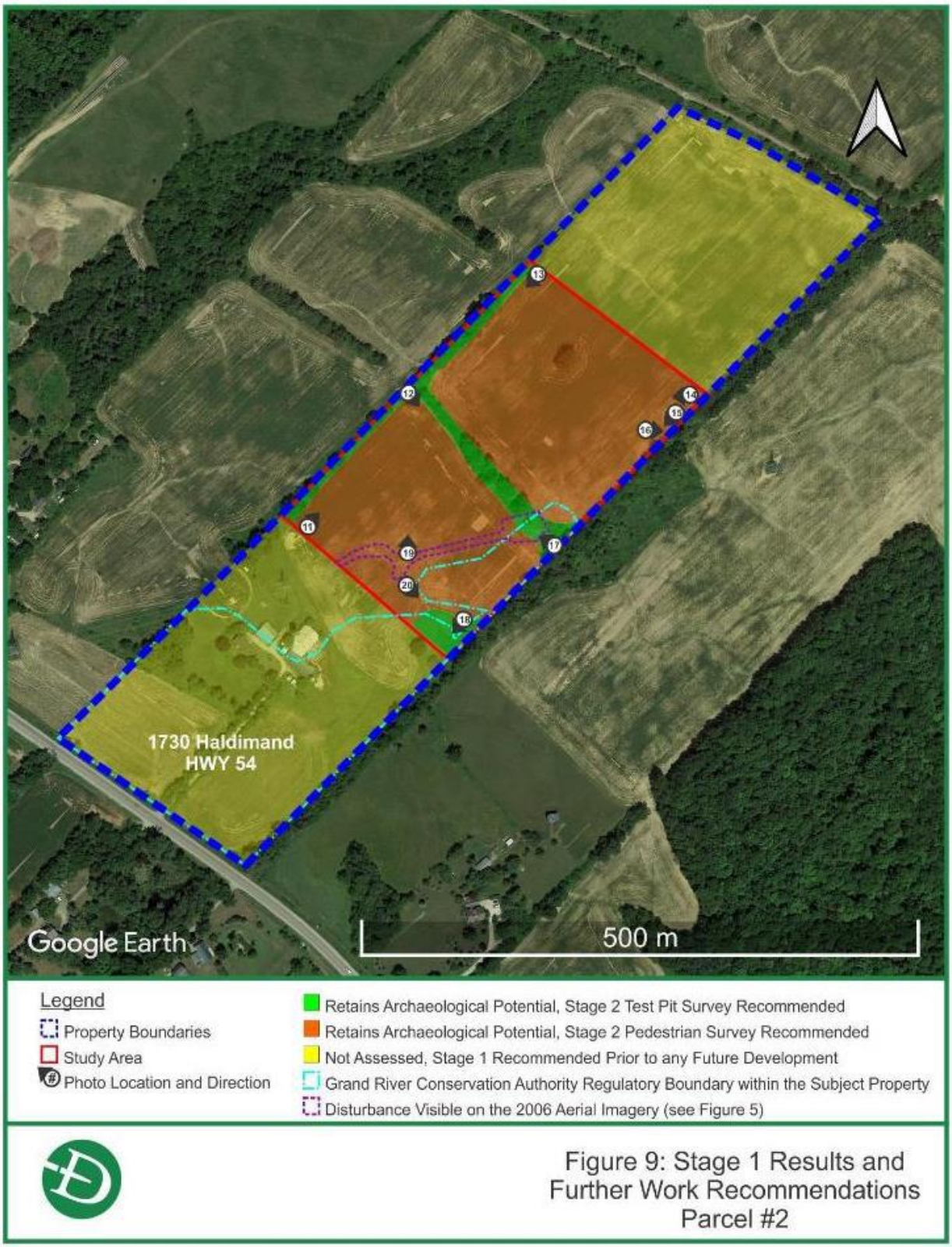


Figure 13 Further Archaeological Recommendations for Parcel #2



4.5 Climate Change

The Considering Climate Change in the Environmental Assessment Process Guide (2017) outlines the MECP's expectation for considering climate change in the preparation, execution and documentation of environmental assessment studies and processes.

4.5.1 Climate Change Mitigation

Climate change mitigation refers to measures implemented to reduce the project's expected production of greenhouse gas (GHG) emissions and impacts on aqueous and terrestrial carbon sinks. The project's GHG emissions can be categorized as operating carbon (emitted during the operation phase) or embodied carbon (emitted during the manufacturing and construction phase).

A WWTP's operating carbon consists of direct and indirect emissions. Direct emissions are a result of combustion of fossil fuels on site (e.g., natural gas combustion for space heating) or process emission (e.g., nitrous oxide fugitive emissions during denitrification). Indirect emissions are due to consuming energy that was generated from off-site combustion of fossil fuels (e.g., electricity generated from gas power plants).

Impacts on carbon sinks are landscape changes that affects the removal or storage of carbon dioxide from the atmosphere. Construction of a new WWTP may alter the landscape's ability to store carbon or remove carbon dioxide from the atmosphere. Mitigation measures to reduce the impact of this project on carbon sinks include preserving green space during construction and maximizing tree planting after the major construction is complete.

4.5.1.1 Operational Carbon Emissions

Direct emissions can primarily be mitigated by reducing the on-site space heating demand that is often supplemented by combustion of fossil fuels, or by reducing process heating loads. Alternatively, indirect emissions can be mitigated by implementing technology that offsets grid electricity purchase with technology that generates electricity on site. Several technologies can mitigate either or both categories of emissions, including but not limited to:

1. Solar Photovoltaic (PV) Panels:

Rooftop PV systems are technically feasible on most buildings, whether they have flat or pitched roofs. As well, wall-mounted PV systems have been deployed on buildings with large walls free of obstructions as awnings or flush with the wall surface. As PV systems currently generate electricity at the approximate retail value of electricity in Ontario, most systems will payback within their lifetime. Roofs with many different levels or large amounts of existing rooftop equipment (e.g., fresh air intakes, air conditioning units, vents, skylights) may not be able to accommodate rooftop PV systems. The availability of space surrounding the WWTPs at each location can be utilized for ground-mounted photovoltaic (PV) panels, which are also technically and economically viable. These systems would reduce indirect emissions at the proposed WWTP by providing renewable electricity generation.

PV systems have been implemented throughout Ontario including at the Woodstock WWTP in Oxford County, ON.

2. Solar Thermal (Air):

Solar thermal air technology utilizes solar energy to generate heating for air. These systems are commonly mounted on south-facing walls of buildings or facilities, and work by preheating incoming ventilation air serving air-handling units that distribute purified, conditioned air to the duct system of a building, thereby reducing direct emissions at the proposed WWTP. Indirect emissions may increase slightly from the use of additional fans to transport the heated air through new or existing ductwork. These collectors are most common on industrial and agricultural buildings with high ventilation requirements.

Solar thermal systems have been used at WWTPs for preheating air to the blowers for aeration (e.g., Wanapitei Sewage Treatment Plant in Sudbury, ON).

3. Energy Recovery Ventilation (ERV):

Energy recovery ventilation (ERV) is a system which works between two air sources at different temperatures. ERV is a method used to reduce the space heating and cooling demand of buildings in the winter and summer seasons, respectively. In winter, ERV systems recover the residual heat in the exhaust air and transfers the heat to the incoming supply (fresh outdoor) air as part of a preheating control; the preheated air is introduced into the ventilation system which serves the interior of the building. In summer, ERV systems pre-cool and dehumidify the exhaust/supply air mix before the air enters the interior space of the building. ERV technology can reduce direct emissions at the proposed WWTP; however, indirect emissions would likely increase due to fan requirements, as well as the additional electrical load demanded for space cooling, though space cooling is not an essential operational mode of these systems.

These systems are regularly incorporated into the HVAC systems of various building archetypes (i.e., commercial, and institutional buildings, industrial, residential, etc.).

4. Air-sourced Heat Pumps (ASHPs):

ASHPs are equipment that can offer both cooling and heating to a space by utilizing a working fluid which is used to either extract or expel thermal energy to the outdoors. In heating mode, the working fluid – at a low pressure and temperature – is passed through coils in an outdoor heat exchanger allowing the fluid to gain heat from ambient air as long as its temperature is less than that of ambient temperature. The fluid is then compressed into a superheated vapour which passes through coils in an interior heat exchanger, allowing thermal energy to be drawn out of the fluid into the space of interest via forced convection. The cycle is reversed in cooling mode, wherein the low temperature, low pressure working fluid passes through coils in an interior heat exchanger, allowing the room to be cooled via forced convection, after which the fluid is compressed into a superheated vapour, which departs thermal energy to the outdoors. These systems utilize ambient thermal energy and thus only require electricity to power pumps and fans; as such, direct emissions related to space heating would be reduced at the proposed WWTP, but indirect emissions would be generated to provide power to the fan and pump equipment.

These systems are regularly incorporated into the HVAC systems of various building archetypes (i.e., commercial, and institutional buildings, industrial, residential, etc.).

5. Wastewater Energy Transfer (WET) Systems:

Similar to ASHP, a WET system exchanges thermal energy with the wastewater at the plant. Independent from the heat recovery system type, two main components may be involved in WET system: a heat exchanger and heat pump. The wastewater is passed through piping that runs through a heat exchanger; inside the exchanger, this piping runs adjacent to a separate network of piping, within which is water that is used in the hydronic heating loop that feed into a heat pump. The heat pump heats the hydronic loop water further, after which the water is fed to buildings that require heat, thereby reducing direct emissions compared to conventional combustion-based heating systems. Heating is accomplished via forced convection using fans that blow air over the hydronic heating coils containing the heated water, which would increase indirect emissions. When the average temperature of the wastewater is higher than 30°C, heat may be recovered by only using a heat exchanger.

WET systems have been implemented at the Saanich Peninsula WWTP in BC; the Cogswell WWTP in Halifax, NS; and similar (upstream) WET systems have been implemented in York Region or Toronto, ON, or have been planned (Peel Region, Toronto, ON).

Due to the surrounding sanitary and stormwater infrastructure to the proposed WWTP sites, as well as the proximity of the proposed WWTP locations to surrounding buildings, the WET system – combined with a heat pump-based heating system – could be an effective means to either reduce direct emissions on site, or supplement off-site heating demand at nearby developments. The application of heat pump technology with an auxiliary heating system (e.g., electric resistance heating) can replace conventional hydronic loop heating systems that typically use natural gas-fired boilers for a heat source. A heat pump-based system for space heating can be augmented by using a wastewater energy transfer (WET) system for a heat source.

A WET system could be installed at the outfall at either of the proposed WWTP locations (4300 River Rd or 1730 Haldimand Hwy 54). The WET system may also be used to supply the residential neighborhoods near the 1730 Haldimand Hwy 54 site that are expected to be developed, this has the potential for WWTP to be a carbon negative facility. The same approach – supplying nearby buildings with heat – can be accomplished by installation of a WET system at the pumping stations serving the WWTP. For example, a WET system installed at the Nairne pumping station can help offset space heating demands throughout the commercial area near the Argyle St. North and Caithness St. West intersection.

6. Combined Heat and Power (CHP):

CHP systems, also known as cogeneration or COGEN systems, are engines that generate both electricity and heat simultaneously. These engines typically use fossil fuels (diesel, natural gas, etc.) for combustion, but biogas produced from the anaerobic digestion process can also be used as a combustion fuel once it is conditioned (the biogas requires pretreatment to remove contaminants such as moisture, hydrogen sulfide, and siloxanes). Molten carbonate fuel cells (as well as other types) may also serve as a cogeneration or CHP system, where – rather than utilizing combustion of fossil fuels – the fuel cell utilizes electrochemical reactions and high temperatures to generate electricity. Both fuel cell-based and fossil fuel-based CHP systems offer substantial amounts of thermal energy to be captured, either from the combustion engine and exhaust stack (in the latter case), or directly from the fuel cell.

CHP systems offer a reduction in direct emissions through waste heat capture, as well as a reduction in indirect emissions through generation of electricity on site when using a fuel cell-based CHP; fossil fuel-based CHP systems may have a greater emissions factor for electricity than grid-purchased electricity depending on the combustion fuel emissions characteristics. In the case of biogas-fueled CHP systems, these emissions may be regarded as biogenic carbon, which is already accounted for in the global carbon cycle and can be considered a net zero carbon fuel.

Many combustion-based CHP systems have been implemented at WWTPs across Ontario.

7. Renewable Natural Gas (RNG):

Renewable Natural Gas (RNG) is the conditioning, re-purifying, and upgrading of biogas to meet the quality standards of natural gas. This technology would only be considered if the proposed WWTP produces biogas from anaerobic digestion. Depending on the end-use of the RNG, as well as the desired rate of RNG production, several design options may be considered, which could change the degree to which GHG emissions are reduced. For example, upgrading only the amount of biogas that would be flared at the WWTP would reduce direct emissions by the same amount produced via flaring. Upgrading biogas to RNG with concurrent application of renewable heat generation technology such as a WET system (or other renewable systems) would make more biogas available for upgrading to RNG. In this case, direct emissions reductions would be decreased by the same amount produced via flaring plus the additional amount that would be emitted in the absence of the WET (or other) system for heat generation. RNG produced that is injected back into the grid to obtain carbon offset credits (withholding the value of environmental attributes associated with the RNG) would be considered a direct emissions reduction at the proposed WWTP.

RNG upgrading is utilized at the Woodward Avenue WWTP in Hamilton, ON; the Dufferin Organics Processing Facility in Toronto, ON; as the Victor Valley Wastewater Reclamation Authority WWTP in Los Angeles, CA, US.

8. Battery Energy Storage Systems (BESS):

A Battery Energy Storage Systems (BESS) is an electrochemical device that charges (or collects energy) from the grid or a power plant and then discharges that energy later to provide electricity or other grid services when needed. Several battery chemistries are available or under investigation for grid-scale applications, including lithium-ion, lead-acid, redox flow, and molten salt (including sodium-based chemistries). A BESS system could be used to provide an alternative source of back-up power for intermittent short-duration power interruptions, or a method to reduce the peak demand of the proposed WWTP, or both. These options would lead to a reduction in indirect emissions; back-up power that is conventionally handled by diesel generators would be sourced from grid-purchased electricity, which would reduce direct emissions by circumventing the combustion of fossil fuels.

BESS technology is being designed for the Oakville water treatment plant.

9. Micro-hydro Power

Micro-hydro power systems can generate up to 100 kW of electricity. A micro-hydropower system needs a turbine, pump, or waterwheel to generate electricity. In detail, the micro-hydropower system converts the energy of flowing water into mechanical energy, which – in turn – is used to generate electricity. Two commonly used types of turbines in micro-hydro power systems are:

Impulse Turbines

Impulse turbines, which have the least complex design, are most-commonly used for high-head micro hydro systems. They rely on the velocity of water to move the turbine wheel, which is called the runner. The most common types of impulse turbines include the Pelton wheel and the Turgo wheel.

Reaction Turbines

Reaction turbines, which are highly efficient, depend on pressure rather than velocity to produce energy. All blades of the reaction turbine maintain constant contact with the water. These turbines are often used in large-scale hydropower sites.

Micro-hydro power generation has been implemented at the Mid-Halton WWTP in Halton Region, ON.

Effluent outfall construction at the proposed WWTP can be designed with maximum allowable elevation with respect to the Grand River such that application of a micro-hydro system can be used to generate renewable electricity, which would reduce indirect emissions.

4.5.1.2 Process Emissions

Although the aforementioned renewable technology has potential to reduce GHG emissions at the proposed WWTP by supplementing electrical and thermal energy generation with that from renewable and/or passive sources, a substantial amount of WWTP emissions result from the wastewater treatment process itself.

For example, tertiary wastewater treatment processes that are intended to mitigate eutrophication and other deleterious effects in the effluent-receiving water body can generate significant fugitive GHG emissions. These fugitive emissions can be the greatest contributor to GHG emissions at WWTPs. Specifically, biological nutrient removal (BNR) via nitrification and denitrification processes can result in significant nitrous oxide (N_2O) emissions. Technologies, such as membrane aerated biofilm reactors, can offer increased biological treatment capacity, and eliminates the need for aeration, which has been demonstrated to substantially reduce N_2O emission. Consideration of N_2O emissions mitigation measures can reduce direct emissions at the proposed WWTP.

Other biological treatment processes that require dissolved oxygen input via oxygen diffusers (aeration) require significant amounts of electricity. These processes can be designed to incorporate technologies that reduce dissolved oxygen demand, such as aeration blowers, or by increasing the size of the anoxic zone in aeration tanks, which also improves denitrification and thus conversion of N_2O into nitrogen gas (N_2). Such technology would reduce direct emissions of N_2O, as well as indirect emissions by reducing the amount of grid-purchased electricity consumed by oxygen diffusers.

In addition, energy efficiency measures can be incorporated into treatment process design to reduce electricity consumption; examples include the selection of premium efficiency motors and variable speed drives for high-light pumps, dynamic modeling of the distribution system to utilize unused storage capacity and decreasing backwash frequency of filtering systems.

It should be noted that process-related GHG emissions and their associated mitigation techniques have not been analyzed in detail herein, and a more extensive review of potential process-emissions pathways should be conducted during the design phase of the proposed WWTP.

4.5.1.3 Embodied Carbon Emissions

As the operating carbon of a facility is reduced through energy efficiency measures, fuel switching and on-site renewable energy generation, the embodied carbon becomes the vast majority of a facility's lifetime GHG emissions and has a greater impact on climate change as it is entirely emitted before the facility is operational. Concrete and steel are the largest contributors to a building's embodied carbon content, and this is especially true for WWTPs. Small adjustments in specifications for these materials can have major reduction in a WWTP's embodied carbon. For example, steel manufactured by electric arc furnaces on a low emissions power grid can have 50% less embodied carbon than traditional basic oxygen furnaces. Similarly, the embodied carbon content of concrete can be reduced by up to 50% by different mixing methods, recycled aggregate, reduced cement levels, controlled particle size distribution, and using concrete as a finishing material. Sustainable material selection for the construction of wastewater treatment infrastructure can be prioritized to minimize the embodied carbon associated with this project.

Chemicals utilized during operation of the proposed WWTP would also contribute to the amount of embodied carbon associated with the facility if the emissions generated during their production is considered. An inventory of common chemicals used in the wastewater treatment process, such as ferric chloride, magnesium hydroxide, sodium bicarbonate, sodium hydroxide, and polymers can provide insight into levels of embodied carbon-related emissions associated with facility operation.

4.5.1.4 Funding Programs

Incorporating climate change mitigation measures into a new WWTP can increase the upfront capital cost of a project but typically reduces the lifetime operating cost. Fortunately, there are funding programs that reduce the burden of this upfront costs.

The Federation of Canadian Municipalities' Green Municipal Fund provides funding to support the new construction of energy-efficient facilities including WWTPs. The program will provide up to $175,000 to cover 50% of the cost for feasibility studies, and up to $10,000,000 in low-interest loans with a grant worth up to 15% of the loan value.

Environment and Climate Change Canada's Low Carbon Economy Challenge – Champion Stream provides up to $25,000,000 in funding to municipal governments to cover 40% of the costs for GHG reducing projects. As of October 2023, The Champion Stream was consolidated with the Partnership Stream into a single Challenge Fund under the recapitalization Low Carbon Economy Fund. The first intake of this Challenge Fund was launched in November 2023. Currently, the program is closed for applications.

4.5.2 Climate Change Adaptation

Climate change adaptation refers to the resilience or vulnerability of the WWTP and the associated collection infrastructure to changing climatic conditions. Climate change has the potential to alter weather patterns that can in turn affect the collection and treatment of wastewater in terms of flow volumes and the reliability of the local utility infrastructure.

Higher intensity and duration precipitation events are likely to become more frequent, resulting in larger volumes of Inflow and Infiltration (I&I) that will need to be addressed by the collection system, any wastewater pumping stations, and the WWTP. Additionally, increasing ambient temperatures and prolonged instances of sustained heat will increase local energy usage, which can stress the grid and increase the potential of brownouts/power failures.

For the purposes of this evaluation, climate change impacts associated with both precipitation changes and ambient temperature changes have been considered. The specific effects and extents of these impacts cannot be predicted; current models evaluate multiple potential scenarios and estimate a wide potential extent of the risks. This portion of the document is designed as a qualitative identification of the potential effects of climate change at the WWTP and will, therefore, not address model specifics.

Increased rainfall, especially in the form of high intensity or duration events can result in increased flow in the wastewater collection system. The Grand River Conservation Authority's Watershed-wide Wastewater Optimization Program noted in their 2018 assessment of eight WWTPs within the watershed that I&I made up between 3 and 36% of the volumes treated at WWTPs (GRCA, 2019). When this I&I flow was compared to the drinking water flow rates for a given community, the wastewater flow rates could be as high as four times the drinking water flows due to high precipitation events (with a range of 1.3 times to 4 times, demonstrating the large variation between collection systems). Future designs need to include provisions for this increased flow, and the extent of these provisions need to be collection system specific. These measures include the need to ensure collection pipes are sufficiently sized for the increased peak flow rates as well as adequate sizing of collection basins and pumps in sewage pumping stations. WWTP processes also need to be adequately sized to address the peak flows and ensure no washout event occur in the various treatment processes that will result in decreased treatment efficiencies in the WWTPs, or that bypass events are avoided. If peak flow attenuation is achieved through storage of the wastewater, these systems will need to be adequately sized and should provide opportunities for expansion should the I&I peaking factors increase over a shorter term than planned expansions of the WWTP.

Increasing ambient temperatures, and the increase in the duration of consistently high temperature "heatwaves" can increase demand on the power grid and lead to longer, or more frequent power failures/brown outs. The emergency management and backup power system at the WWTP and the pump stations needs to be capable of addressing the potential of longer and more frequent power grid failures. The extent of the risks will be highly dependant on the local power grid and the designs for the backup power systems will be site specific. There are two potential methods of addressing this concern: by utilizing renewable energy generation at the WWTP or the pump stations to reduce or eliminate the reliance on the local grid (thereby decreasing or eliminating the effect of grid failures at the sites – this will also help with climate change mitigation at the various sites), or adequately sizing the backup power systems to address the increased risk of longer duration power outages.

5.0 Design Criteria and Equivalent Population

5.1 Design Criteria

Design criteria were developed during the 2020 Draft MSP Update (JLR, 2020). Design criteria for estimating wastewater collection flows are summarized in Table 4.

Table 4 Design Criteria for Estimating Existing and Future Wastewater Collection Flows

Parameter	Criteria	Source
Existing Average Domestic and Equivalent Industrial Community and Institutional (ICI) Dry Weather Flow	243 L/capita/day	Water Billing records 2018
Existing Employment and Community Area Dry Weather Flow	3.25 m^3/day/h	Water Billing records 2018 (~54.3 hectare developed) – excluding residential and institutional
Residential Greenfield Development Density	40 persons and jobs per hectare	Haldimand County Planning Department (March 2022) (Appendix B)
Residential Persons Per Unit (P.P.U)	2.47 persons per unit	Haldimand County Population Final Report (Watson, 26 June 2019) (2016 – 2046 Average)
Future Average Domestic and Equivalent ICI Dry Weather Flow	243 L/capita/day	Water Billing records 2018
Future Industrial Dry Weather Unit Sewage Flow	12 m^3/day/ha	Gateway North SPS Tender Documents (Dry Weather Flow) (WSP, March 2020)
Future Commercial Dry Weather Unit Sewage Flow	10 m^3/day/ha	County provided Job Density of 40 jobs per hectare * Future Residential Unit Sewage Flow
Infiltration Flow (Allowance)	0.23 L/s/ha	Haldimand County Design Criteria (Section K)
Peaking Factor	Harmon Formula	Haldimand County Design Criteria (Section K)

Design criteria for estimating wastewater treatment flows are summarized in Table 5.

Table 5 Design Criteria for Estimating Existing and Future Wastewater Treatment Flows

Parameter	Criteria	Source
Per Capita Sewage Generation Rate	338 L/capita/day	Based on 2016 Actuals
Peak Factor (Day)	3.0	Input from Haldimand County – 2019 Actuals = 3.2

5.2 Equivalent Population

The future residential equivalent population was calculated by converting residential units to persons using 2.47 persons per unit (P.P.U). The residential P.P.U is from the Haldimand County Population Housing and Employment Forecast Update and Land Needs Assessment Final Report (Watson, 2019). Residential P.P.U is calculated based on the average number of persons per unit from 2016-2046 for Caledonia Total Population and Household Forecast (Figure D-5) (Watson, 2019).

The future ICI equivalent population was calculated by dividing the total ICI average day dry weather flow (m^3/day) for each future development parcel by the average domestic and equivalent ICI dry weather flow of 243 L/Capita/day. See Section 7 for the distribution of growth in the build-out horizon.

A summary of the existing and future equivalent population is provided in Table 6.

Table 6 Equivalent Population

Time Period	Total Equivalent Population
Existing (1)	10,781
2027	14,395
2032	17,075
2037	29,157
2042	31,009
2047 (2)	39,585
Build-out	41,919
Existing – Build-out Growth	31,100

Table 6 Notes:

(1) Existing conditions are based on the 2020 Draft MSP Update. Existing equivalent population excludes an additional 168 persons that were added since the completion of the 2020 Draft MSP Update. The additional equivalent population are included in future conditions.

(2) The 2047 equivalent population represents build-out of all future development areas excluding potential future south end developments.

The projected equivalent population for the build-out horizon is 41,919.

5.3 Proposed Level of Service Standard

The proposed level of service required from the wastewater system is summarized for each different component of the system in Table 7.

Table 7 Level of Service Criteria Summary

Component	Dry Weather Criteria	Wet Weather Criteria
Wastewater Treatment Plant	Average day flow (ADF) to be less than 85% of rated capacity	n/a
Pumping Stations	Flow to be less than pump station firm capacity	1:10 year storm flow to be less than firm capacity and 1:100-year storm flow to be less than peak capacity
Gravity Sewers	Flow to be less than sewer capacity	Flow to be less than sewer capacity
Pressurized Sewers	The maximum velocity shall not be greater than 3 m/s with the pipe flowing full and the minimum velocity shall not be less than 0.60 m/s. The actual velocity for a 200mm diameter pipe (or greater) shall not be less than 0.5 m/s.	

6.0 Existing and Future Wastewater Servicing Requirements

6.1 Historical Wastewater Treatment Plant Flows

Historical treatment flows are based on the 2020 Draft MSP Update (JLR, 2020) and were calculated as described in the following section. Historical treatment flows are from the 2018 Caledonia WWTP Annual Report (Haldimand County, 26 February 2019). Historical average day flows, peak factors, and peak day flows are summarized in Table 8.

Table 8 Existing Wastewater Treatment Flows

Year	Average Day Flow (m^3/day)	Peak Factor	Peak Day Flow (m^3/day)
2016	3,383	4.23	14,298
2017	3,517	5.63	18,863
2018	3,208	5.26	16,884
2019	3,114	3.20	9,959
4-Year Average	3,306	4.58	15,001

The 2016-2019 average day flow is 3,306 m^3/day. The historical 4-year average peak day flow is 15,001 m^3/day. In 2017 and 2018, peak flows were higher because of significant inflow from the McClung Development. The higher inflow in these years was due to open basements being drained to the sanitary sewer. A peak factor of 3 was selected to calculate future treatment flows because historical peak flows were higher, and this value is within the typical value range of 2.5-3.5 for peak factors based on the 2018 Watershed Overview of Wastewater Treatment Plant Performance Report prepared by the GRCA (GRCA, July 2018). A per capita sewage generation rate of 338 L/capita/day based on the 2016 actual flows was selected to calculate future treatment flows.

6.2 Future Wastewater Treatment Plant Flows

Future flow for the WWTP was determined using equivalent population and a uniform per capita sewage generation rate of 338 L/capita/day based on the 2016 Actual WWTP Flow. Per Table 5 in Section 5.1, the peak factor used to calculate peak day flow is 3. See Table 9 for a summary of future treatment flows.

Table 9 Future Wastewater Treatment Flows

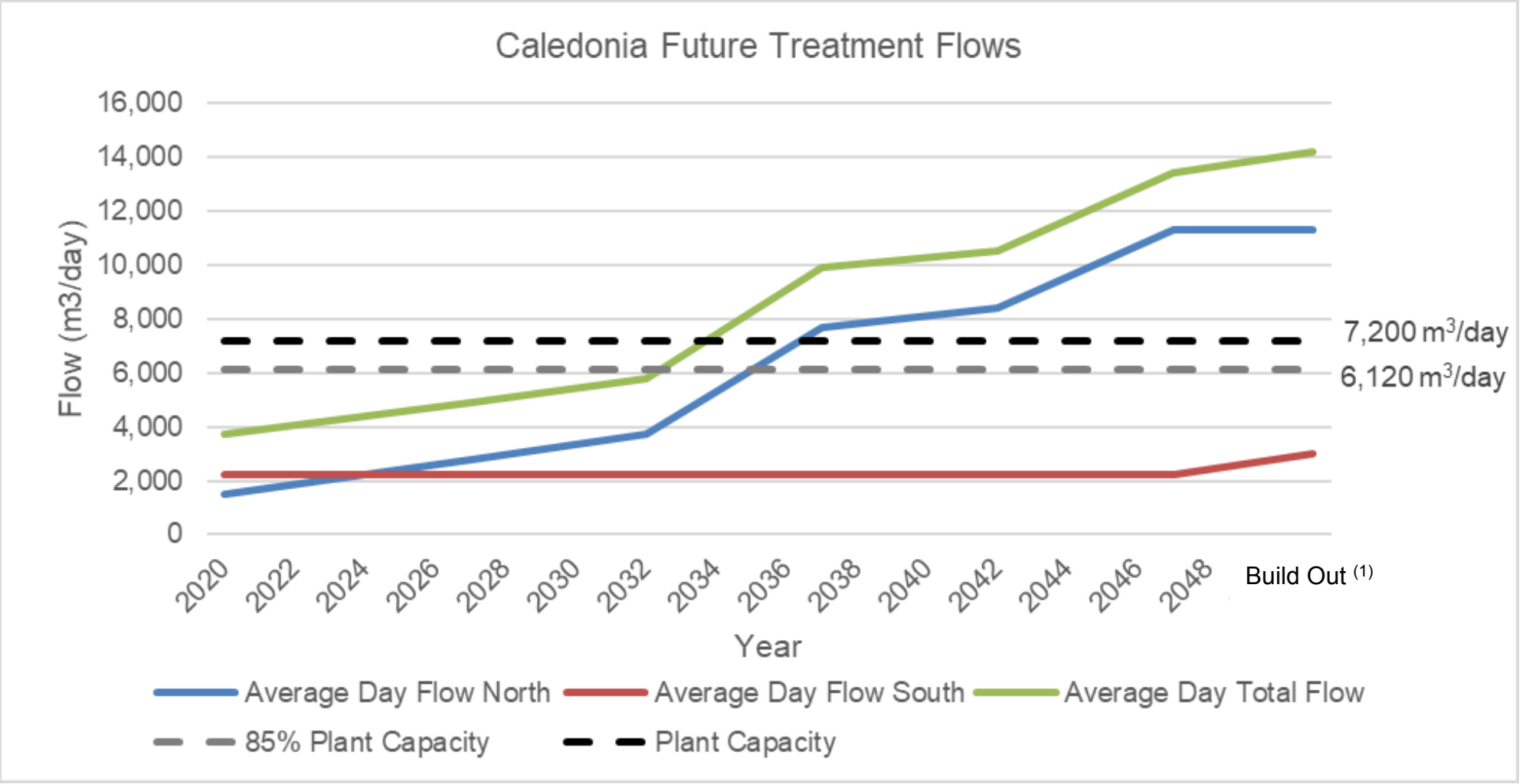
	Average Day Flow (m^3/day)	Max Day Flow (m^3/day)
Existing (1)	3,700	11,100
2027	4,900	14,700
2032	5,800	17,400
2037	9,900	29,700
2042	10,500	31,500
2047 (2)	13,400	40,200
Build-out	14,200	42,600
Existing to Build-out Growth	10,500	31,500

Table 9 Notes:
(1) Existing flows are based on the 2020 Draft MSP Update. Existing flows exclude flows from an additional 168 persons that were added since the completion of the 2020 Draft MSP Update. The additional flows are included in future conditions.
(2) The design flow to 2047 represents build-out conditions, excluding potential future south end developments

The average day wastewater flow to be used for treatment system design purposes at the WWTP is 14,200 m^3/day at build-out. The design flow to 2047 represents nearly build-out conditions and only excludes the potential future south end developments.

Figure 14 illustrates the future treatment flows from 2020 to 2047 relative to the existing treatment plant capacity of 7,200 m^3/day and 85% of the rated capacity of the plant. Based on current flow estimates, the existing WWTP will reach 85% of its rated capacity in 2032. It is important to note, however, that the rate of growth in the community over the next 10-years (i.e., faster, or slower growth rate) will impact the actual WWTP expansion timing.

Figure 14 Caledonia Future Treatment Flows



(1) Timing of actual development of the potential south end developments, which is anticipated to occur after 2047 is unknown. Buildout shown in 2051 for illustrative purposes only.

6.3 Historical and Future Sewage Pumping Station Flows

A steady flow pipe-by-pipe model of Caledonia's wastewater conveyance system was developed during the 2020 Draft MSP Update in PCSWMM for the purposes of assessing existing and future flow capacity within the system.

Existing wastewater flows were modelled, and future wastewater flows were calculated for the sewage pump stations using the following approach:

- The average day dry weather flow was calculated using unit sewage flow rates for each type of development, see Table 4 for unit sewage rates used.
- Peaking factors, based on the Harmon formula, were used to determine the peak flow rates generated from future development.
- Wet weather flow rates were calculated by assuming an inflow and infiltration (I/I) rate of 0.23 L/s/ha per the 2015 Haldimand County Design Criteria.

Refer to the 2020 Draft MSP Update for details on the model set up, calibration and recommendations for the conveyance system.

For this Study, the future wastewater collection flows were calculated for sewage pumping stations impacted by the treatment alternatives, including Nairne SPS, McClung SPS, and the Main SPS. The other five sewage pumping stations are local stations not impacted by the treatment alternatives. The sewershed areas and SPS sizes must be confirmed in future studies for future developments.

The future flows were calculated for each new development and assigned to a sewershed area based on location. The calculated future flows were added to the existing modelled flows for Nairne, McClung, and Main SPSs. Two pumping scenarios were calculated based on treatment Alternatives 2 through 5, depending on where the flow is pumped (alternatives are discussed further in Section 7.0).

Refer to Appendix G for the detailed calculations.

Table 10 summarizes the modelled existing and calculated build-out peak flows for each SPS.

Table 10 Pumping Stations Existing and Future Peak Flows

Facility	Rated Capacity (L/s)	Firm Capacity (L/s)	Existing Peak Flow (Modelled) (L/s)	Build-out Peak Flow (Calculated) (L/s)
North				
Nairne SPS	207	138	79.7	430 (1) 220 (2)
McClung SPS	230	115	20.6	220
Orkney SPS	Capacity unknown	Capacity unknown	1.5	Included in Nairne SPS
Gateway SPS (will eventually replace Domtar SPS)	~200	~100	10.9	Included in Nairne SPS
Kincardine SPS	28	14	3.2	Included in Nairne SPS
South				
Main SPS (3)	293	114 (4)	109.9	111 (5) 150 (6)
Paisley SPS	104	50 (7)	36.6	Included in Main SPS

Table 11 Notes:

(1) Based on treatment Alternatives 2 and 5, refer to Section 7.0.

(2) Based on treatment Alternatives 3 and 4, refer to Section 7.0.

(3) Main SPS only receives flow from south Caledonia.

(4) Based on the Capacity Evaluation of the Main SPS completed by Wood in 2018. The capacity does not include upstream flow equalization from the equalization tank at the WWTP (Wood, 2018).

(5) Based on treatment Alternative 3, refer to Section 7.0.

(6) Based on treatment Alternatives 2, 4, and 5, refer to Section 7.0.

(7) Firm capacity from ECA # 9571-7DCMJ4. Based on the Capacity Evaluation of the Paisley SPS completed by Wood in 2018, the Paisley SPS firm capacity is 54 L/s (Wood, 2018).

The future peak flows at the existing pumping stations were modelled based on the available information provided by the Haldimand County. Later, hourly flow data was provided for Nairne and Main SPS from the County, which included higher existing peak flows than had previously been modeled. Using the existing measured peaks, build out peak flows are estimated as 305 L/s at Main SPS, 287 L/s at Nairne SPS and 220 L/s at McClung SPS. Main SPS flow was estimated by applying a factor of 1.5 to the maximum hourly flow value recorded between August 2022 and July 2023, assuming no growth within this catchment. Nairne SPS flow from existing sources was estimated by applying a factor of 1.5 to the maximum hourly flow value recorded between August 2022 and July 2023; additional flow from anticipated growth areas provided by the model was then added. McClung SPS flow was derived directly from the model.

The discrepancy between the modelled peak flows and actual peak flows are potentially related to inflow and infiltration (I&I) issues at Nairne and Main SPS due to age of infrastructure.

Future peak flow assumptions for the pump stations will be reviewed during Phase 3 of the Class EA. Installation of flow meters at the SPSs that do not currently have flowmeters is recommended to refine flows prior to detailed design. Regardless of peak selected for design purposes, it is still expected that Nairne SPS, McClung SPS, and Main SPS will require upgrades to meet future servicing needs.

6.4 Summary of Existing and Future Servicing Constraints

The following major constraints for the Caledonia wastewater system were identified:

- The existing WWTP will reach its rated capacity in approximately 2032.
- Main SPS (located at the current WWTP) is potentially operating at or near capacity. This was highlighted in the "Capacity Evaluation of Main and Paisley Sewage Pumping" report completed by Wood Group (2018) in support of the Caledonia Master Servicing Plan (2022). More detailed investigations are required for confirmation.
- Under future conditions, Nairne SPS and McClung SPS will have capacity constraints.

The initial focus of this MCEA is evaluating the wastewater treatment expansion options and assessing the associated conveyance alternatives.

7.0 Future Servicing Alternatives

7.1 Introduction

The existing Caledonia WWTP will reach its rated capacity in approximately 2032 and total wastewater treatment capacity of 13,400 m^3/day is required to meet 2047 demands. There are five proposed alternatives to increase wastewater treatment capacity for the community of Caledonia, four of which are based on the 2020 Draft Master Servicing Plan Update (JLR, 2020a). A new alternative, pump all or some wastewater from Caledonia to a neighbouring WWTP for treatment, was also added because of new drivers further described in Section 1.5.

The Caledonia WWTP expansion alternatives under consideration are:

- Alternative 1 – Do Nothing
- Alternative 2 – Increase Capacity at the Existing Caledonia WWTP
- Alternative 3 – New WWTP – Shared Treatment with Existing Caledonia WWTP
- Alternative 4 – New WWTP – Decommission Existing Caledonia WWTP
- Alternative 5 – Pump All or Some Wastewater to a new potential WWTP in Nanticoke, ON

The five alternatives are described in detail in the following sections, including the proposed works, an Opinion of Probable Construction Cost, and high-level advantages and disadvantages. For Alterative 3 and 4, with new WWTP, the study area consists of two sites located on the north and south sides of the Grand River.

This study includes recommendations for sewage pumping stations impacted by the treatment alternatives (see Section 6.3). Refer to the 2020 Draft MSP Update for recommendations for other local SPS.

7.2 Summary of Servicing Alternatives

7.2.1 Alternative 1 – Do Nothing

Alternative 1 is do nothing. This alternative is considered as the baseline against which the impacts of other alternatives can be compared to. This alternative does not address the identified issues, and Alternative 1 has only been carried forward as the baseline alternative for evaluation.

7.2.2 Alternative 2 – Increase Capacity at Existing Caledonia WWTP

Alternative 2 is based on upgrading the existing Caledonia WWTP to treat 2047 flows. The existing WWTP capacity would be increased from 7,200 m^3/day to 13,400 m^3/day (the potential south end developments flows are not considered). Upgrade costs have been developed based on a review of similar plant expansions recently completed by JLR and others. Upgrades at the existing WWTP assume the conventional activated sludge process is retrofitted to a small footprint technology, however, this would need to be confirmed in Phase 3 and 4 of the MCEA. Major works include retrofitting the existing liquid treatment system for small footprint technology and replacing the solids treatment train. Construction sequencing to maintain plant operations will be extremely challenging since the contractor must build several new systems overtop of existing systems on the site.

Proposed Works:

- Replace the Main SPS
- New headworks, including screening, grit removal, and equalization tank.
- Demolish the existing primary clarifiers.
- New aeration tanks and retrofit the existing aeration tanks.
- Retrofit the existing secondary clarifiers for new, small footprint technology.
- Demolish the tertiary filters.
- New UV system.
- New sludge thickening.
- Demolish existing aerobic digesters and replace with new anaerobic digesters.
- Site works including site grading, excavation, trenching and backfilling.

Studies/ Approvals:

- Application to amend the Environmental Compliance Approval (ECA)
- Assimilative Capacity Assessment – complete
- Geotechnical investigation before detailed design.
- Topographic survey before detailed design.
- Ecology, Cultural Heritage, Archaeology – complete

For Alternative 2, other works include:

- Upgrade Nairne SPS and forcemain for 430 L/s capacity, including a new river crossing.
- Upgrade McClung SPS and forcemain for 220 L/s capacity
- The cost to replace the existing Main SPS is included with the treatment upgrades.

Specific routing options will be confirmed for the preferred alternative. The other works listed above and assumed sewage flow routing are based on Crossing Alternative 3 (Section 10.2.3), and do not reflect the only routing option. This was selected for comparative purposes.

Nairne SPS and forcemain would be upgraded to accommodate a build-out peak flow of 430 L/s. The upgrade costs assume the construction of a new Nairne SPS on the same site because expanding the existing SPS is not anticipated to be cost effective. However, the Nairne SPS site selection should be confirmed. For the forcemain upgrades, the cost conservatively includes a new river crossing. However, it is noted that the County has installed a new twin forcemain with casing capacity tor additional linear infrastructure (refer to Section 2.3), which may reduce this cost depending on constructability constraints. Geotechnical investigations must be completed before detailed design and construction to confirm site-specific conditions. The cost of the upgraded forcemain from after the river crossing to the existing WWTP is based on a 450 mm diameter pipe and the same length as the existing forcemain (approximately 500 m).

McClung SPS and forcemain would be upgraded to accommodate a build-out peak flow of 220 L/s. Upgrades at McClung SPS consist of installing four new pumps. The cost for the upgraded McClung SPS forcemain is based on a 450 mm diameter pipe and the same length as the existing forcemain (approximately 2 km).

All sewer and forcemain diameters are approximate and should be confirmed as part of detailed design.

The Opinion of Probable Construction Cost (OPCC) for Alternative 2 is summarized in Table 11 A detailed cost breakdown is provided in Appendix H. **The total capital cost is estimated at $98,641,000.** A conceptual layout is provided in Figure 15. OPCCs assume that the works are constructed in one phase. Consideration could be given to phased implementation once a preliminary preferred alternative is identified.

Alternative 2 Advantages:

- Re-use of some existing treatment infrastructure
- Less potential for impacts on the natural and cultural environment
- Lower capital cost

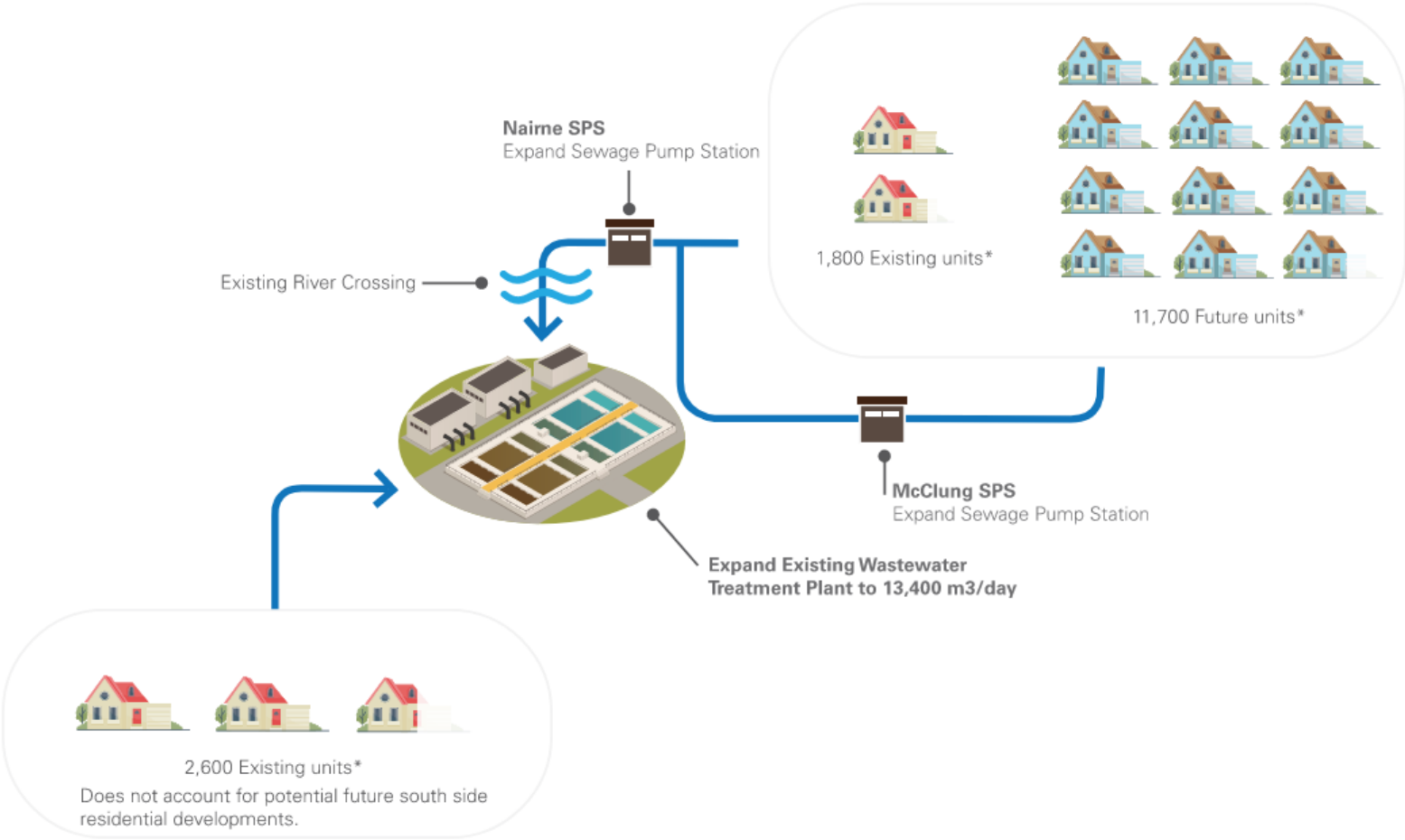
Alternative 2 Disadvantages:

- Difficult construction sequencing to meet build-out flow.
- Extremely limited ability to expand further on site.

Table 11 Alternative 2 – Increase Capacity at/ or near Existing Caledonia WWTP OPCC

DESCRIPTION	TOTAL
Treatment	
Headworks and Main SPS Upgrades	$10,300,000
Primary Clarifiers	$1,000,000
Secondary Treatment	$10,900,000
Tertiary Filter Building/ Sludge Thickening	$8,200,000
UV System	$2,300,000
Digesters	$11,500,000
Site Wide Works	$8,000,000
Sewage Pump Station	
Nairne SPS	
Property Acquisition	$350,000
Site Work	$2,600,000
Building	$1,200,000
Service and Generator	$580,000
Pumping System	$1,400,000
Instrumentation and Controls	$200,000
McClung SPS	
Service and Generator	$350,000
Pumping System	$1,000,000
Instrumentation and Controls	$150,000
Forcemain	
New Twin Forcemain across Grand River (River Crossing)	$1,750,000
Upgrade Nairne SPS Forcemain south of the Grand River (after the River Crossing to the Existing Caledonia WWTP)	$750,000
Upgrade McClung SPS Forcemain	$2,925,000
SUB-TOTAL COST	**$65,455,000**
Bonding and Overhead (10%)	$6,545,500
Contingency and Engineering (37%)	$26,640,500
TOTAL COSTS	**$98,641,000**
(Rounded, in 2022 Dollars, HST Not Included)	

Figure 15 Alternative 2 Concept Plan



7.2.3 Alternative 3 – New 7,000 m^3/day WWTP and Shared Treatment with Existing Caledonia WWTP

Alternative 3 includes constructing a new WWTP in Caledonia while maintaining the existing Caledonia WWTP to share treatment. The new WWTP interim design capacity would be 7,000 m^3/day, and the County would maintain the existing WWTP at the current rated capacity. The total treatment capacity realized in this alternative is 13,400 m^3/day. The treatment capacity of this alternative was calculated by assuming the existing Caledonia Plant will be running at 90% of its rated capacity, for a total of 6,500 m^3/day. The new WWTP could be expanded beyond this to serve all of Caledonia when the existing WWTP reaches the end of its useful life, or the two plants could be maintained indefinitely. Major works include constructing a new interim conventional activated sludge (CAS) WWTP in or around Caledonia and maintaining operations at the existing Caledonia WWTP.

Alternative 3 represents an interim alternative, and further consideration of phasing and flow splitting will be required during Phase 3 and 4 of the MCEA and as part of detailed design.

For costing purposes, the flow splitting was estimated on the following assumptions:

- Alternative does not include flows from potential south end developments. (If these developments were to proceed, they would need to be accommodated in future expansions)
- The County maintains the existing Caledonia WWTP at the current rated capacity.
- The existing WWTP treats all existing south flows through 2047.
- Nairne SPS continues to pump flows south to the existing WWTP.
- Future north flows will predominantly be treated at the new WWTP.
- McClung SPS will pump directly to the new WWTP.

Table 12 summarizes the estimated flows for costing purposes.

Table 12 Alternative 3 Interim Treatment Design Flows

	Existing WWTP	New WWTP	Total
Rated Capacity (m^3/day)	7,200	7,000	n/a
Interim Future South Flows (m^3/day) (1)	2,200	0	2,200
Interim Future North Flows (m^3/day)	4,300	7,000	11,300
Total Interim Future Flows (m^3/day)	6,500 (2)	7,000	13,500

Table 12 Notes:
(1) Excludes potential south end developments
(2) Assuming existing Caledonia WWTP running at 90% of its rated capacity.

The County is considering two potential site locations for the new WWTP. Both locations are just east of Caledonia and are outside the urban boundary. The first location is north of the Grand River at 1730 Haldimand Highway 54 and the second location is south of the Grand River at 4300 River Road. Site locations for the new WWTP will need to be evaluated when selecting the preferred servicing alternative. Available lands that can be considered for a new WWTP are constricted by regulated lands, environmental issues, and undermined areas that are not suitable for development. Land use constraints will be an important consideration in the ultimate selection of a site. Buffers should also be maintained.

The MECP recommends a 150 m buffer (100 m minimum) between the WWTP and a sensitive land use for plants with capacity greater than 500 m^3/day but less than 25,000 m^3/day (MECP, August 1996).

For costing purposes, assume a new WWTP at the north location, which has comparable total cost to a south WWTP though some individual components are different. Site locations and pumping arrangements could be considered Phase 3 and 4 of the MCEA and as part of detailed design.

Proposed Works – new 7,000 m^3/day WWTP:

- New headworks, including screening, grit removal, equalization tank and SPS.
- New primary clarifiers
- New aeration tanks
- New secondary clarifiers
- New tertiary filters
- New UV system
- New outfall
- New anaerobic digesters
- New generator
- New administration building
- Site works including site grading, excavation, trenching and backfilling.

Studies/ Approvals:

- Environmental Compliance Approval (ECA) Application
- Assimilative Capacity Assessment – complete
- Geotechnical investigation before detailed design.
- Topographic survey before detailed design.
- Ecology, Cultural Heritage, Archaeology – complete

For Alternative 3, other works include:

- Upgrade Nairne SPS and forcemain to 230 L/s capacity
- New potential river crossing (if the south side were to proceed)
- Upgrade McClung SPS for 220 L/s capacity
- New forcemain from McClung SPS to new WWTP, including a new pipeline crossing.
- Main SPS lifecycle rehabilitation

Specific routing options will be confirmed for the preferred alternative. The other works listed above and assumed sewage flow routing are based on Crossing Alternative 3 (Section 10.2.3), and do not reflect the only routing option. This was selected for comparative purposes.

Nairne SPS and forcemain would be upgraded to accommodate a build-out peak flow of 230 L/s. The upgrade costs assume the construction of a new Nairne SPS on the same site because expanding the existing SPS is not anticipated to be cost effective. However, the feasibility of this assumption should be confirmed in subsequent stages. For the forcemain upgrades, the cost includes a new river crossing as the preferred location of the crossing has not been established. Geotechnical investigations must be completed before detailed design and construction to confirm site-specific conditions.

The cost for the upgraded forcemain from after the river crossing to the existing WWTP is based on a 450 mm diameter pipe and the same length as the existing forcemain (approximately 500 m).

McClung SPS would be upgraded to accommodate a build-out peak flow of 220 L/s. Upgrades at McClung SPS consist of installing four new pumps. A new forcemain will be constructed from McClung SPS to the new interim WWTP, including a pipeline crossing. The cost for the new forcemain is based on a 375 mm diameter pipe and approximately 1.8 km in length.

All sewer and forcemain diameters are approximate and should be confirmed as part of detailed design.

Based on a Capacity Evaluation of the Main SPS completed by Wood in 2018, the Main SPS firm capacity is 114 L/s (Wood, 2018). The 2047 estimated peak flow is 111 L/s, excluding McKenzie Meadows and Beattie Estates, similar to the estimated firm capacity. Assume minor upgrades and lifecycle rehabilitation are required, including twinning the forcemain, miscellaneous structural upgrades and repairs, and installing three new pumps.

The OPCC for Alternative 3 are summarized in Table 13. A detailed cost breakdown is provided in Appendix H. **The total capital cost is estimated at $93,219,000.** A conceptual layout is provided in Figure 16. OPCCs assume that the works are constructed in one phase. Consideration could be given to phased implementation once a preliminary preferred alternative is identified. The cost estimates are contingent on the site of the new WWTP and must be verified in subsequent stages of the MCEA process.

Advantages:

- More straightforward construction sequencing and ability to phase expansion.
- Highest level of redundancy
- Lower capital cost

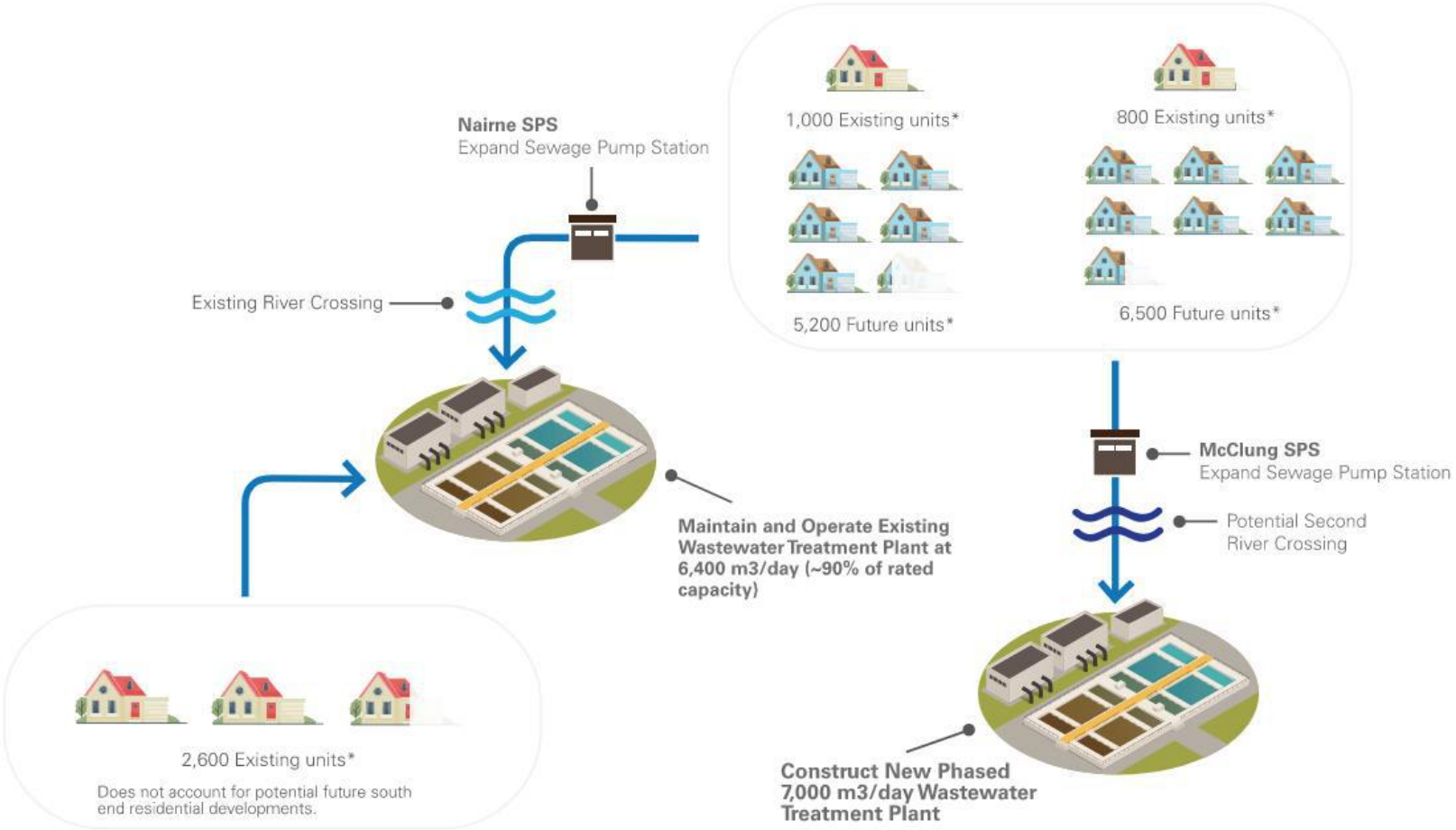
Disadvantages:

- Higher embodied and operating carbon due to operating two WWTPs.
- More potential for impacts on the natural and cultural environment
- Higher operating costs for the Haldimand County, due to operating two WWTPs.

Table 13 Alternative 3 – New WWTP – Shared Treatment with Existing Caledonia WWTP OPCC

DESCRIPTION	TOTAL
Treatment	
Headworks	$5,132,400
Primary Clarifiers	$5,033,700
Secondary Treatment	$9,870,000
Tertiary Filter Building/ Sludge Thickening	$7,040,600
UV System	$1,118,600
Digesters	$6,711,600
Site Wide Works	$8,000,000
Generator	$3,000,000
Admin Building	$1,200,000
Outfall	$1,320,200
Land Acquisition	$1,600,000
Sewage Pump Station	
Nairne SPS	
Property Acquisition	$350,000
Site Work	$1,400,000
Building	$1,000,000
Service and Generator	$580,000
Pumping System	$1,000,000
Instrumentation and Controls	$200,000
McClung SPS	
Service and Generator	$350,000
Pumping System	$1,000,000
Instrumentation and Controls	$150,000
Main SPS	
Site Work	$250,000
Building	$50,000
Pumping System	$450,000
Instrumentation and Controls	$50,000
Forcemain	
New Twin Forcemain across Grand River (River Crossing)	$1,750,000
Upgrade Nairne SPS Forcemain south of the Grand River (after the River Crossing to the Existing Caledonia WWTP)	$750,000
New Forcemain from McClung SPS to new WWTP	$2,250,000
New Pipeline Crossing	$250,000
SUB-TOTAL COST	**$61,857,000**
Bonding and Overhead (10%)	$6,186,000
Contingency and Engineering (37%)	$25,176,000
TOTAL COSTS	**$93,219,000**
(Rounded, in 2022 Dollars, HST Not Included)	

Figure 16 Alternative 3 Concept Plan



7.2.4 Alternative 4 – New 13,400 m^3/day WWTP – Decommission Existing WWTP

Alternative 4 includes constructing a new WWTP to treat all flow from Caledonia and decommissioning the existing Caledonia WWTP. The new WWTP design capacity would be 13,400 m^3/day to match the 2047 predicted flows (the potential south end developments flows are not considered). The County is investigating two potential site locations for the new WWTP either north or south of the Grand River. For costing purposes, assume a new WWTP at the north location. Major works include constructing a new CAS WWTP in or around Caledonia and decommissioning the existing Caledonia WWTP.

For costing purposes, assume a new WWTP at the north location, which has comparable total cost to a south WWTP though some individual components are different. Site locations and pumping arrangements could be considered Phase 3 and 4 of the MCEA and as part of detailed design.

Proposed Works – new 13,400 m^3/day WWTP:

- New headworks, including screening, grit removal, equalization tank and SPS.
- New primary clarifiers
- New aeration tanks
- New secondary clarifiers
- New tertiary filters
- New UV system
- New outfall
- New anaerobic digesters
- New generator
- New administration building
- Site works including site grading, excavation, trenching and backfilling.
- Decommission the existing Caledonia WWTP

Studies/ Approvals:

- Environmental Compliance Approval (ECA) Application
- Assimilative Capacity Assessment – complete
- Geotechnical investigation before detailed design.
- Topographic survey before detailed design.
- Ecology, Cultural Heritage, Archaeology – complete

For Alternative 4, other works include:

- Upgrade Nairne SPS for increased capacity of 230 L/s
- New forcemain from Nairne SPS to McClung SPS
- Upgrade McClung SPS for increased capacity of 220 L/s
- New joint forcemain from McClung SPS to new WWTP that serves Nairne and McClung SPSs, including a new pipeline crossing.
- New Main SPS and forcemain to the new WWTP, including a river crossing.

Nairne SPS would be upgraded to accommodate a build-out peak flow of 230 L/s. The upgrade costs assume the construction of a new Nairne SPS on the same site because expanding the existing SPS is not anticipated to be cost effective.

However, the feasibility of this assumption should be confirmed in subsequent stages. For the forcemain upgrades, a new forcemain would be constructed from Nairne SPS to McClung SPS. The cost for the new forcemain from Nairne SPS to McClung SPS is based on an approximately 450 mm diameter pipe and the same length as the existing forcemain (approximately 2 km). The County could review the potential to reuse the existing forcemain from McClung SPS to Nairne SPS based on phasing of future peak flows.

McClung SPS would be upgraded to accommodate a build-out peak flow of 220 L/s. Upgrades at McClung SPS consist of installing four new pumps. A new joint forcemain would be constructed from McClung SPS to the new WWTP with capacity for the combined peak flows from Nairne and McClung SPSs, including a pipeline crossing. The cost for the new forcemain is based on a 450 mm diameter pipe and approximately 2 km in length.

The Main SPS would be upgraded to accommodate a build-out peak flow of 150 L/s. The upgrade costs assume construction of a new SPS on the existing WWTP site since the existing SPS must remain in operation while the new WWTP is constructed. For the forcemain upgrades, the cost includes a new river crossing as the preferred location of the crossing has not been established. Geotechnical investigations must be completed before detailed design and construction to confirm site-specific conditions. The forcemain cost includes a new Main SPS forcemain from after the river crossing to the new WWTP. The cost for the new forcemain is based on an approximately 375 mm diameter pipe and approximately 3 km in length.

All sewer and forcemain diameters are approximate and should be confirmed as part of detailed design.

The OPCC for Alternative 4 are summarized in Table 14. A detailed cost breakdown is provided in Appendix H. **The total capital cost is estimated at $129,892,000.** A conceptual layout is provided in Figure 17. OPCCs assume that the works are constructed in one phase. Consideration could be given to phased implementation once a preliminary preferred alternative is identified. The cost estimates are contingent on the site of the new WWTP and must be verified in subsequent stages of the MCEA process.

Advantages:

- More straightforward construction sequencing
- Lower operating carbon due to operating only one new greenfield WWTP.
- Can meet build-out growth and beyond.

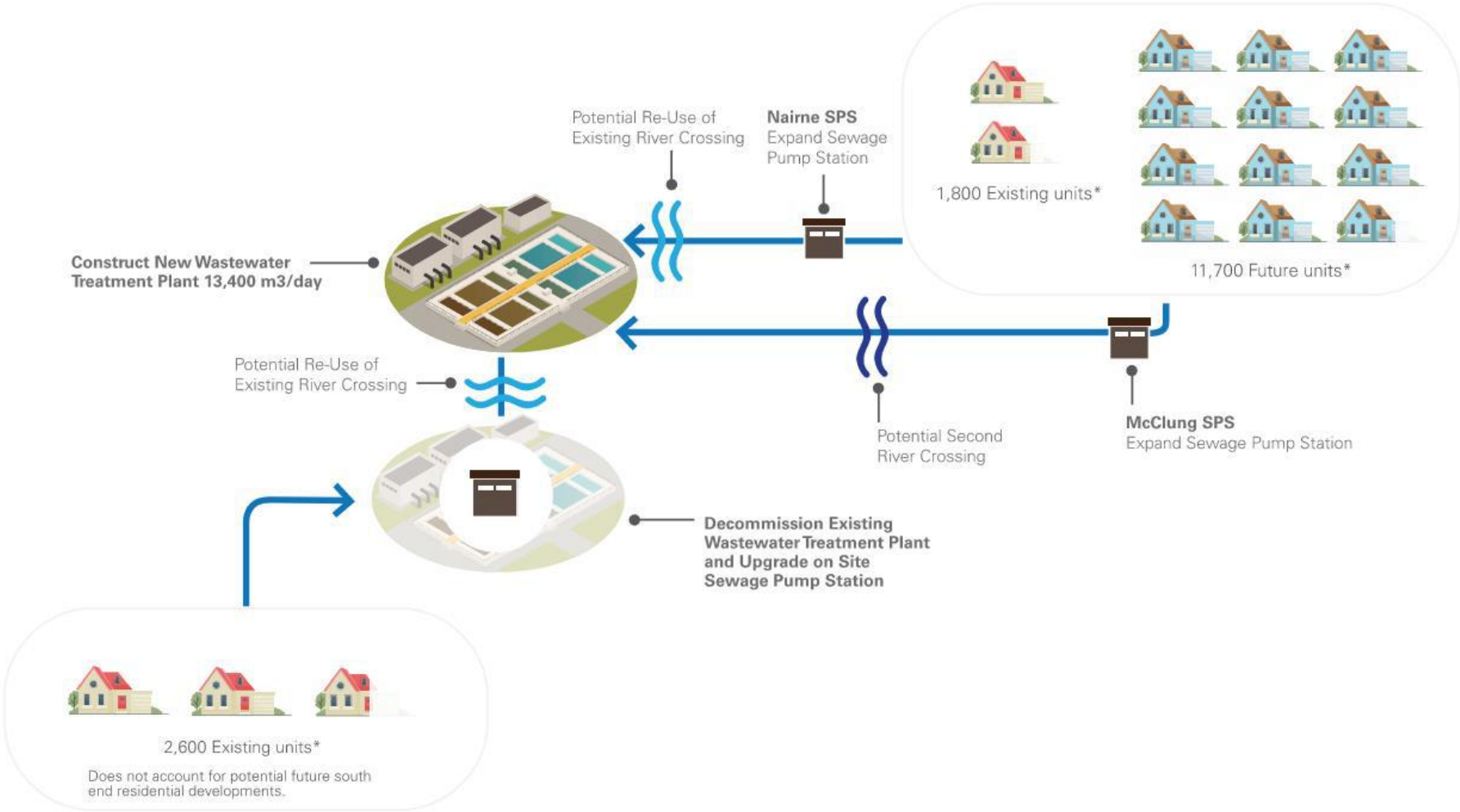
Disadvantages:

- Higher capital cost
- More potential for impacts to the natural and cultural environment
- Higher embodied carbon by not using existing treatment infrastructure.

Table 14 Alternative 4 – New 13,400 m^3/day WWTP – Decommission Existing Caledonia WWTP OPCC

DESCRIPTION	TOTAL
Treatment	
Headworks	$7,332,000
Primary Clarifiers	$7,191,000
Secondary Treatment	$14,100,000
Tertiary Filter Building/ Sludge Thickening	$10,058,000
UV System	$1,598,000
Digesters	$9,588,000
Site Wide Works	$8,000,000
Generator	$3,000,000
Admin Building	$1,200,000
Outfall	$5,740
Decommission Existing Caledonia WWTP	$400,000
Land Acquisition	$1,600,000
Sewage Pump Station	
Nairne SPS	
Property Acquisition	$350,000
Site Work	$1,400,000
Building	$1,000,000
Service and Generator	$580,000
Pumping System	$1,000,000
Instrumentation and Controls	$200,000
McClung SPS	
Service and Generator	$350,000
Pumping System	$1,000,000
Instrumentation and Controls	$150,000
Main SPS	
Site Work	$1,400,000
Building	$800,000
Instrumentation and Controls	$1,050,000
Forcemain	
Upgrade Forcemain from Nairne to McClung	$2,925,000
New Forcemain from McClung SPS to New WWTP servicing Nairne SPS and McClung SPS	$2,700,000
New Forcemain Across Grand River (River Crossing)	$1,750,000
New Forcemain from Main SPS to New WWTP (after the river crossing to new WWTP)	$3,750,000
New Pipeline Crossing	$250,000
SUB-TOTAL COST	**$86,192,000**
Bonding and Overhead (10%)	$8,619,000
Contingency and Engineering (37%)	$35,081,000
TOTAL COSTS	**$129,892,000**
(Rounded, in 2022 Dollars, HST Not Included)	

Figure 17 Alternative 4 Concept Plan



7.2.5 Alternative 5 – Pump to New Potential Nanticoke WWTP

Alternative 5 includes pumping all or some of Caledonia's wastewater to a new potential neighbouring WWTP for treatment. Empire Communities proposed developing a new community at the Lake Erie Industrial Park (LEIP) in Nanticoke, ON, including a new proposed LEIP WWTP. For costing purposes, assume the new alternative is to pump all wastewater from Caledonia to Nanticoke for treatment at the proposed LEIP WWTP.

The proposed LEIP WWTP will include the capacity to treat build-out flows from Caledonia (13,400 m^3/day). This alternative assumes no changes to the existing pumping arrangement within Caledonia. Major works include modifying the existing plant for pre-treatment, a new conveyance system to neighbouring WWTP, and additional treatment capacity at the selected neighbouring WWTP. WT Infrastructure prepared the preliminary design concept and costing for this alternative (excluding upgrades at Nairne SPS, McClung SPS, and existing forcemains in the collection system) (WT Infrastructure, January 2022). The Class D OPCC were developed based on conveying flows to the proposed LEIP WWTP.

Proposed Works – actual works contingent on new potential LEIP WWTP location:

- New forcemain extension
- New headworks, including screening and grit removal (at existing Caledonia WWTP)
- Upgrade Main SPS at Caledonia WWTP
- Wet weather flow management, including new equalization tank/reconfigure existing tanks.
- New single 42 km forcemain from Caledonia WWTP to Nanticoke, including water crossings, pipeline crossings, and a railway crossing.
- Three to four new SPSs along the forcemain route
- Treatment capacity at the proposed LEIP WWTP

Studies/ Approvals:

- Environmental Compliance Approval (ECA) Application
- Geotechnical investigation before detailed design.
- Topographic survey before detailed design.
- Ecology, Cultural Heritage, Archaeology

For Alternative 5, other works include:

- Upgrade Nairne SPS and forcemain for increased capacity, including a new river crossing.
- Upgrade McClung SPS and forcemain for increased capacity

Nairne SPS and forcemain would be upgraded to accommodate a build-out peak flow of 430 L/s. The upgrade costs assume the construction of a new Nairne SPS on the same site because expanding the existing SPS is not anticipated to be cost effective. However, the site selection should be confirmed as part of Phase 3 and 4 of the MCEA. For the forcemain upgrades, the cost conservatively includes a new river crossing. However, it is noted that the County is installing a new twin forcemain with casing capacity for additional linear infrastructure (refer to Section 2.3), which may reduce this cost depending on constructability constraints. Geotechnical investigations must be completed before detailed design and construction to confirm site-specific conditions.

The cost for the upgraded forcemain from after the river crossing to the existing WWTP is based on a 450 mm diameter pipe and the same length as the existing forcemain (approximately 500 m).

McClung SPS and forcemain would be upgraded to accommodate a build-out peak flow of 220 L/s. Upgrades at McClung SPS consist of installing four new pumps. The cost for the upgraded McClung SPS forcemain is based on a 450 mm diameter pipe and the same length as the existing forcemain (approximately 2 km).

All sewer and forcemain diameters are approximate and should be confirmed as part of detailed design.

The cost to upgrade the Main SPS is included with the treatment upgrades.

The total capital cost is estimated to be in the order of $191,000,000 however, this cost is highly variable depending on the location of the neighbouring facility considered. A detailed cost breakdown is provided in Appendix H. A conceptual layout is provided in Figure 18. OPCCs assume that the works are constructed in one phase. Consideration could be given to phased implementation once a preliminary preferred alternative is identified.

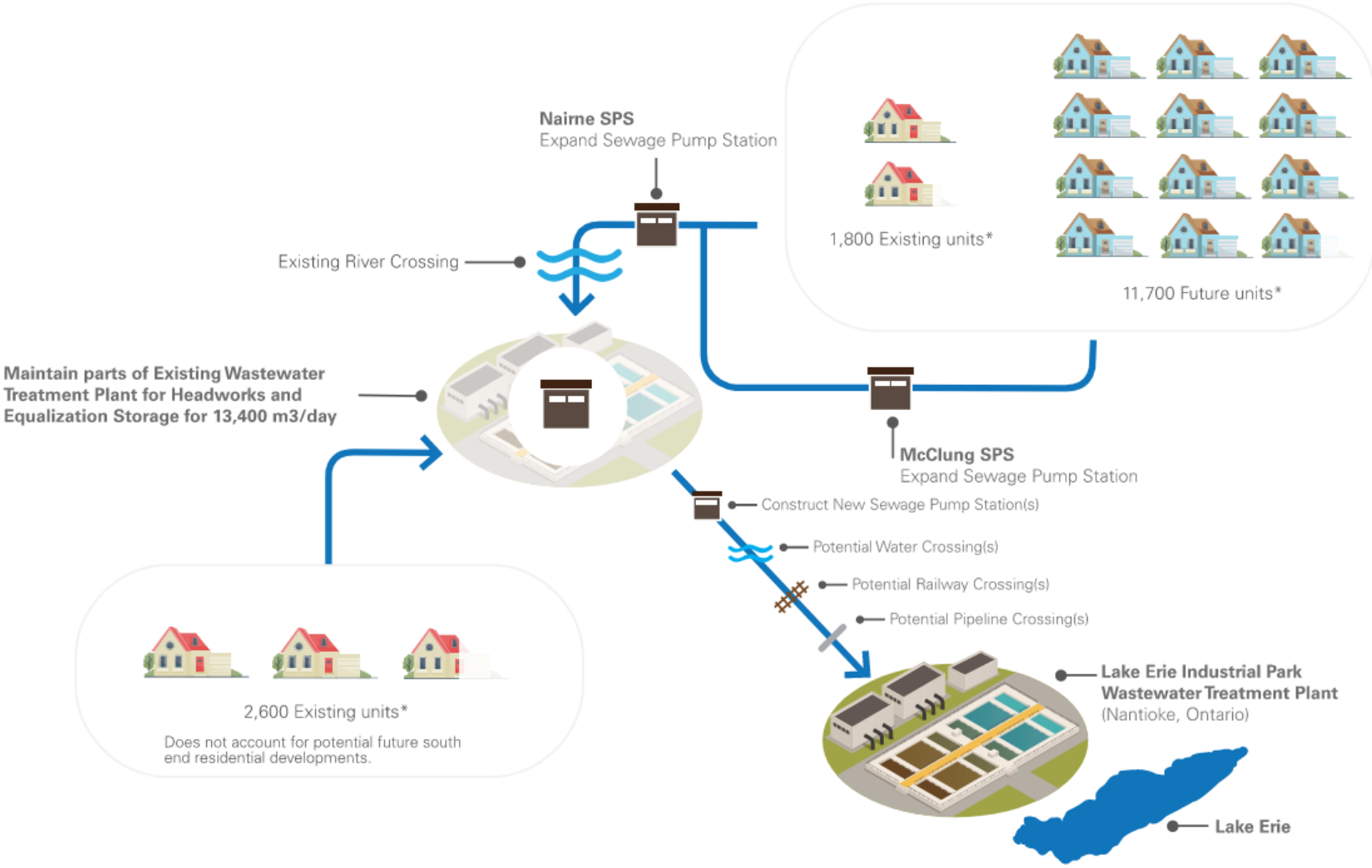
Advantages:

- Regional treatment approach
- Potential to meet build-out growth and beyond.
- WWTP would discharge into Lake Erie instead of the Grand River. Lake Erie has a higher assimilative capacity compared to the Grand River.

Disadvantages:

- Timing contingent on construction of the new Nanticoke WWTP
- Highest capital costs
- Higher operating carbon due to operating multiple facilities and SPSs.
- Expensive to twin forcemain for redundancy
- Potential for impacts on the natural and cultural environment

Figure 18 Alternative 5 Concept Plan



7.3 Capital Cost Comparison

An Opinion of Probable Construction Costs (OPCC) with a Class 'D' (Indicative Estimate) level of accuracy was developed for each of the shortlisted alternates and includes allowances for design elements that have not been fully developed. Class 'D' OPCCs developed for this assignment are expected to be within +/- 30%. The OPCCs were developed based on experience on similar projects, professional judgment, and equipment costs provided by suppliers. The cost of land acquisition, where required, has been included. Design completed as part of this MCEA is conceptual in nature for the purpose of obtaining Class 'D' cost estimates. All design parameters (e.g., pipe size, storage volume, pump size, etc.) should be confirmed during detailed design.

Any provided estimate of costs or budget is an OPCC that is based on historic construction data and does not include labour, material, equipment, manufacturing, supply, transportation, or any other cost impacts in relation to COVID-19. Variation in the estimate is possible due to the foregoing factors. These estimates should be review at the time of budgeting or project implementation.

All cost estimates are provided in 2022 dollars. It is not possible to ascertain future price escalations, however, by industry best practices escalation should be considered likely between baseline date of October 2022 and in the implementation of these projects. A cost escalation rate should be applied once implementation timing is known.

A summary of the Class 'D' capital cost estimates for each alternative are provided in Table 16. Detailed cost breakdowns are provided in Appendix H.

7.4 Evaluation of Servicing Alternatives

Table 17 shows the evaluation of the alternatives. Each alternative was assigned an evaluation impact level (refer to Table 15) for each evaluation criterion. This method provides an overall assessment of each alternative's positive and negative impacts.

Table 15 Evaluation Impact Levels

Evaluation Impact Level	Indicator
High Positive	⮝⮝
Positive	⮝
Neutral	●
Negative	⮟
High Negative	⮟⮟

Table 16 Summary of Caledonia WWTP Alternative Capital Costs

Alternatives	Sub Total	Bonding/ Overhead (10%)	Contingency & Engineering (37%) (4)	Total Cost
Alternative 2: Increase Capacity at/ or near Existing Caledonia Wastewater Treatment Plant	**$65,455,000**	**$6,545,500**	**$26,640,500**	**$98,641,000**
Treatment	$52,200,000	$5,220,000	$21,245,400	$78,665,400
Sewage Pumping Stations	$7,830,000	$783,000	$3,187,000	$11,800,000
Forcemains	$5,425,000	$542,500	$2,208,100	$8,175,600
Alternative 3: New 7,000 m^3/day Wastewater Treatment Plant and Shared Treatment with Existing Wastewater Treatment Plant (2)	**$61,857,00**	**$6,186,00**	**$25,176,000**	**$93,219,000**
Treatment	$50,027,100	$5,002,690	$20,361,000	$75,390,900
Sewage Pumping Stations	$6,830,000	$683,000	$2,780,200	$10,293,200
Forcemains	$5,000,000	$500,000	$2,035,200	$7,535,200
Alternative 4: New 13,400 m^3/day Wastewater Treatment Plant and Decommission Existing Caledonia Wastewater Treatment Plant (3)	**$86,192,000**	**$8,619,000**	**$35,081,000**	**$129,892,000**
Treatment	$65,387,200	$6,538,700	$26,612,500	$98,538,400
Sewage Pumping Stations	$9,430,000	$943,000	$3,838,300	$14,211,300
Forcemains	$11,375,000	$1,137,500	$4,629,800	$17,142,300
Alternative 5: Pump to new potential Nanticoke WWTP (3)	**$123,701,000**	**$12,370,000**	**$50,347,000**	**$186,418,000**
Treatment	$52,786,000	$5,278,600	$21,484,000	$79,548,600
Sewage Pumping Stations	$18,130,000	$1,813,000	$7,379,300	$27,322,300
Forcemains	$52,785,000	$5,278,500	$21,483,700	$79,547,200

Table 16 Notes:

(1) The cost estimates are contingent on the site of the new WWTP and must be verified in subsequent stages of the MCEA process.
(2) The cost is based on the preliminary design concept for Alternative A.1: Caledonia WWTP to Nanticoke WWTP – Direct connection (single forcemain) prepared by WT Infrastructure (WT Infrastructure, January 2022)
(3) The cost is based in a 13,400 m^3/day rated capacity
(4) This value (37% contingency & Engineering markup) was used to be consistent with rate study conducted by Watson & Associates Economists Ltd. ("Watson") for a Haldimand – Norfolk regional supply in 2020.

Table 17 Detailed Evaluation of Caledonia WWTP Alternatives

Criteria		Alternative 1 Do Nothing		Alternative 2 Increase capacity at Existing Caledonia WWTP to 13,400 m^3/day		Alternative 3 New 7,000 m^3/day WWTP - Shared Treatment with Existing Caledonia WWTP		Alternative 4 New WWTP 13,400 m^3/day Decommission Existing Caledonia WWTP		Alternative 5 Pump to a New Potential WWTP in Lake Erie Industrial Park (Nanticoke)
System Components *** WWTP = Wastewater Treatment Plant** **** SPS = Sewage Pumping Station**		None		• Increase capacity at existing Caledonia WWTP using small footprint technology. • Operate existing Caledonia WWTP at expanded capacity • Upgrade Nairne SPS and forcemain (twin river crossing) • Upgrade McClung SPS and forcemain to Nairn SPS		• New conventional technology wastewater treatment plant • Land acquisition • Operate existing Caledonia WWTP at 6,400 m^3/day (~90% of current rated capacity) • Upgrade and lifecycle rehabilitation Main SPS • Upgrade Nairne SPS and forcemain and river crossing (flow splitting and conveyance routes/crossings to be confirmed) • Upgrade McClung SPS and construct new forcemain and river crossing to new treatment plant (flow splitting and conveyance routes/crossings to be confirmed)		• New conventional technology wastewater treatment plant • Land acquisition • Decommission existing Caledonia WWTP • Upgrade Nairne SPS and forcemain and river crossing (flow splitting and conveyance routes/crossings to be confirmed) • Upgrade McClung SPS and construct new forcemain and river crossing to new treatment plant (flow splitting and conveyance routes/crossings to be confirmed) • Upgrade Main SPS and construct new forcemain to new treatment plant. (flow splitting and conveyance routes/crossings to be confirmed)		• Modify the existing WWTP for equalization • New Approximately 30 km of forcemain or gravity sewers from Caledonia to Nanticoke. • New sewage pumping station(s) • Additional 13,400 m^3/day treatment capacity at potential new Lake Erie Industrial Park WWTP • Upgrade Nairne SPS and forcemain (twin river crossing) • Upgrade McClung SPS and forcemain to Nairn SPS *The new Lake Erie Industrial Park WWTP has been considered as part of a separate MCEA and impacts are not evaluated here.*
Natural & Cultural Environment										
Receiver Impact	●	No change: Loading to the Grand River will remain the same as the current loading	⮝	Positive: Proposed effluent limits for the upgraded plant will maintain or improve downstream water quality compared to current permitted conditions. This will mitigate the environmental impact from effluent entering the Grand River aquatic ecosystem.	⮝	Positive: Proposed effluent limits for the upgraded plant will maintain or improve downstream water quality compared to current permitted conditions. This will mitigate the environmental impact from effluent entering the Grand River aquatic ecosystem.	⮝	Positive: Proposed effluent limits for the upgraded plant will maintain or improve downstream water quality compared to current permitted conditions. This will mitigate the environmental impact from effluent entering the Grand River aquatic ecosystem.	⮝ ⮝	High Positive: Effluent will no longer discharge into the Grand River. This will improve downstream water quality in the Grand River compared to current permitted conditions. The receiving body will be Lake Erie, which will be able to accommodate greater loading from the treated effluent.

	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
Floodplains and GRCA Natural Hazard Features	●	No change: Part of the existing site and property is in a GRCA regulated area and the floodplain.	➘	Potential Negative: Part of the existing site and property is in a GRCA regulated area and the floodplain. Consultation with the GRCA may be required regarding site preparation and construction to determine if permitting is necessary.	➘	Negative: Part of the property is in GRCA regulated area and the floodplain and regulated watercourse(s) cross through the property. The new WWTP site can be positioned to avoid regulated areas and hazards or mitigate the use of those areas. The outfall will need to be constructed within the GRCA regulated limits. Consultation with the GRCA will be required regarding site preparation and construction of the WWTP and outfall to determine if permitting is necessary.	➘	Negative: Part of the property is in GRCA regulated area and the floodplain and regulated watercourse(s) cross through the property. The new WWTP site can be positioned to avoid regulated areas and hazards or mitigate the use of those areas. The outfall will need to be constructed within the GRCA regulated limits. Consultation with the GRCA will be required regarding site preparation and construction of the WWTP and outfall to determine if permitting is necessary.	➘	Negative: The forcemain route could cross multiple conservation authority regulated areas. Multiple water crossings may present environmental concerns (e.g., floodplains), though these can be mitigated using directions drilling/ boring techniques. The impacts from a new WWTP would be considered under a separate MCEA. Consultation with the GRCA may be required regarding site preparation and construction to determine if permitting is necessary.
Ecology and Species at Risk	➚	High Positive: There is no potential to disrupt vegetation and wildlife or species at risk.	●	Potential Negative: Construction on the existing site has less potential to disrupt vegetation and wildlife and may impact species at risk less. The river crossing may present environmental concerns, though these can be mitigated using directions drilling/boring techniques. Environmental impacts and mitigation measures must be confirmed before construction.	➘	Negative: Construction on a greenfield site and a new outfall to the Grand River can potentially disrupt vegetation and wildlife and impact species at risk and species of conservation concern. The south site has potential habitat for an endangered snake species and may provide Significant Wildlife Habitat for Monarch Butterfly and Grasshopper Sparrow. A desktop study identified fifteen aquatic species with the potential to occur in the Grand River. The river crossing(s) may present environmental concerns, though these can be mitigated using directions drilling/boring techniques.	➘	Negative: Construction on a greenfield site and a new outfall to the Grand River can potentially disrupt vegetation and wildlife and impact species at risk and species of conservation concern. The south site has potential habitat for an endangered snake species and may provide Significant Wildlife Habitat for Monarch Butterfly and Grasshopper Sparrow. A desktop study identified fifteen aquatic species with the potential to occur in the Grand River. The river crossing(s) may present environmental concerns, though these can be mitigated using directions drilling/boring techniques.	➘	Negative: Construction on the existing site and along road easements may disrupt vegetation and wildlife and impact species at risk. Environmental impacts and mitigation measures must be confirmed before construction.
Archaeological and Heritage Resources	➚	High Positive: No potential to disrupt archaeological resources.	●	Neutral: Construction on the existing site has less potential to disrupt archaeological resources. Archaeological impacts and mitigation measures must be confirmed before construction.	➘	Negative: The proposed WWTP site has some areas with moderate to high archaeological potential. Archaeological impacts and mitigation measures must be confirmed before construction, recommend a Stage 2 Archaeological Assessment.	➘	Negative: The proposed WWTP site has some areas with moderate to high archaeological potential. Archaeological impacts and mitigation measures must be confirmed before construction, recommend a Stage 2 Archaeological Assessment.	➘	Negative: Construction on the existing site and along road easements has less potential to disrupt archaeological resources. Archaeological impacts and mitigation measures must be confirmed before construction.

	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
Community Development	↓↓	High Negative: Can not service near or long-term growth in Caledonia. Negative score is reflective of not meeting development allocation in Haldimand Official Plan and Growth Strategy.	↓↓	High Negative: The expanded treatment plant is unlikely to accommodate all buildout growth due to space and construction constraints. Expanding on the existing site for buildout capacity will be challenging, and the ability to expand beyond that capacity may be extremely limited.	↑↑	High Positive: A new treatment plant could be expanded to service residential, commercial, and industrial users beyond buildout. A new treatment plant will have sufficient capacity to service long-term growth in Caledonia.	↑↑	High Positive: A new treatment plant could be expanded to service residential, commercial, and industrial users beyond buildout. A new treatment plant will have sufficient capacity to service long-term growth in Caledonia.	↑↑	High Positive: Conveyance infrastructure can be built to service long-term growth in Caledonia. WWTPs discharging to the Great Lakes may have more potential to expand.
Climate Change Mitigation	↑↑	High Positive: No new embodied carbon, and operating carbon may remain unchanged or increase with higher flows due to new growth.	↓	Negative: Less new embodied carbon by using and retrofitting existing infrastructure. Operating carbon may increase with higher flows due to new growth. Various technologies or practices could reduce or mitigate embodied or operating carbon. But they could be limited due to site constraints.	↓↓	High Negative: New construction on a greenfield site has a higher embodied carbon footprint, although this alternative uses the existing WWTP. Operating carbon would be higher to run two WWTPs. Various technologies or practices could reduce or mitigate embodied or operating carbon.	↓	Negative: New construction on a greenfield site has a higher embodied carbon footprint. Various technologies or practices could reduce or mitigate embodied or operating carbon.	↓↓	High Negative: Operating carbon contributions come from operating conveyance infrastructure (e.g., SPSs) and WWTPs (e.g., neighbouring and/ or existing). Various technologies or practices could reduce or mitigate embodied or operating carbon.
Climate Change Adaptation	↓↓	High Negative: No ability to accommodate higher peak flows due to increased I/I and less flexibility to address increased power failures in the grid or changing backup power requirements.	↓	Negative: Difficult to accommodate higher peak flows because there would be less space to expand on-site or construct additional equalization storage.	↑↑	High Positive: A new plant can be designed to handle peak flows and adequate power capacity to address increased power failures in the grid or changing backup power requirements. The new plant could be expanded if the existing WWTP can no longer manage peak flows.	↑↑	High Positive: A new plant can be designed to handle peak flows and adequate power capacity to address increased power failures in the grid or changing backup power requirements.	●	Neutral: Equalization storage is required to mitigate higher peak flows. Potential for larger impacts on downstream conveyance infrastructure if peak flows exceed design peak flows because a substantial investment may be needed to add more capacity (e.g., twin forcemain).
Technical Environment										
Effluent Quality	●	Potential Negative: Plant may be unable to meet very stringent effluent criteria in the future.	↑	Positive: Expanded plant can be designed to meet very stringent effluent criteria if required, using small footprint technology.	↑	Positive: Greenfield plant can be designed to meet very stringent effluent criteria if required.	↑	Positive: Greenfield plant can be designed to meet very stringent effluent criteria if required.	↑	Positive: Greenfield plant can be designed to meet very stringent effluent criteria if required.
Constructability	↑↑	High Positive: No construction required.	↓↓	High Negative: Significant work is required, including a river crossing. Construction will temporarily impact the existing WWTP operations, and complex sequencing is needed to maintain operations during construction.	↑	Positive: Significant work, including a river crossing(s), is required. The existing WWTP can remain in service during construction. The proposed sites have space for construction staging.	↑	Positive: Significant work, including a river crossing(s), is required. The existing WWTP can remain in service during construction. The proposed sites have space for construction staging.	●	Potential Negative: Significant work is required. Most of the work to construct the forcemain is along roadways, and forcemain route could require multiple water crossings, railway, or pipeline crossings. The existing WWTP can remain in service while the conveyance infrastructure is constructed. If this alternative includes constructing equalization storage at the existing WWTP, this alternative could be more complicated.

	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
Phasing and Expandability	⮟⮟	High Negative: No phasing or expandability possible.	⮟⮟	High Negative: The treatment capacity of the WWTP could be expanded in phases, however constructability and construction sequencing is going to be very challenging. Additionally, site constraints and separation distances may limit options for future expansion.	⮝⮝	High Positive: The treatment capacity of the new WWTP could be expanded in phases, and the existing WWTP would not need to be expanded. The County could apply to re-rate the existing WWTP for less treatment capacity or use that capacity to service additional south Caledonia growth beyond 25 years.	⮝	Positive: The treatment capacity of the new WWTP could be expanded in phases.	⮟	Negative: Pumping stations can be built with the ability to expand (e.g., additional wet well space, space to add new pump(s)). However, the forcemain can not be phased and would be built for future build-out flows and expanding the forcemain could require complete replacement. The treatment capacity of the proposed Nanticoke WWTP could be expanded in phases.
System Redundancy and Resiliency	⮟⮟	High Negative: No change to system redundancy or resiliency.	●	Potential Negative: Upgraded treatment plant would be highly reliable, however, space constraints may limit opportunities to include redundancy in the design.	⮝⮝	High Positive: Two treatment plants provide a high level of redundancy and new treatment plants are highly reliable. The County could construct the flexibility to direct flows to either plant during routine or emergency maintenance activities. However, pumping arrangement may be complicated.	⮝	Positive: New treatment plants are highly reliable, and design can include redundancy.	●	Potential Negative: New treatment plants are highly reliable, and the design can include redundancy. There can be some redundancy in sewage pump stations. However, twinning would be required to create redundancy in the forcemain, adding to the project cost.
Economic Environment										
Capital Costs (1)	●	Status quo.	⮝	Positive: Low capital costs relative to other options. ~ $99 M	⮝	Positive: Low capital costs relative to other options. ~ $94 M (2)	⮟	Negative: Higher capital costs relative to other options. ~ $130 M (2)	⮟⮟	High Negative: Highest capital costs ~ $187 M (3)
Overall Rating		⮟		⮟		⮝		⮝		⮟

Table 17 Notes:

(1) An Opinion of Probable Construction Costs (OPCC) with a Class 'D' (Indicative Estimate) level of accuracy was developed for each of the shortlisted alternates and includes allowances for design elements that have not been fully developed.

(2) Cost estimates are contingent on the final location of the new WWTP, conveyance routing/river crossing locations, and phasing and must be verified in subsequent stages of the MCEA process.

(3) The cost is based on the preliminary design concept for Alternative A.1: Caledonia WWTP to Nanticoke WWTP – Direct connection (single forcemain) prepared by WT Infrastructure (WT Infrastructure, January 2022).

7.5 Preferred Servicing Alternative

From this evaluation, Alternatives 3 and 4 are anticipated to address the problem and opportunity statement and score similarly. The key highlights of the evaluation are related to:

- **Constructability and Expansion:** The alternatives involving the construction of greenfield plants (Alternatives 3 and 4) have the advantage of being simpler from a construction sequencing perspective. They also have a greater potential for cost-effective expansion beyond the build-out design flows due to the availability of land at a new greenfield site and the required separation distance from adjacent development. For Alternative 2, construction sequencing will be extremely challenging to maintain plant operations and site constraints and separation distances may limit options for future expansion.
- **Capital Costs:** The main disadvantage associated with Alternatives 4 is the high capital costs compared to the alternative to expand the existing WWTP (Alternative 2) or operate the existing plant and a new plant (Alternative 3). Alternative 3, however, may have higher operation and maintenance (O&M) and lifecycle costs to operate two plants. Based on the 2020 Draft MSP Update, at some point, the O&M costs for operating two plants may exceed the capital cost differences between alternatives 3 and 4. It is anticipated that the County will transition to a single plant (Alternative 4) as the existing plant approaches the end of its useful life and requires major lifecycle rehabilitation.
- **Natural and Cultural Environment:** Greenfield development has more potential to impact the natural and cultural environment than expanding on the existing site. For Alternatives 3 and 4, the potential impacts will vary based on site selection, refer to Section 4.0. However, with further studies, continued consultation with stakeholders, and implementation of appropriate mitigation measures recommended by experts, the County could manage potential impacts for any of the alternatives.

Based on the evaluation the preliminary preferred alternative is Alternative 3 – New WWTP – Shared Treatment with Existing Caledonia WWTP. It is anticipated that the County will transition to a single plant (Alternative 4) as the existing plant approaches the end of its useful life and requires major lifecycle rehabilitation. The existing Caledonia WWTP was constructed in approximately 1991, so the normal life span of the WWTP is to 2042 and the extended rehabilitation life span is to 2063. Proposed timing to decommission the existing WWTP must be assessed in subsequent phases of the MCEA.

The main benefits of this alternative (Alternative 3 with transition to 4) includes:

- Reliable treatment plant with ability to meet current and potential more stringent effluent requirements in the future. A new greenfield plant can service the community of Caledonia in and beyond the 25-year and build-out horizon.
- Lowest capital costs and simpler construction sequence because the existing WWTP can remain in operation during construction.
- Option to decommission the existing plant and expand the new plant in phases. During subsequent phases of this Class EA, further evaluation will be required to determine at what point the existing WWTP should be decommissioned. As the capacity of the new WWTP is increased over time, the rated capacity of the existing WWTP plant can be downgraded.

7.6 Future Regional Scale Considerations

Due to high capital costs and impacts on existing users, the County is not pursuing Alternative 5 – Pump to New Potential Nanticoke WWTP. However, this could be considered as a future alternative if one of the following drivers is realized:

- Commitment to proceed with centralized wastewater treatment plant in Nanticoke accompanied by a feasible funding plan for connecting Caledonia to Nanticoke for existing users.
- Section 16 Order request (previously Part II Order) received by MECP about the proposed new WWTP in Caledonia.
- Inability to secure lands in Caledonia to construct a new WWTP.

If required, the County will revisit the Phases 1 and 2 work to include consideration of non-local treatment alternatives.

8.0 Site Selection and Constraints

Approximately six sites were considered within and near Caledonia for the potential construction of a new WWTP, including sites on both the north and south of Caledonia. From this high-level review, the County has identified two potential short-listed locations for the WWTP. Site options were limited due to requirements of being near existing infrastructure and the need to access the receiving water body, the Grand River. As part of Phase 2 of the Class EA, a site evaluation was undertaken to determine the preferred potential location for the new Caledonia WWTP.

The methodology included reviewing contextual information for the two potential sites identified by the County. All data was publicly available or provided by Haldimand County. In some instances, utilities were contacted to provide high level input into serviceability.

Following aspects of each of the four potential sites were reviewed:

1. Site Location
2. Access and Traffic
3. Topography
4. Surrounding Land Uses and Setbacks
5. Environmental Features
6. Site Serviceability
7. Overall Site Limitations and Opportunities

For each site a conceptual site layout and outfall route was also developed. We note that this assessment is high level in nature and there may be other factors that were not included in the assessment that alter the outcome of the evaluation. Evaluations within the assessment are preliminary and detailed assessments may reveal additional factors which may also alter the outcome of the evaluation. Evaluations may include statements that suggest that a site is preferred, however, it should be noted that the evaluations are largely relative to each other.

8.1 North Site – 1730 Haldimand Hwy 54

The site is located at 1730 Haldimand Highway 54 and the property is legally described as –

PT LT 25 FRONT CON ON GRAND RIVER SENECA; PT LT 26 FRONT CON ON GRAND RIVER SENECA SRO AS IN HC81994; BTN PT 1 18R3444 & DEP2621 S/T RIGHT IN HC50465 S/T & T/W HC81994; S/T HC118236, HC118237; S/T HC120530, HC120531, S7453, S7508; HALDIMAND COUNTY

The property is currently under private ownership with two Roll Numbers and one PIN. It is presently designated as Agricultural in the County Official Plan and zoned as Agricultural (A) in the County Zoning By-law. There are hydro line and gas line easements on the property which, depending on the site configuration, may also go through the WWTP footprint. A site plan is provided in Figure 19.

The key advantages and disadvantages are as follows:

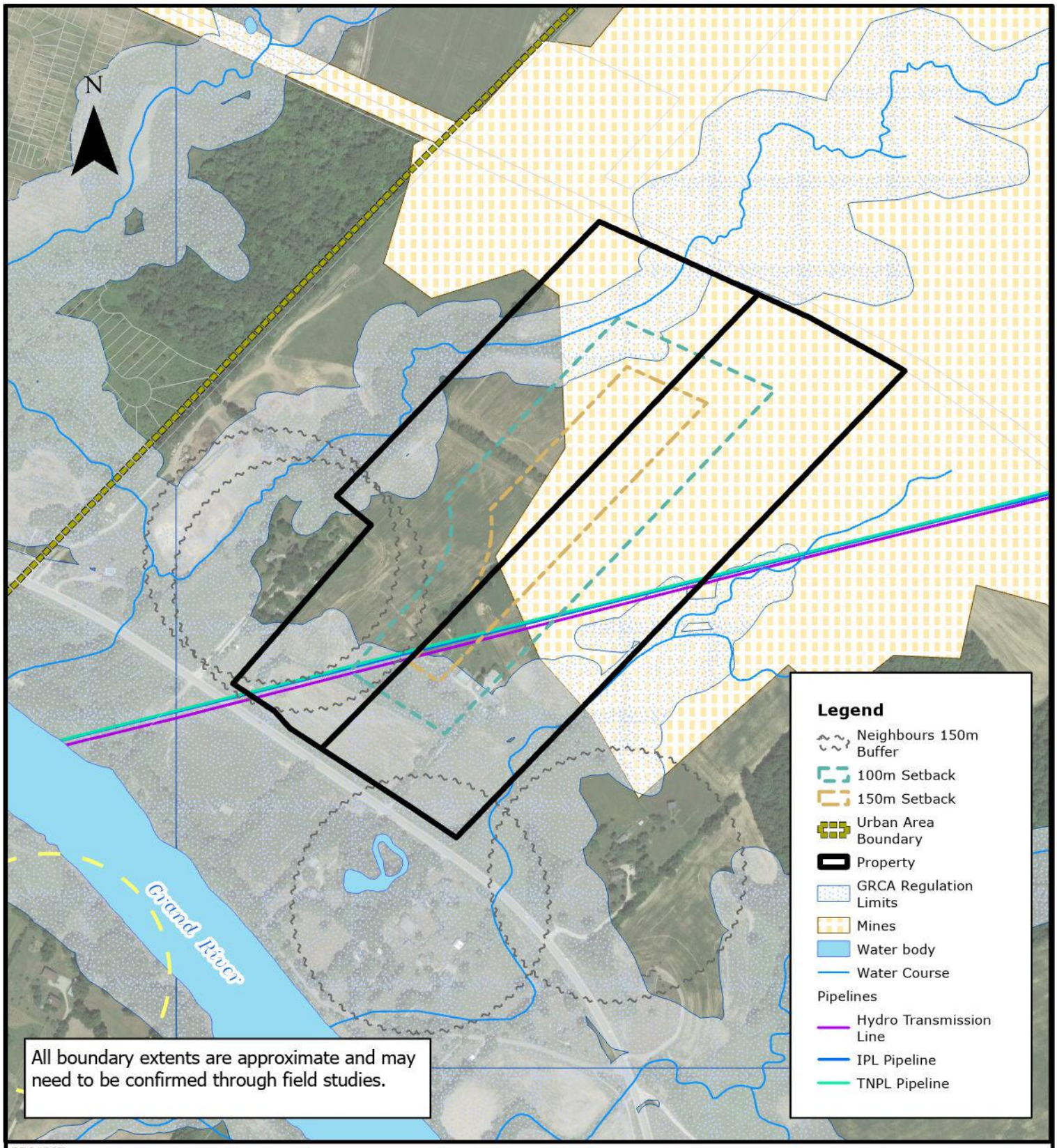
Advantages:

- Site is located east of Caledonia and has good access through Haldimand Highway 54.
- It is near the Grand River with a shorter outfall route (approx. 600 m). ACS requires a detailed bathymetric analysis to- select the ideal outfall location.
- Site is located outside of the urban boundary of Caledonia and existing agricultural character in the surroundings is not likely to be adversely impacted.
- Union Gas distribution line present along Haldimand Highway 54 and a simple road crossing to site will be required.
- Hydro lines are present along Haldimand Highway 54.
- 300 mm diameter water transmission main present along Haldimand Highway 54.
- A cultural heritage study was developed, and it was concluded that the study area is not considered a cultural heritage landscape.

Disadvantages:

- Site is located on privately held property.
- County intention to buy existing buildings on the property may incur significantly higher acquisition costs.
- There are existing easements on the property which restrict the effective use of this site.
- The required 100 m separation distance and buffering for sensitive uses, such as residential uses, severely limit the usability of this site. Once all required setbacks are in place, the site is extremely constrained.
- Site is partially located within the Grand River Floodplain and appropriate protection from potential flood hazard will need to be provided pursuant to Policy 3.1.5 of the PPS.
- Site has a secondary water source (stream) running along east boundary of the property and a Headwater Fisheries Assessment might be required in the future design phases.
- Partially within Riverine Hazard Lands and exact limits of the hazards need to be assessed.
- A significant portion of this site is undermined by the, now closed, Georgia Pacific Mine 3. An Engineering Assessment (including Geotechnical Study) would be required to determine which areas must be avoided or remediated for use. These additional efforts significantly increase costs.

- From the stage 1 archaeological study it was concluded that the portions of the site exhibit a moderate to high potential for the identification and recovery of archeological resources
- Possible conflict for WB-20 vehicles with existing overhead utilities needs to be verified.
- Species at risk were identified during the SAR study within the study.
- Highly unlikely that this site provides sufficient space to service the community of Caledonia beyond the 25-year horizon.
- Design and construction of the new WWTP would be more challenging for this location due to site constraints and sloped topography.



PROJECT:

CALEDONIA WASTEWATER TREATMENT PLANT CLASS ENVIRONMENTAL ASSESSMENT

CALEDONIA, ONTARIO

DRAWING:

CONSTRAINTS MAP OF NORTH SITE - 1730 HALDIMAND HWY 54

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS
www.jlrichards.ca

DESIGN:	LP/TB
DRAWN:	TB/CK
CHECKED:	LP/JW
JLR #:	31196-009

DRAWING #:

FIGURE 19

File Location: \\jlrichards\Corp\Projects\31000\31196-009 - Caledonia WWTP Class EA\3-Production\1-Civil\GIS\31196-009_Pro\31196-009_Pro.aprx

Plot Date: February 7, 2024 11:53 AM

8.2 South Site– 4300 River Road

This site is located at 4300 River Road and the property is legally described as –

OND CON BF GRAND RIVER PT LOTS 33 TO 36 RP 18R6372 PARTS 1 TO 9

The property is currently under private ownership. It is presently designated as Agricultural in the County Official Plan and zoned as Agricultural (A) in the County Zoning By-law. There are hydro line and gas line easements on the property which, depending on the site configuration, may also go through the WWTP footprint. A site plan is provided in Figure 20.

The key advantages and disadvantages are as follows:

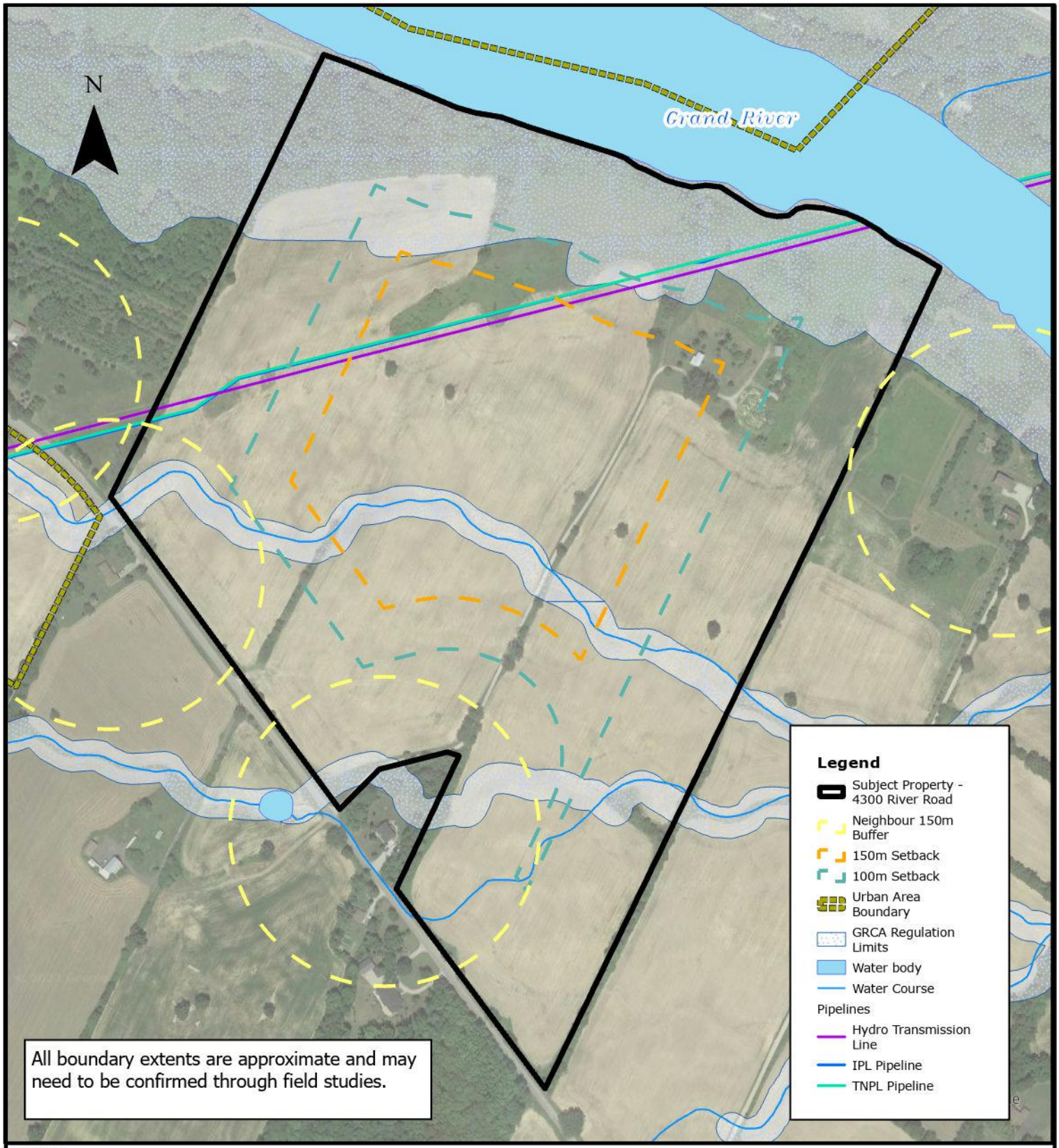
Advantages:

- Site is located east of Caledonia and has good access through River Road.
- It is near the Grand River with shortest outfall route (approx. 250 metres). ACS requires a detailed bathymetric analysis to select the ideal outfall location.
- Site is located outside of the urban boundary of Caledonia and existing agricultural character in the surroundings is not likely to be adversely impacted.
- Site has a gradual hill sloping downwards north to south across the site and a hill in the north-west corner of the site. Otherwise, the site is relatively flat in the east-west direction. The site has a similar elevation of River Road. The site is elevated above the river.
- Union Gas distribution line present along Haldimand Highway 54 and a simple road crossing to site will be required. Enbridge pipeline and Trans-Northern pipeline cut across the lot.
- Hydro lines are present along River Road, primary overhead hydro line is connected by primary overhead line crossing the Grand River to connect to the study area.
- The site is not impacted by the, now closed, Georgia Pacific Mine 3.
- The site has sufficient space to maintain all required setbacks and buffers. When all easements and other constraints are considered, there is still substantial space for the placement of the WWTP.
- A cultural heritage study was conducted, and it was concluded that the study area is not considered a cultural heritage landscape.
- Site is large enough to allow for an optimized design of the WWTP and to accommodate future expansions beyond the 25-year horizon of this study.
- More convenient site location. The site is located directly across from McClung SPS and is slightly down river from the existing WWTP allowing conveyance infrastructure to follow a more direct route.

Disadvantages:

- Site is located on privately held property.
- County intention to buy existing buildings on the property which may increase acquisition costs overall, however, since these buildings are abandoned, the increase in costs may not be substantial.
- There are existing easements on the property which may restrict plant placement.
- Property is partially located within the Grand River Floodplain and appropriate protection from potential flood hazard will need to be provided pursuant to Policy 3.1.5 of the PPS.
- Site has two additional water sources (streams) running across the centre of the property and along the southeast boundary. A Headwater Fisheries Assessment may be required during the further design phases.

- Property is partially within Riverine Hazard Lands and Other Hazard Lands on the south boundary. Exact limits of the hazards need to be assessed.
- Site is within 300 m of a primary water source (Grand River), from the stage 1 archaeological study it was concluded that the portions of the site exhibit a moderate to high potential for the identification and recovery of archeological resources.
- Sixteen species at risk were identified during the background review as having potentially suitable habitat within the study area. Two species (Barn Swallow and Eastern Wood - Pewee) were documented during field investigations.
- Connection to water transmission lines is far relative to other option.
- Possible conflict for WB-20 vehicles with existing overhead utilities needs to be verified.



PROJECT:

CALEDONIA WASTEWATER TREATMENT PLANT CLASS ENVIRONMENTAL ASSESSMENT

CALEDONIA, ONTARIO

DRAWING:

CONSTRAINTS MAP OF SOUTH SITE - 4300 RIVER ROAD

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS
www.jlrichards.ca

DESIGN:	LP/TB
DRAWN:	TB/CK
CHECKED:	LP/JW
JLR #:	31196-009

DRAWING #:

FIGURE 20

File Location: \\jlrichards\Corp\Projects\31000\31196-009 - Caledonia WWTP Class EA\3-Production\1-Civil\GIS\31196-009_Pro\31196-009_Pro.aprx

Plot Date: February 7, 2024 11:53 AM

8.3 Evaluation of Site Alternatives

Evaluation criteria were developed for assessing each site based on a review of the background information, experience on similar assessments, and consultation with County staff. The evaluation was conducted using criteria in the following four major criteria categories:

- Site Location, Land Uses and Setbacks
- Environmental Features
- Site Serviceability

Each alternative was assigned an evaluation impact level for each criterion (refer to Table 18).

Table 18 Evaluation Impact Level

Evaluation Impact Level	Color Indicator
High Positive	▲▲
Positive	▲
Neutral	●
Negative	▼
High Negative	▼▼

This method provides an overall assessment of the positive and negative impacts of each alternative. Further consideration of site and design alternatives will need to be conducted as part of Phase 3 Schedule C Class EA. The detailed evaluation the two sites is provided in Table 19 below.

Table 19 Detailed Potential Caledonia WWTP Site Evaluation Table

Criteria	North Site – 1730 Haldimand Hwy 54		South Site – 4300 River Road	
Site Location, Land Uses and Setbacks				
Property Ownership	●	Neutral: The site is located on privately held property (two roll numbers but one PIN) with an approximate area of 30 ha. This site may be more complicated to deal with relative to other site, however, the County can acquire through appropriate means or expropriate lands.	●	Neutral: Site is located on a single privately held property with an approximate area of 42 ha. The County can acquire through appropriate means or expropriate lands.
Easement and Encumbrances	▼▼	High Negative: Easements on lot (possibly on-site location) • Interprovincial Pipeline Limited Easement • Trans-Northern Pipeline Company Easement • Hydro-Electric Power Commission of Ontario (Hydro One) These easements severely limit the usability of the site.	▼	Negative: Easements on lot (possibly on-site location) • Interprovincial Pipeline Limited Easement • Trans-Northern Pipline Company Easement • Hydro-Electric Power Commission of Ontario (Hydro One)
Site Location	▲	Positive: Site located east of Caledonia and will remain outside the urban boundary. This site is also relatively close to the Grand River (receiver) – less than 600 m.	▲▲	High Positive: Site located southeast of Caledonia and will remain outside the urban boundary. This site is also closest to the Grand River (receiver) – less than 300 m
Site Surroundings and Potential Setbacks	▼▼	High Negative: Property has a farming operation with residence (sensitive use to WWTP) at present. Existing surrounding uses are predominantly agricultural with rural residences. South side of the property across Hwy 54 has higher intensity of residential (sensitive) uses. Existing agricultural character will likely remain in the north, south and east side of the property. West side of the property has residential subdivision planned. Site will be likely be highly visible from roadway. Screening can be implemented but will not be able to fully obscure the site. As per D-2 Compatibility between Sewage Treatment and Sensitive Land Use Guidelines, the minimum separation distance for WWTP with capacity greater than 500 m^3/day but less than 25,000 m^3/day is 100 m while the recommended separation distance is 150 m. The current sensitive uses (residential use) on the property will be within the minimum separation distance of 100 m but since the County is intending to acquire the existing buildings on the property, maintaining minimum separation distance is not likely to be an issue. Acquiring the existing uses on the property will decrease the long-term operating cost of the WWTP to mitigate impact on these uses. The residential uses on the south side of the property across Hwy 54 should not be within the 100 m minimum separation distance. It is important to note that after implementing all required separation distances and buffering for sensitive uses, the remaining space is extremely constrained, and the usability of the site is severely limited. MDS I and MDS II is not required for infrastructure in relation to existing farm related operations on property (The Minimum Distance Separation (MDS) Document – Formulae and Guidelines for Livestock Facility and Anaerobic Digester Odour Setbacks – IG#3).	▲	Positive: Property has a farming operation with residence (sensitive use to WWTP) at present. Existing surrounding uses are predominantly agricultural with rural residences. West side of the property across River Road has higher intensity of residential (sensitive) uses. Existing agricultural character will likely remain in the south and east side of the property. Southwest side of the property has residential subdivision planned. Site will likely be visible from roadway. Screening can be implemented. As per D-2 Compatibility between Sewage Treatment and Sensitive Land Use Guidelines, the minimum separation distance for WWTP with capacity greater than 500 m^3/day but less than 25,000 m^3/day is 100 m while the recommended separation distance is 150 m. The current sensitive uses (residential use) on the property will be within the minimum separation distance of 100 m but since the County is intending to acquire the existing buildings on the property, maintaining minimum separation distance is not likely to be an issue. Acquiring the existing uses on the property will decrease the long-term operating cost of the WWTP to mitigate impact on these uses. MDS I and MDS II is not required for infrastructure in relation to existing farm related operations on property (The Minimum Distance Separation (MDS) Document – Formulae and Guidelines for Livestock Facility and Anaerobic Digester Odour Setbacks – IG#3)
Site Access and Traffic	▲	Positive: Access to site on north side of Haldimand Highway 54 (2 lane public road). Abandoned Railway along north side of the property which has been converted into the Gypsum Mine Tract Trail (Multi-use, off road trail). There is a possible conflict with existing utilities. Overhead utilities along Hwy 54 appear to be low and a WB-20 vehicle may not be	▲	Positive: Access to site on north side of River Road (2 lane public road). Access to River Road is through Haddington Street. There is a possible conflict with existing utilities. Overhead utilities along River Road appear to be low and a WB-20 vehicle may not be able to safely pass under. This potential limitation will need to be verified. Site location is within the lot therefore access road will be required to connect from River Road.

Criteria	North Site – 1730 Haldimand Hwy 54		South Site – 4300 River Road	
		able to safely pass under. This potential limitation will need to be verified. Site location is within the lot therefore access road will be required to connect from Highway 54.		
Official Plan and Zoning By-Law	●	Neutral: Property is designated as Agriculture. Section 5.E.1. of OP mentions that utilities and services are permitted in all land use designations provided that such development satisfies the provisions of the Environmental Assessment Act, the Environmental Protection Act, and any other relevant legislation.	●	Neutral: Property is designated as Agriculture. Section 5.E.1. of OP mentions that utilities and services are permitted in all land use designations provided that such development satisfies the provisions of the Environmental Assessment Act, the Environmental Protection Act, and any other relevant legislation.
	●	Neutral: Property is zoned as Agriculture (A). Section 4.62 € of the ZBL permits water or sewage treatment plant including any accessory public utility yard in all zones	●	Neutral: Property is zoned as Agriculture (A). Section 4.62 € of the ZBL permits water or sewage treatment plant including any accessory public utility yard in all zones.
Environmental Features				
Natural Environment (Wetlands, Woodlands)	➘	Negative: Site location is located with active agricultural fields with low ecological value. No provincially significant wetlands, woodlands, or ANSIs were identified in the site area. However, adjacent lands may include forest, wetlands, watercourse, and grassland habitat. There are no significant wetlands on the property or the site. Small, wooded area is present along property boundary outside of the site location. There is a line of trees on the site, which may need to be removed or relocated.	➚	Positive: There are no significant wetlands on the property or the site. Small, wooded area is present along north property boundary outside of the site location.
Species At Risk and Species of Conservation Concern	➘	Negative: A SAR study was completed to evaluate wildlife in the north sites. Five species at risk were identified during the background review as having potentially suitable habitat within the study area. Of these, three species (Monarch Butterfly, Barn Swallow, and Eastern Wood-pewee) were documented during the field investigations.	➘	Negative: Sixteen species at risk were identified during the background review as having potentially suitable habitat within the study area. Two species (Barn Swallow and Eastern Wood-pewee) were documented during field investigations.
Water Resources and Hazard Lands	➘	Negative: The site is within the GRCA Watershed boundary and part of the property is within the Grand River Floodplain. Policy 3.1.5 of the PPS generally prohibits such a use unless it can be protected from flood. There is a water course (stream) running along the east boundary of the property. Part of the property (along the water course) is designated as Riverine hazard lands and other hazard lands. Exact limits if the hazard are unknown and should be assessed. A headwater fisheries assessment will be required although sensitivity for the same cannot be assessed at this time. The site (and other sites) is outside Wellhead Protection Area and Intake Protection Zone.	➘	Negative: Site is within the GRCA Watershed boundary and part of the property is within the Grand River Floodplain. Policy 3.1.5 of the PPS generally prohibits such a use unless it can be protected from flood. There is a water course (stream) running across the property (east-west). There is a second water course (stream) running across the southeast corner of the property. Part of the property (along the north boundary on the Grand River) is designated as Riverine hazard lands. Part of the property (along the water courses) is designated as natural hazard, which may possibly be on site as well. Exact limits of the hazard are unknown and should be assessed. A headwater fisheries assessment will be required although sensitivity for the same cannot be assessed at this time. The site (and other sites) is outside Wellhead Protection Area and Intake Protection Zone. Small section of property in southeast of the property is designated as other hazard lands, outside the site.
Agricultural Potential	➘	Negative: Site has Canada Land Inventory Soil level 2 (moderate limitations) and level 5 (very severe limitations) – similar or slightly more suitable for agriculture compared to the south site. Property has Canada Land Inventory Soil as levels 2, 3, 4, and 5.	➘	Negative: Site has Canada Land Inventory Soil as level 3 (moderately severe limitations) and level 5 (very severe limitations) – similar suitable for agricultural compared to north site. Property has Canada Land Inventory Soil as levels 2, 3, 4 and 5.
Natural Resources (Mineral Aggregate, Mining)	➘ ➘	High Negative: Site is located outside but is adjacent to the Closed Georgia Pacific Mine 3. Policy 3.2.1 of the PPS permits development adjacent to mine hazards only if rehabilitation or other measures to address and mitigate hazards are under way or have been completed. Impact on extraction zones needs to be evaluated. Engineering assessment (including geotechnical study) will be required.	➚	Positive: Site is outside the Closed Georgia Pacific Mine 3. Geotechnical assessment will be required.
Archaeological and Cultural Heritage Resources	➘	Negative: A Stage 1 Archaeological Assessment of the site was completed in September 2022. A desktop study identified 426 archaeological sites within 1km of both sites (north and south). The field study determined that the site has some areas with moderate to high archaeological potential due to soil quality, proximity to the Grand River, length of occupation, and proximity to the aforementioned archaeological sites. A Stage 2 Archaeological Assessment is recommended for the areas of the site retaining archaeological potential. A cultural heritage study was developed, and it was concluded that the study area is not considered a cultural heritage landscape.	➘	Negative: A Stage 1 Archaeological Assessment of the site was completed in September 2022. A desktop study identified 426 archaeological sites within 1km of both sites (north and south) and one site was identified within 50m of the south site. The field study determined that the site has some areas with moderate to high archaeological potential due to soil quality, proximity to the Grand River, length of occupation, and proximity to the aforementioned archaeological sites. A Stage 2 Archaeological Assessment is recommended for the areas of the site retaining archaeological potential. A single area located within the site was confirmed that to have been subject to extensive and deep land alterations that has severely damaged the integrity of any archaeological resources. A

Criteria	North Site – 1730 Haldimand Hwy 54		South Site – 4300 River Road	
				cultural heritage study was developed, and it was concluded that the study area is not considered a cultural heritage landscape.
Site Serviceability				
Natural Gas	⮝⮝	High Positive: Union Gas distribution line present along Haldimand Hwy 54 (site adjacent). Capacity is available. Connecting is a simple road crossing to site and will be cheapest amongst the two sites.	⮝⮝	High Positive: Union Gas Distribution line present along River Road (site is greater than one kilometer away) and a transmission line is present along the west property boundary. Capacity is available. Connecting may involve a road crossing and extending the distribution line.
Electricity	⮝⮝	High Positive: Above ground primary hydro lines present along Haldimand Hwy 54 and appear to be connected to the lot. Capacity needs to be confirmed with Hydro One. Assuming there is sufficient capacity, cost for new overhead service to the site will be the least amongst the two sites.	⮝⮝	High Positive: Above ground primary hydro lines present along River Road. Primary overhead hydro line present crossing the Grand River and appear to be connected to the lot. Assuming there is sufficient capacity, cost for new overhead service will vary based on using a service connection from River Road or from across the Grand River.
Water Services	⮝⮝	High Positive: Will need to connect to 300 mm diameter Transmission Main along Haldimand Highway 54 (site adjacent). The available capacity and pressure will need to be confirmed. Fire flow availability and demand will also need to be reviewed.	⮟	Negative: Will need to connect to 200 mm diameter Water Main along River Road greater than 1 km west from the site. The available capacity and pressure will need to be confirmed. Fire flow availability and demand will also need to be reviewed.
Sanitary Sewage (on-site considerations)	●	Neutral: On-site sanitary sewage will be pumped into headworks. This is consistent across all sites under consideration.	●	Neutral: On-site sanitary sewage will be pumped into headworks. This is consistent across all sites under consideration.
Site Topography	⮟⮟	High Negative: Slight slope from west to east along the entire site. Minor slope from north to south on the north end of the site. Transitions to a relatively steep slope north to south in the south end as the property drops to Highway 54.	⮝	Positive: Relatively flat along majority of site. Slight slope west to east. Moderately steep slope on north end, down the river.
Overall Rating	⮟		⮝	

8.4 Preferred Site Alternative

From this evaluation, the south site is anticipated to be the location of the new Caledonia WWTP. The key highlights of the evaluation are related to:

- **Construction Constraints:** A variety of constraints are present in both sites (including undermined areas, ecological constrains, flood plain and Utility corridors). However, the South site constrains are significantly less than the north site. The available land where the new WWTP would be developed is larger and would allow for future growth beyond the 25-year horizon allowing for adequate separation from neighboring properties.
- **Proximity to the Grand River:** One disadvantage of the north site is the proximity to the discharge location (Grand River). The north site is located significantly further away from the receiver, which would implicate higher construction costs. The north site would require crossing the Haldimand HWY 54 and major servicing easements.
- **Site Size and Usability:** The south site has a much larger area allowing for adequate buffer zones for neighboring properties, and sufficient space accommodate plant layout optimization. The northern site has a much smaller area and is significantly narrower. Once all required buffers are in place, the remaining area is very limited and restricted. The topography on the northern site also complicates plant design and placement.
- **Conveyance Infrastructure Routing Options:** The proposed south site is located directly across from the existing McClung SPS. McClung SPS was designed to receive all sewage flows from future western developments in Caledonia. Through a new river crossing, McClung could have direct access to a WWTP on the south site. If a new crossing is not feasible, the south site is just down river from the existing WWTP, also providing a direct route for servicing. The northern site is much further from the existing infrastructure in Caledonia and has limited servicing options.

Based on the evaluation, the preliminary preferred site is the south site. With the future servicing alternative selected, along with a preferred site location, the first Public Open House was held to gather feedback and concerns from the general public and stakeholders (see Section 16.2.1). Following the Public Open House, further consideration has been given to the southern conveyance options and the river crossing alternatives, as described in Sections 9.0 and 10.0 to follow. The proposed design configuration of the plant will be further evaluated during Phase 3 of the Class EA.

9.0 Southern Conveyance Options

9.1 Introduction

A conveyance option is needed to transmit sewage from Main SPS (located on the current WWTP site) to the new WWTP once the current WWTP is decommissioned in the future. There are three (3) proposed options for this sanitary forcemain routing:

- Option 1 – Routing Along the Southern Riverbank
- Option 2 – Routing Along River Rd.
- Option 3 – Routing Along the Southern Riverbank, Elgin St., and River Rd.

The three options are described in detail in the following section, including an Opinion of Probable Construction Cost, and high-level advantages and disadvantages.

9.2 Summary of Conveyance Options

9.2.1 Option 1 - Routing Along the Southern Riverbank

Option 1 looks at installing a sanitary forcemain along the southern bank of the Grand River. This proposed route starts by following an existing County owned easement for about 600 m southeast of the current WWTP. The route continues along the riverbank, passing through four residential lots before reaching the new WWTP property. An easement would need to be secured along these residential lots for this to be a viable option. The total length of required forcemain is approximately 1915 m for this option.

A majority of this proposed route falls within the floodplain, therefore approval from the Grand River Conservation Authority (GRCA) is required for the proposed work. This route also crosses over a Trans-Northern Pipelines Inc. (TNPI) gas pipeline buried within the Hydro One utility corridor, so a TNPI crossing application will be needed.

The OPCC for Option 1 is estimated at $6,155,000. This cost includes the forcemain installation, and TNPI crossing costs. A detailed cost breakdown is provided in Appendix H. The OPCCs assume that the works are constructed in one phase. A conceptual layout is provided in Figure 21.

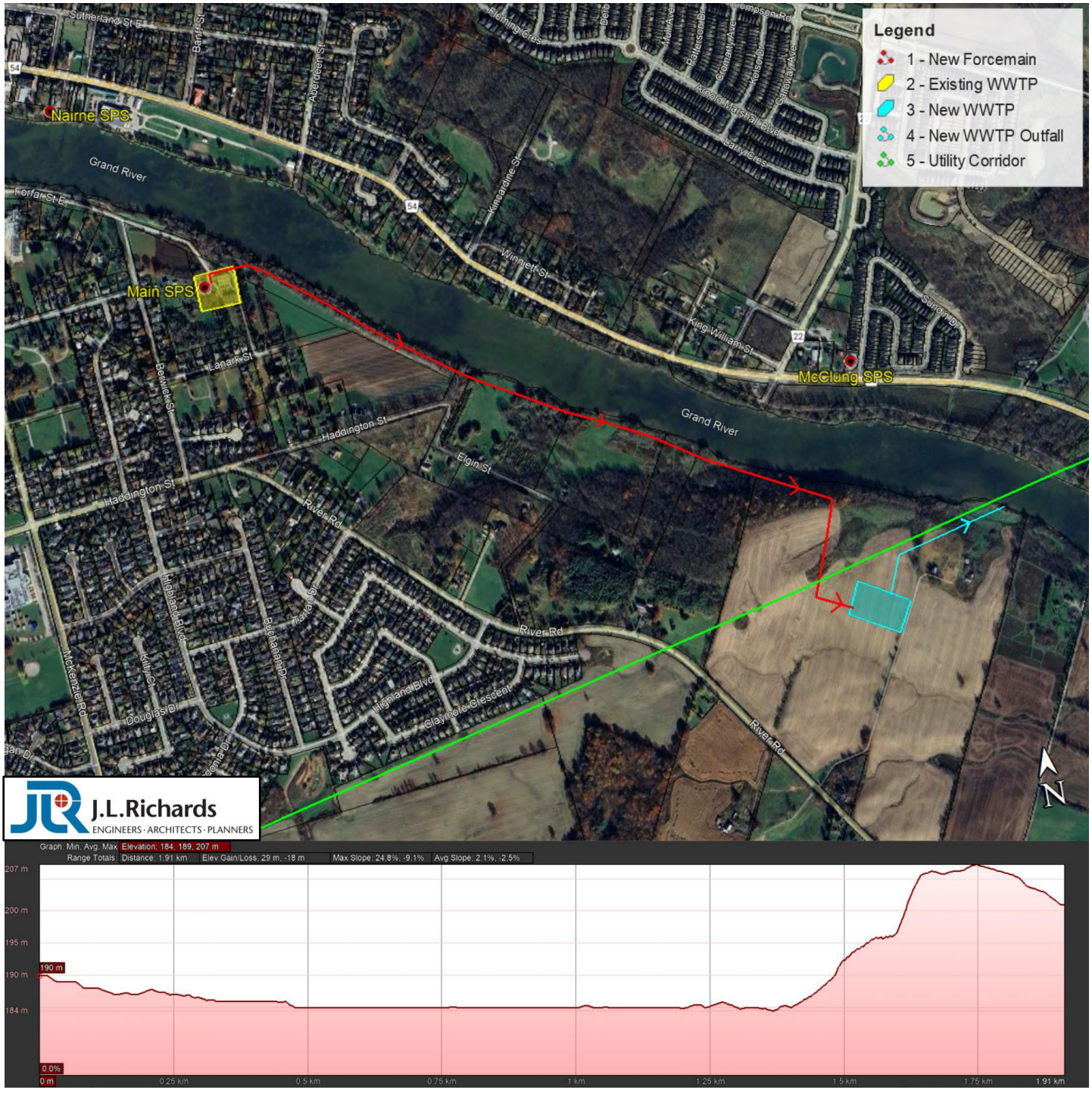
Option 1 Advantages:

- Most direct route
- Existing County easement for portion of required length

Option 1 Disadvantages:

- Required GRCA approval
- Highest potential for ecological damage
- Will require securing easement from landowners along the river.
- More difficult access due to remote/undeveloped land for maintenance and installation.

Figure 21 Southern Forcemain Routing Option 1 Proposed Layout and Elevation Profile



9.2.2 Option 2 - Routing Along River Rd.

Option 2 looks at installing a sanitary forcemain following River Rd. This proposed route utilizes various road easements to connect the two WWTP. From the current WWTPs the forcemain travels south to Lanark St where it turns and travels west for about 200 m. At the intersection of Lanark St. and Berwick St., the forcemain turns south for 250 m reaching Haddington St. Turning east, the forcmain follows Haddington St. as it transitions into River Rd. and continues until the new WWTP site location is reached. The total length of required forcemain is approximately 2670 m for this option.

This route crosses over a TNPI gas pipeline buried within the Hydro One utility corridor, therefore a TNPI crossing application will be needed.

The OPCC for Option 2 is estimated at $11,806,000. This cost includes the forcemain installation, and TNPI crossing costs. A detailed cost breakdown is provided in Appendix H. The OPCCs assume that the works are constructed in one phase. A conceptual layout is provided in Figure 22.

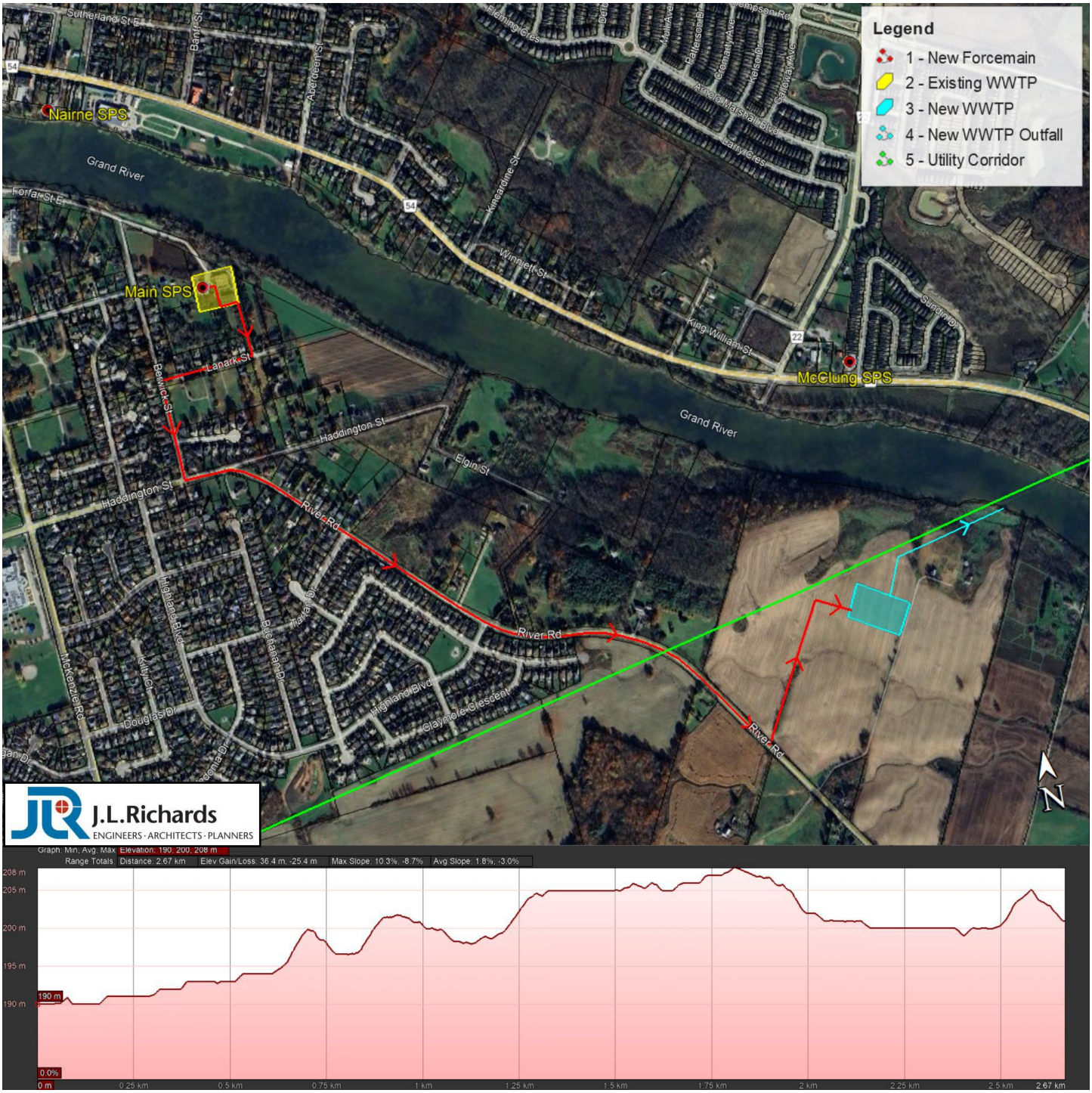
Option 2 Advantages:

- Outside the floodplain.
- Utilizing road easement may simplify approval process.
- Easier access for maintenance and installation along roadways

Option 2 Disadvantages:

- Most linear infrastructure required.
- Potentially more interference with other utilities within the road.
- Higher cost due to road rehabilitation after forcemain installation.
- Most of the route is along major roadways that require more traffic management efforts during construction.

Figure 22 Southern Forcemain Routing Option 2 Proposed Layout and Elevation Profile



9.2.3 Option 3 - Routing Along the Southern Riverbank, Elgin St., and River Rd.

Option 3 considers installing a sanitary forcemain partially along the southern bank of the Grand River, then transitioning to follow road and stormwater easements on Elgin St., and River Rd. to access the new WWTP. This proposed route starts by following an existing County owned easement southeast along the riverbank, for approximately 600 m. The route then turns in the southwest direction to follow the Elgin St. easement. After about 265 m, the forcemain will continue southwest along an existing stormwater easement to reach River Rd. The forcemain would then travel eastward following River Rd. until the new WWTP property is reached. The total length of required forcemain is approximately 2640 m for this option.

Some of the proposed route falls within the Grand River floodplain, therefore approval from the GRCA is required for the proposed work. This route also crosses over a TNPI gas pipeline buried within the Hydro One utility corridor, so a TNPI crossing application will be needed.

The OPCC for Option 3 is estimated at $10,081,000. This cost includes the forcemain installation, and TNPI crossing costs. A detailed cost breakdown is provided in Appendix H. The OPCCs assume that the works are constructed in one phase. A conceptual layout and elevation profile is provided in Figure 23.

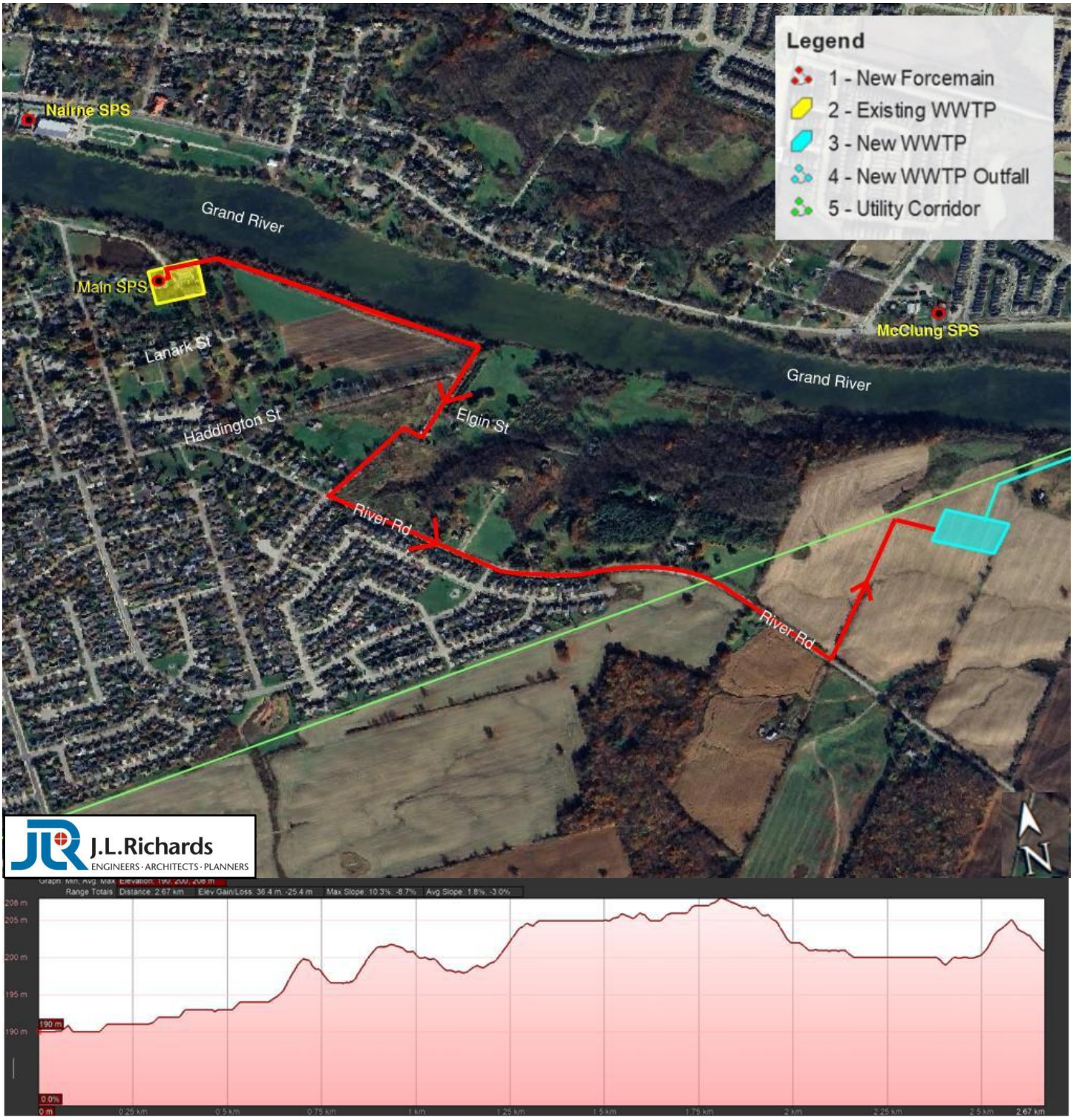
Option 3 Advantages:

- Utilizing existing riverbank, road and stormwater easements may simplify approval process.
- Easier access for maintenance and installation along roadways.
- Requires less traffic management by minimizing construction along River Rd.

Option 3 Disadvantages:

- Moderate amount of linear infrastructure required.
- In floodplain, requires GRCA approval.
- Slightly higher cost due to part of route requiring road rehabilitation after forcemain installation.
- Some of the route is along major roadways that require more traffic management efforts during construction.

Figure 23 Southern Forcemain Routing Option 3 Proposed Layout and Elevation Profile



9.3 Capital Cost Comparison

An Opinion of Probable Construction Costs (OPCC) with a Class 'D' (Indicative Estimate) level of accuracy was developed for each of the shortlisted alternates and includes allowances for design elements that have not been fully developed. Class 'D' OPCCs developed for this assignment are expected to be within +/- 30%. The OPCCs were developed based on experience on similar projects, professional judgment, and equipment costs provided by suppliers. The cost of land acquisition, where required, has been included. Design completed as part of this MCEA is conceptual in nature for the purpose of obtaining Class 'D' cost estimates. All design parameters (e.g., pipe size, storage volume, pump size, etc.) should be confirmed during detailed design.

Any provided estimate of costs or budget is an OPCC that is based on historic construction data and does not include labour, material, equipment, manufacturing, supply, transportation, or any other cost impacts in relation to COVID-19. Variation in the estimate is possible due to the foregoing factors. These estimates should be reviewed at the time of budgeting or project implementation.

All cost estimates are provided in 2023 dollars. It is not possible to ascertain future price escalations, however, by industry best practices escalation should be considered likely between baseline date of October 2022 and in the implementation of these projects. A cost escalation rate should be applied once implementation timing is known.

A summary of the Class 'D' capital cost estimates for each alternative are provided in Table 21. Detailed cost breakdowns are provided in Appendix H.

9.4 Evaluation of Conveyance Options

Table 22 shows the evaluation of the alternatives. Each alternative was assigned an evaluation impact level (refer to Table 20) for each evaluation criterion. This method provides an overall assessment of each alternative's positive and negative impacts.

Table 20 Evaluation Impact Levels

Evaluation Impact Level	Indicator
High Positive	▲▲
Positive	▲
Neutral	●
Negative	▼
High Negative	▼▼

Table 21 Summary of Caledonia WWTP South Routing Options Capital Costs

Alternatives	Sub Total	Bonding/ Overhead (10%)	Contingency & Engineering (37%) (1)	Total Cost
Option 1 – Along Southern Riverbank	**$4,084,000**	**$408,000**	**$1,662,000**	**$6,155,000**
New Forcemain Along Southern Riverbank	$3,830,000	$383,000	$1,558,800	$5,772,000
New Pipeline Crossing – Trans-Northern Pipeline	$254,000	$25,400	$103,400	$383,000
Option 2: Along River Rd.	**$7,834,000**	**$783,000**	**$3,188,000**	**$11,806,000**
New Forcemain Within Greenspaces	$860,000	$86,000	$350,000	$1,296,000
New Forcemain Within Roadways	$6,720,000	$672,000	$2,735,000	$10,127,000
New Pipeline Crossing – Trans-Northern Pipeline	$254,000	$25,400	$103,400	$383,000
Option 3: Along Riverbank, Elgin St., and River Rd.	**$6,689,000**	**$669,000**	**$2,723,000**	**$10,081,000**
New Forcemain Within Greenspaces	$2,970,000	$297,000	$1,208,800	$4,476,000
New Forcemain Within Roadways	$3,465,000	$346,500	$1,410,300	$5,222,000
New Pipeline Crossing – Trans-Northern Pipeline	$254,000	$25,400	$103,400	$383,000

Table 21 Notes:
(1) This value (37% Contingency & Engineering markup) was used to be consistent with rate study conducted by Watson & Associates Economists Ltd. (“Watson”) for a Haldimand – Norfolk regional supply in 2020.

Table 22 Detailed Evaluation of the Caledonia WWTP Southern Routing Options

	Option 1		Option 2		Option 3	
Criteria	**Along Southern Riverbank**		**Along River Rd.**		**Along Southern Riverbank to Elgin St. and River Rd. (following stormwater easement)**	
System Components * SPS = Sewage Pumping Station * WWTP = Wastewater Treatment Plant	• Approximate length: 1915 m • Utilises the existing county easement along the southern bank of the Grand River extending approximately 600 m East of Main SPS. • New easements would be secured following the southern bank until the new WWTP property is reached.		• Approximate length: 2670 m • Utilises road easements on Lanark St., Berwick St., and River Rd to install forcemain until the new WWTP property is reached.		• Approximate length: 2640 m • Utilises the existing county easement along the southern bank of the Grand River extending approximately 650m East of Main SPS. • The forcemain would turn south following road easements on Elgin St. for approximately 265 m until an existing stormwater easement could be followed (285 m) to reached River Rd. • River Rd. would be followed until the new WWTP property is reached.	
Natural & Cultural Environment						
Ecology and Species at Risk	⮟⮟	High Negative: Construction near the Grand River can impact/disrupt vegetation, wildlife, species at risk, and species of conservation concern. The proposed routing is close to the riverbank posing potential harm to both terrestrial and aquatic species. There is an existing easement for a section of the proposed route, however the remaining length has some flexibility with placement. A larger setback from the river may reduce ecological concerns. A more detailed ecological survey should be done to fully assess all potential risks. Environmental impacts and mitigation measures must be confirmed before construction.	⮝	Positive: Construction along existing road easements poses less direct ecological and environmental concerns than construction along the riverbank. A more detailed ecological survey should be done to fully assess all potential risks. Environmental impacts and mitigation measures must be confirmed before construction.	●	Potential Positive: Construction near the Grand River can impact/disrupt vegetation, wildlife, species at risk, and species of conservation concern. A section of the proposed routing is close to the riverbank posing potential harm to both terrestrial and aquatic species. The remaining infrastructure is proposed along existing road and stormwater easements which poses less direct ecological and environmental concerns. A more detailed ecological survey should be done to fully assess all potential risks. Environmental impacts and mitigation measures must be confirmed before construction.
Archaeology and Cultural Heritage	⮟	Negative: The proposed route has some areas with moderate to high archaeological potential. This can potentially impact infrastructure placement and routing on site. A Stage 1 Archaeological Assessment	●	Potential Positive: The proposed route has some areas with moderate to high archaeological potential. This can potentially impact infrastructure placement and routing of the forcemains. Construction along existing	●	Potential Negative: The proposed route has some areas with moderate to high archaeological potential. This can potentially impact infrastructure placement and routing on site. A Stage 1 Archaeological Assessment is

	Option 1		Option 2		Option 3	
		is recommended for the length of forcemain outside the initial study area. Archaeological impacts and mitigation measures must be confirmed before construction.		road easements has less potential to disrupt archaeological resources. Archaeological impacts and mitigation measures must be confirmed before construction.		recommended for the length of forcemain outside the initial study area, specifically along the riverbank. Construction along existing road and stormwater easements have less potential to disrupt archaeological resources. Archaeological impacts and mitigation measures must be confirmed before construction. Archaeological impacts and mitigation measures must be confirmed before construction.
Technical Environment						
Constructability and complexity of construction	●	Slight Negative: Construction along the riverbank may require more dewatering efforts due to proximity to the river.	↓↓	High Negative: This alternative follows a major roadway for a substantial portion of the required length. Construction within road easement requires additional consideration for existing utilities. This also requires road rehabilitation after construction. Additional effort for road closures and traffic management is required.	↓	Negative: Construction along the riverbank may require more dewatering efforts due to proximity to the river. This alternative follows a major roadway for a small portion of the required length. Construction within road easement requires additional consideration for existing utilities. This also requires road rehabilitation after construction. Additional effort for road closures and traffic management is required.
Regulatory Approvals	↓	Negative: Nearly the entire length of the proposed construction falls within a GRCA regulated area and the floodplain. Consultation and approval from the GRCA is required. There is one required TNPI gas pipeline crossing therefore a new crossing permit is required.	↑	Positive: There is one required TNPI gas pipeline crossing therefore a new crossing permit is required.	●	Slight Negative: A portion of the proposed construction falls within a GRCA regulated area and the floodplain. Consultation and approval from the GRCA is required. There is one required TNPI gas pipeline crossing therefore a new crossing permit is required.
Easements	↓↓	High Negative: This option required 4 new easements along residential properties.	↑↑	High Positive: This option requires no new easements.	↑↑	High Positive: This option requires no new easements.
Economic Environment						
Capital Costs	↑↑	High Positive: Low capital costs relative to other options ~ $6.15M	↓↓	High Negative: Highest capital costs relative to other options ~ $11.8M	↓	Negative: Higher capital costs relative to other options ~ $10.1M
Overall Rating	↓↓		●		●	

9.5 Preferred Conveyance Options

From this evaluation, the key highlights are related to:

- **Ecology and Species at Risk:** Option 1 carries the highest amount of ecological risk as the proposed route is right along the riverbank. This route has potential to harm both terrestrial and aquatic species. Option 2 carries the least amount of ecological risk as the entire route follows existing road easements the entire way to the new WWTP location. Option 3 falls somewhere in between as the route follows the riverbank for a short distance, then transitions into road easements for the remainder of the route.

- **Regulatory Approvals and Required Easements:** Option 1 proposes a route that is completely within the GRCA regulated area and floodplain. As a result, GRCA approval is required for this option. This route also requires four (4) new easements along residential properties next to the new WWTP site. Option 2 requires no additional regulatory approval as it is completely outside the GRCA floodplain and follows existing County owned roadways. No new easements for this route. Option 3 once again falls somewhere in between the other two, having the route partially in and partially out of the GRCA regulated area and floodplain. GRCA approval is required for the section within their limits. This proposed route also requires no new easements reducing the construction impacts to neighbouring properties.

- **Constructability and complexity of construction:** Option 1 represents the route with the least constructability constraints. The only potential constraint is equipment access issues along the riverbank. Option 2 carries the highest potential for construction complexity as it predominantly follows a major roadway. This route would require navigation around existing utilities found beneath the road, and increased coordination needed for traffic management. Option 3 once again falls somewhere in between having a mix of both riverside construction and road construction.

Based on the evaluation Option 2 and 3 score similarly. Based on cost savings and constructability considerations, the preliminary preferred alternative is **Option 3 - Routing Along the Southern Riverbank, Elgin St., and River Rd.** The main reasons the recommendation of this option includes:

- Moderate capital cost at $10.1M
- The route requires no new easements.
- Less construction required along the riverbank helping to mitigate some ecological concerns.
- Shorter distance for construction along major roadways which results in decreases costs for traffic management efforts.

10.0 River Crossing Alternatives

10.1 Introduction

From Section 8.0, two potential locations were considered for the new WWTP, one at 1730 Haldimand County Hwy. 54 north of the Grand River (north site) and the other at 4300 River Rd. south of the Grand River (south site). After comparing the two locations, the south site was determined to be the preliminary preferred alternative and will be the assumed site moving forward. To reach this south site, sewage flow from the northern portion of Caledonia will need to be conveyed across the Grand River. There are three (3) proposed alternatives for crossing the Grand River:

- Alternative 1 – River Crossing Within the existing Hydro One Easement
- Alternative 2 – River Crossing at McClung SPS
- Alternative 3 – River Crossing Using the Existing Crossing

The three alternatives are described in detail in the following sub-sections, including the proposed works, an Opinion of Probable Construction Cost, and high-level advantages and disadvantages.

For each of these alternatives, a trenchless installation method is anticiapted, but the exact method cannot be confirmed until a detailed geotechnical review is complete. For this environmental assessment, it was assumed that all locations have similar conditions to those found near the Nairne SPS, where geotechnical information was available. Based on this assumption, two methods of trenchless installation could be used: Microtunneling or Horizontal Directional Drilling (HDD). Microtunneling involves constructing two vertical shafts on either side of the river and then creating a horizontal bore between them. The shafts and horizontal bore need to be constructed watertight to manage infiltrating ground water. HDD involves drilling a pilot hole, from the ground surface, using a steerable drill bit to bore below the river and then back up on the other side. Using HDD would result in a longer crossing length, but typically has lower costs than microtunneling since it does not require vertical shafts or ground water control. To remain conservative with costing estimates, microtunneling will be the assumed method of installation as it has higher cost, until a detailed geotechnical review can be done to confirm the method.

10.2 Summary of Crossing Alternatives

10.2.1 Alternative 1 – River Crossing Within the Hydro One Easement

Alternative 1 includes installing a sanitary forcemain across the Grand River within the boundaries of the Hydro One utility easement. This easement is located approximately 450 m east of McClung SPS. It is 30 m wide and crosses the Grand River at approximately a 60° angle. Within the easement there are existing overhead power lines running along the center line, and a Trans-Northern Pipelines Inc. (TNPI) gas pipeline buried parallel and to the north of the power lines. The TNPI gas pipeline is contained within a 12 m right of way (ROW). It is expected that the sanitary forcemain could be installed parallel and to the south of the power lines for this crossing. Approval from Hydro One and TNPI would be required for this alternative.

Proposed Works:

- Upgrade McClung Sewage Pumping Station (SPS) to a capacity of 220 L/s
- New river crossing including forcemain installation and two valve chambers.
- New sanitary forcemain from McClung SPS to the river crossing location
- New sanitary forcemain from the river crossing to the New WWTP location

McClung SPS would be upgraded to accommodate a build-out peak flow of 220 L/s. Upgrades at McClung SPS consist of installing four new pumps. No major upgrades are assumed to be needed to the building. The new river crossing would consist of two valve chambers, similar to those installed at Nairne SPS, and a 400 mm diameter forcemain crossing below the river (estimated at 175 m). The option for twining the forcemain crossing the river can be explored during detailed design. The exact location of the valve chambers and the layout of the linear infrastructure will be highly dependant on TNPI as they have many regulations around construction near their pipeline. The cost of the new forcemains from McClung to the new river crossing (950 m) and from after the river crossing to the new WWTP (480 m) is based on a 400 mm diameter pipe but all sewer and forcemain diameters are approximate and should be confirmed as part of detailed design.

Studies/ Approvals:

- Geotechnical investigation before detailed design.
- Hydro One and TNPI approvals
- Grand River Conservation Authority (GRCA) approval
- Topographic survey before detailed design.
- Ecology, Cultural Heritage, Archaeology – where required

A detailed geotechnical investigation must be completed before detailed design and construction to confirm site-specific conditions. The geotechnical conditions at the crossing location highly impact the feasibility of utilizing a trenchless crossing, and as a result, has an impact on the final design of the project. This alternative is also only viable if approval from Hydro One and TNPI can be secured. TNPI has strict requirements and protocols on construction projects within 30 m of their infrastructure. A formal review by TNPI on the proposed design would need to be completed before approval would be given. The GRCA should be consulted with to ensure the crossing and the required valve chambers comply with environmental protection regulations in place.

For Alternative 1, other works include:

- Upgrade Nairne SPS for 230 L/s capacity
- Upgrade Main SPS for 111 L/s capacity (Immediate)
- Upgrading forcemain from the existing river crossing to the current WWTP
- *New forcemain connecting Main SPS to the new WWTP (Routing options explored in-depth in Section 9.0)*
- Upgrade Main SPS for 345 L/s capacity (when existing Caledonia WWTP decommissioned)

Nairne SPS would be upgraded to accommodate a build-out peak flow of 230 L/s. The upgrade costs assume the construction of a new Nairne SPS on the same site**,** because expanding the existing SPS is not anticipated to be cost effective. However, the feasibility of this assumption should be confirmed in subsequent stages. Main SPS firm capacity is 114 L/s which is similar to the 25-year estimated peak flow of 111 L/s, excluding McKenzie Meadows and Beattie Estates.

It is assumed that only minor upgrades and lifecycle rehabilitation are required, including miscellaneous structural upgrades and repairs, and installing three new pumps. Finally, the forcemain connecting the existing river crossing to the current WWTP will be upgraded to accommodate the higher flows coming from Nairne SPS. **It is important to note that both the 300 mm diameter (installed in 2024) and 200 mm diameter (existing) forcemains are required at the current crossing to support the 230 L/s flow leaving Nairne SPS.** With both forcemains operating at maximum capacity, the theoretical conveyance limit is 254 L/s.

Once the service life of the current WWTP is reached, the plant will ultimately be decommissioned. At that time, any sewage flow being treated at that plant would need to be rerouted to the new WWTP. In Section 9.0, a detailed evaluation of all potential southern routing options can be found. From these options, Option 3 – Along Southern Riverbank, Stormwater Easement, and River Rd. was selected as the preliminary preferred option and is what was used for this comparison. Main SPS would require expansion and upgrading to increase its capacity to 345 L/s. to pump between the two WWTP locations. Not factored into costing presented below, with the decommissioning of the existing plant, there is a possibility of utilizing existing infrastructure for equalization at the current WWTP to help reduce peak pumping volumes and peak treatment requirements at the new WWTP. Please note, all sewer and forcemain diameters are approximate and should be confirmed as part of detailed design.

The Opinion of Probable Construction Cost (OPCC) for Alternative 1 is summarized in Table 23. A detailed cost breakdown is provided in Appendix H. **The total capital cost is estimated at $41,954,000.** A conceptual layout is provided in Figure 24. OPCCs assume that the works are constructed in one phase. Consideration could be given to phased implementation once a preferred alternative is identified.

Alternative 1 Advantages:

- Utilizing an existing easement may simplify the approval process
- Requires Schedule A Class Environmental Assessment
- Higher levels of redundancy having two crossings.
- Existing crossing remains in service for treatment during construction.
- Some system upgrades could be phased for future construction
- Construction of the forcemain between Main SPS and the new WWTP along with the associated Main SPS capacity upgrades can be postponed for future construction.

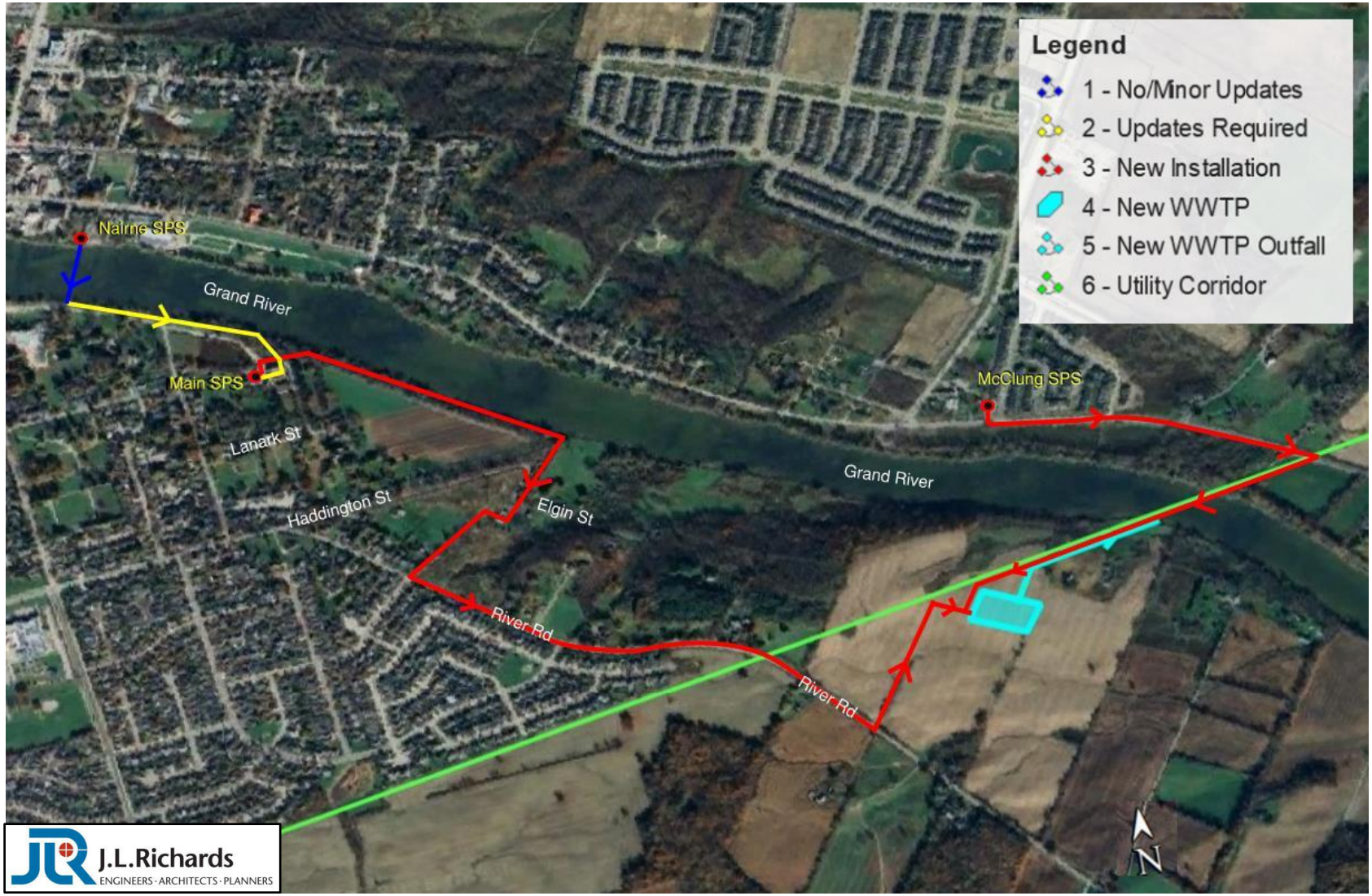
Alternative 1 Disadvantages:

- Additional approval is needed from Hydro One and TNPI
- Crossing location is fixed, limited flexibility for alignment and profile adjustments
- High potential for impacts to the natural environment with the construction of valve chambers along the north and south riverbanks.
- Additional linear infrastructure required to reach the Hydro One Easement when compared to Alternative 2.

Table 23 Alternative 1 – River Crossing Within the Hydro Easement OPCC

DESCRIPTION	TOTAL
Sewage Pump Station	
McClung SPS	
Service and Generator	$356,000
Pumping System	$1,018,000
Instrumentation and Controls	$153,000
Nairne SPS	
Property Acquisition	$356,000
Site Work	$1,425,000
Building	$1,018,000
Service and Generator	$590,000
Pumping System	$1,018,000
Instrumentation and Controls	$204,000
Main SPS (Immediate)	
Site Work	$254,000
Building	$51,000
Pumping System	$458,000
Instrumentation and Controls	$51,000
Forcemain and River Crossing	
McClung SPS to Crossing Location	$2,850,000
New River Crossing	$4,000,000
Crossing Location to New WWTP	$960,000
Upgrade from Existing River Crossing to Current WWTP	$1,725,000
TNPI New Crossing Costs	$254,000
Southern Routing and Pumping Upgrades	
New Forcemain Between WWTPs	$6,435,000
TNPI New Crossing Costs	$254,000
Main SPS (Future)	
Site Work	$1,425,000
Building	$1,018,000
Service and Generator	$590,000
Pumping System (including Instrumentation and Controls)	$1,374,000
SUB-TOTAL COST	**$27,837,000**
Bonding and Overhead (10%)	$2,784,000
Contingency and Engineering (37%)	$11,330,000
TOTAL COSTS	**$41,954,000**
(Rounded, in 2023 Dollars, HST Not Included)	

Figure 24 River Crossing Alternative 1 Proposed Layout



10.2.2 Alternative 2 – River Crossing at McCLung SPS

Alternative 2 looks at installing a sanitary forcemain across the Grand River at a new location at McClung SPS. This alternative has many similarities to Alternative 1 but does not require the involvement of Hydro One and TNPI and allows for the crossing to be established anywhere along the Grand River. This allows for great flexibility to select the location with optimum site conditions and works best with current infrastructure. For simplicity, the crossing has been proposed directly south of McClung SPS.

Proposed Works:

- Upgrade McClung SPS to a capacity of 220 L/s
- New river crossing including forcemain installation and two valve chambers.
- New sanitary forcemain from McClung SPS to the river crossing location
- New sanitary forcemain from the river crossing to the New WWTP location

McClung SPS would be upgraded to accommodate a build-out peak flow of 220 L/s similar to Alternative 1. The new river crossing would consist of two valve chambers, similar to those installed at Nairne SPS, and a 400 mm diameter forcemain crossing below the river (estimated at 150 m long). The option for twining the forcemain crossing the river can be explored during detailed design. The exact location of the valve chambers and the layout of the linear infrastructure will be refined in Phase 3 and 4 of the MCEA. The cost of the new forcemains from McClung to the new river crossing (150 m) and from after the river crossing to the new WWTP (355 m) is based on a 400 mm diameter pipe but all sewer and forcemain diameters are approximate and should be confirmed as part of detailed design.

Studies/ Approvals:

- Geotechnical investigation before detailed design.
- GRCA approval
- Topographic survey before detailed design.
- Ecology, Cultural Heritage, Archaeology – complete

A detailed geotechnical investigation must be completed before detailed design and construction to confirm site-specific conditions. This alternative may consider gathering geotechnical information from a few locations along the river to find the optimum location for the crossing. The GRCA should be consulted with to ensure the crossing and the required valve chambers comply with environmental protection regulations in place.

For Alternative 2, other works include:

- Upgrade Nairne SPS for 230 L/s capacity
- Upgrade Main SPS for 111 L/s capacity (Immediate)
- Upgrading forcemain from the existing river crossing to the current WWTP
- *New forcemain connecting Main SPS to the new WWTP (Routing options explored in-depth in Section 9.0)*
- Upgrade Main SPS for 345 L/s capacity (when existing Caledonia WWTP decommissioned)

The other works associated with Alternative 2 are the same as Alternative 1. The only difference between the two alternatives is the crossing location. Please note, all sewer and forcemain diameters are approximate and should be confirmed as part of detailed design.

The OPCC for Alternative 2 is summarized in Table 24. A detailed cost breakdown is provided in Appendix H. **The total capital cost is estimated at $37,960,000.** A conceptual layout is provided in Figure 25. OPCCs assume that the works are constructed in one phase. Consideration could be given to phased implementation once a preferred alternative is identified.

Alternative 2 Advantages:

- High flexibility in crossing location.
- Does not require approvals from Hydro One and TNPI
- Least linear infrastructure required
- Higher levels of redundancy having two crossings
- Existing crossing remains in service for treatment during construction.
- Some system upgrades could be phased for future construction.
- Construction of the forcemain between Main SPS and the new WWTP along with the associated Main SPS capacity upgrades can be postponed for future construction.
- Carries the lowest capital cost of all alternatives

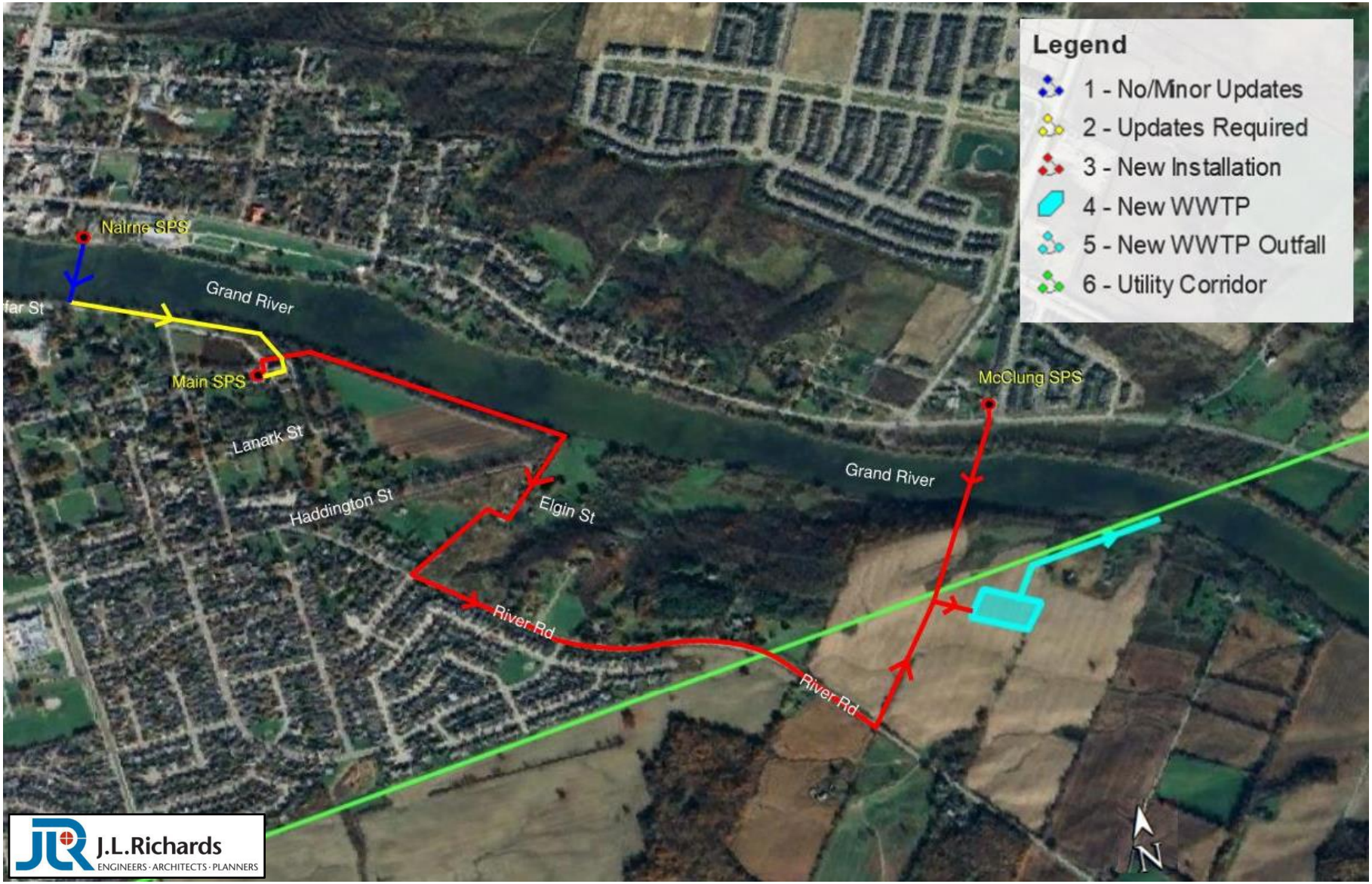
Alternative 2 Disadvantages:

- Requires Schedule B Class Environmental Assessment
- High potential for impacts to the natural environment with the construction of valve chambers along the north and south riverbanks .

Table 24 Alternative 2 – River Crossing at a New Location OPCC

DESCRIPTION	TOTAL
Sewage Pump Station	
McClung SPS	
Service and Generator	$356,000
Pumping System	$1,018,000
Instrumentation and Controls	$153,000
Nairne SPS	
Property Acquisition	$356,000
Site Work	$1,425,000
Building	$1,018,000
Service and Generator	$590,000
Pumping System	$1,018,000
Instrumentation and Controls	$204,000
Main SPS (Immediate)	
Site Work	$254,000
Building	$51,000
Pumping System	$458,000
Instrumentation and Controls	$51,000
Forcemain and River Crossing	
McClung SPS to Crossing Location	$450,000
New River Crossing	$4,000,000
Crossing Location to New WWTP	$710,000
Upgrade from Existing River Crossing to Current WWTP	$1,725,000
TNPI New Crossing Costs	$254,000
Southern Routing and Pumping Upgrades	
New Forcemain Between WWTPs	$6,435,000
TNPI New Crossing Costs	$254,000
Main SPS (Future)	
Site Work	$1,425,000
Building	$1,018,000
Service and Generator	$590,000
Pumping System (including Instrumentation and Controls)	$1,374,000
SUB-TOTAL COST	**$25,187,000**
Bonding and Overhead (10%)	$2,519,000
Contingency and Engineering (37%)	$10,251,000
TOTAL COSTS	**$37,960,000**
(Rounded, in 2023 Dollars, HST Not Included)	

Figure 25 River Crossing Alternative 2 Proposed Layout



10.2.3 Alternative 3 – River Crossing Using the Existing Crossing

Alternative 3 looks at installing a sanitary forcemain across the Grand River utilizing the existing crossing for the current WWTP. Completed in early 2024, the crossing now consists of an oversized 1200 mm diameter casing, with a single 300 mm diameter forcemain running through it. The purpose of installing the oversized casing was to allow for capacity upgrades to be done by simply slotting in more pipes as needed. At this point, it is uncertain if adding additional forcemain pipes to this casing is even possible without removing the existing pipe, so in efforts to be conservative with costing, it was assumed that the current pipe must be removed before the installation of the new twin forcemains.

Proposed Works:

- Upgrade McClung SPS to a capacity of 220 L/s
- Upgrade forcemain between McClung SPS and Nairne SPS
- Upgrade Nairne SPS to a capacity of 430 L/s
- Upgrade existing river crossing to a twin 300 mm diameter forcemain
- Upgrade forcemain from the river crossing to the current WWTP
- *New forcemain connecting Main SPS to the new WWTP (Routing options explored in-depth in Section 9.0)*
- Upgrade Main SPS for 545 L/s capacity

McClung SPS would be upgraded to accommodate a build-out peak flow of 220 L/s similar to Alternatives 1 and 2. The forcemain between McClung SPS and Nairne SPS would need to be upgraded to accommodate the increased flow coming from McClung. It would be upgraded to a 400 mm diameter pipe and would follow the same path as the existing forcemain (2100 m). Nairne SPS would be upgraded to accommodate a build-out peak flow of 430 L/s to support flows coming from the entire northern portion of Caledonia. Now that all the flows are passing through Nairne SPS, the existing river crossing would be upgraded to accommodate these changes. The upgrade would include installing twin 300 mm diameter forcemains into the existing casing installed under the river. The twin forcemains would be combined back to a single pipe on the south side of the river and the existing forcemain connecting the river crossing to the current WWTP would be upgraded to a 475 mm diameter pipe (575 m) to accommodate the increase flows.

For this alternative, a southern conveyance option must be selected upfront as it is an essential piece of infrastructure for the operation of the system. This forcemain is the sole connection to the new WWTP. Option 3 – Along Southern Riverbank, Elgin St., and River Rd. was selected for this alternative as it was the preliminary preferred option selected in Section 9.0. Finally, Main SPS would be upgraded to accommodate a peak flow of 545 L/s to accommodate the total combined flows from the City of Caledonia. The full upgrade to Main SPS is not required right upfront as a portion of the sewage will still be treated at the current WWTP, but strategic planning ahead of time will simplify upgrades in the future. Not factored into costing presented below, with the decommissioning of the existing plant, there is a possibility of utilizing existing infrastructure for equalization at the current WWTP to help reduce peak pumping volumes and peak treatment requirements at the new WWTP. Please note, all sewer and forcemain diameters are approximate and should be confirmed as part of detailed design.

Studies/ Approvals:

- Geotechnical investigation before detailed design.
- Topographic survey before detailed design.
- Research into sliplinning metods.
- GRCA approval
- Ecology, Cultural Heritage, Archaeology – complete

A detailed geotechnical investigation must be completed before detailed design and construction to confirm site-specific conditions. Since the current crossing is set to finish construction in the Spring of 2024, some geotechnical insight may be gained from that project. More information and research are required on the best methods to slip line a new forcemain into the existing casing without removing the current forcemains within. Conversations with experienced contractor may aid in this research. The GRCA should also be consulted with to ensure the crossing and the required valve chambers comply with environmental protection regulations in place.

The OPCC for Alternative 3 are summarized in Table 25. A detailed cost breakdown is provided in Appendix H. **The total capital cost is estimated at $47,038,000.** A conceptual layout is provided in Figure 26. OPCCs assume that the works are constructed in one phase. Consideration could be given to phased implementation once a preferred alternative is identified**.**

Advantages:

- May have simpler approval process utilizing an existing crossing.
- Schedule A Class Environmental Assessment
- Most upgrades are within a road allowance making for easy access.

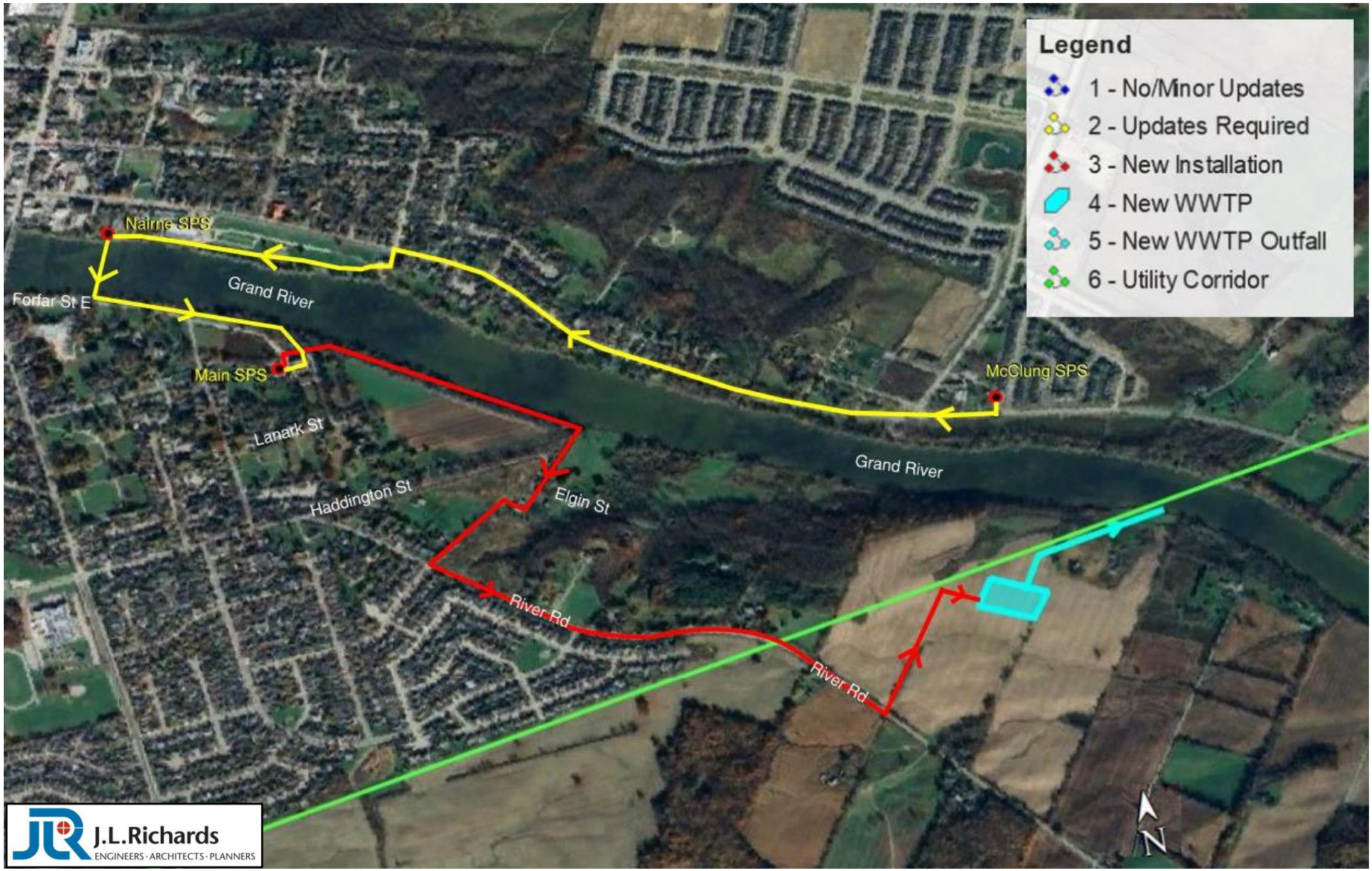
Disadvantages:

- Most linear infrastructure needed upfront (i.e. both north and south forcemain).
- Low redundancy with only one crossing
- Difficult/complex construction
- Existing forcemain may need to be taken out of service during construction so a temporary bypass may be needed.

Table 25 River Crossing Using the Existing Crossing OPCC

DESCRIPTION	TOTAL
Sewage Pump Station	
McClung SPS	
Service and Generator	$356,000
Pumping System	$1,018,000
Instrumentation and Controls	$153,000
Nairne SPS	
Property Acquisition	$356,000
Site Work	$2,646,000
Building	$1,221,000
Service and Generator	$590,000
Pumping System	$1,425,000
Instrumentation and Controls	$204,000
Forcemain and River Crossing	
Upgrade Forcemain from McClung to Nairne	$6,300,000
Twin Forcemain at Existing River Crossing	$1,781,000
Upgrade Forcemain from Crossing to Current WWTP	$1,725,000
Southern Routing and Pumping Upgrades	
New Forcemain Between WWTPs	$6,435,000
TNPI New Crossing Costs	$254,000
Main SPS	
Site Work	$2,646,000
Building	$1,221,000
Service and Generator	$590,000
Pumping System (including Instrumentation and Controls)	$2,290,000
SUB-TOTAL COST	**$31,211,000**
Bonding and Overhead (10%)	$3,121,000
Contingency and Engineering (37%)	$12,703,000
TOTAL COSTS	**$47,038,000**
(Rounded, in 2023 Dollars, HST Not Included)	

Figure 26 River Crossing Alternative 3 Proposed Layout



10.3 Capital Cost Comparison

An Opinion of Probable Construction Costs (OPCC) with a Class 'D' (Indicative Estimate) level of accuracy was developed for each of the shortlisted alternates and includes allowances for design elements that have not been fully developed. Class 'D' OPCCs developed for this assignment are expected to be within +/- 30%. The OPCCs were developed based on experience on similar projects, professional judgment, and equipment costs provided by suppliers. The cost of land acquisition, where required, has been included. Design completed as part of this MCEA is conceptual in nature for the purpose of obtaining Class 'D' cost estimates. All design parameters (e.g., pipe size, storage volume, pump size, etc.) should be confirmed during detailed design.

Any provided estimate of costs or budget is an OPCC that is based on historic construction data and does not include labour, material, equipment, manufacturing, supply, transportation, or any other cost impacts in relation to COVID-19. Variation in the estimate is possible due to the foregoing factors. These estimates should be reviewed at the time of budgeting or project implementation.

All cost estimates are provided in 2023 dollars. It is not possible to ascertain future price escalations, however, by industry best practices escalation should be considered likely between baseline date of October 2023 and in the implementation of these projects. A cost escalation rate should be applied once implementation timing is known.

A summary of the Class 'D' capital cost estimates for each alternative are provided in Table 27 Detailed cost breakdowns are provided in Appendix H.

10.4 Evaluation of Crossing Alternatives

Table 28 shows the evaluation of the alternatives. Each alternative was assigned an evaluation impact level (refer to Table 26) for each evaluation criterion. This method provides an overall assessment of each alternative's positive and negative impacts.

Table 26 Evaluation Impact Levels

Evaluation Impact Level	Indicator
High Positive	▲▲
Positive	▲
Neutral	●
Negative	▼
High Negative	▼▼

Table 27 Summary of Caledonia WWTP River Crossing Alternatives Capital Costs

Alternatives	Sub Total	Bonding/ Overhead (10%)	Contingency & Engineering (37%) (3)	Total Cost
Alternative 1: River Crossing Within the Hydro Easement	**$27,837,000**	**$2,784,000**	**$11,330,000**	**$41,954,000**
Sewage Pumping Station Upgrades	$6,952,000	$695,200	$2,829,500	$10,478,000
Forcemains	$5,789,000	$578,900	$2,356,200	$8,725,000
River Crossing	$4,000,000	$400,000	$1,628,000	$6,028,000
Southern Routing and Pumping Upgrades (1)	$11,096,000	$1,109,600	$4,516,100	$16,723,000
Alternative 2: River Crossing at a New Location	**$25,187,000**	**$2,519,000**	**$10,251,000**	**$37,960,000**
Sewage Pumping Station Upgrades	$6,952,000	$695,200	$2,829,500	$10,478,000
Forcemains	$3,139,000	$313,900	$1,277,700	$4,731,000
River Crossing	$4,000,000	$400,000	$1,628,000	$6,028,000
Southern Routing and Pumping Upgrades (1)	$11,096,000	$1,109,600	$4,516,100	$16,723,000
Alternative 3: River Crossing Using the Existing Crossing	**$31,211,000**	**$3,121,000**	**$12,703,000**	**$47,038,000**
Sewage Pumping Station Upgrades	$7,969,000	$796,900	$3,243,300	$12,011,000
Forcemains	$8,025,000	$802,500	$3,266,200	$12,094,000
River Crossing	$1,781,000	$178,100	$724,900	$2,684,000
Southern Routing and Pumping Upgrades (2)	$13,436,000	$1,343,600	$5,468,400	$20,249,000

Table 27 Notes:

(1) Includes cost for Southern Conveyance Option 3 and the future capacity upgrades to Main SPS (345 L/s).
(2) Includes cost for Southern Conveyance Option 3 and the capacity upgrades to Main SPS (545 L/s)
(3) This value (37% Contingency & Engineering markup) was used to be consistent with rate study conducted by Watson & Associates Economists Ltd. (“Watson”) for a Haldimand – Norfolk regional supply in 2020.

Table 28 Detailed Evaluation of the Caledonia WWTP River Crossing Alternatives

	Alternative 1		Alternative 2		Alternative 3	
Criteria	**Cross the Grand River within the Hydro easement**		**Cross the Grand River near watermain crossing south of McClung SPS.**		**Cross the Grand River using the existing crossing location**	
System Components * SPS = Sewage Pumping Station * WWTP = Wastewater Treatment Plant	• Upgrade McClung SPS (220 L/s) • New forcemain from McClung SPS to new crossing location • New forcemain crossing the river within the Hydro easement. • New forcemain connecting the river crossing to the new WWTP. • Upgrade Nairne SPS (230 L/s) • Minor upgrades Main SPS (Immediate) • Upgrade forcemain from the river crossing to the current WWTP. • New forcemain connecting Main SPS to the new WWTP • Upgrades Main SPS (345 L/s -Future)		• Upgrade McClung SPS (220 L/s) • New forcemain from McClung SPS to new crossing location • New forcemain crossing the river south of McClung SPS. • New forcemain connecting the river crossing to the new WWTP. • Upgrade Nairne SPS (230 L/s) • Minor upgrades Main SPS (Immediate) • Upgrade forcemain from the river crossing to the current WWTP. • New forcemain connecting Main SPS to the new WWTP • Upgrades Main SPS (345 L/s -Future)		• Upgrade McClung SPS (220 L/s) • Upgrade forcemain from McClung SPS to Nairne SPS • Upgrade Nairne SPS (430 L/s) • New forcemain crossing the river at the existing crossing location. • Upgrade forcemain from the river crossing to the current WWTP. • New forcemain connecting Main SPS to the new WWTP • Upgrades Main SPS (545 L/s).	
Natural & Cultural Environment						
Ecology and Species at Risk	➘	Negative: Construction near the Grand River can impact/disrupt vegetation, wildlife, species at risk, and species of conservation concern. The actual river crossing may present some environmental concerns, though these can be mitigated using directional drilling/boring techniques. Most of the concern comes with the construction of the valve chambers on either side of the river, and with installing new forcemains in current greenspaces. Environmental impacts and mitigation measures must be confirmed before construction	➘	Negative: Construction near the Grand River can impact/disrupt vegetation, wildlife, species at risk, and species of conservation concern. The actual river crossing may present some environmental concerns, though these can be mitigated using directional drilling/boring techniques. Most of the concern comes with the construction of the valve chambers on either side of the river, and with installing new forcemains in current greenspaces. Environmental impacts and mitigation measures must be confirmed before construction	➚	Positive: Upgrading the existing river crossing may present minor environmental concerns. The current crossing is comprised of an oversized casing within which new forcemains can be installed. This system will help limit the impact on the river ecosystem. In addition, construction along existing road easements pose minor ecological and environmental concerns. Environmental impacts and mitigation measures must be confirmed before construction.
Archaeology and Cultural Heritage	➘	Negative: The proposed route will cross areas with moderate to high archaeological potential. This can potentially impact infrastructure	➘	Negative: The proposed route will cross areas with moderate to high archaeological potential. This can potentially impact infrastructure	➚	Positive: Construction and infrastructure upgrades along existing road easements have less potential to disrupt archaeological

	Alternative 1		Alternative 2		Alternative 3	
		placement and routing of the forcemains. Archaeological impacts and mitigation measures must be confirmed before construction. A Stage 1 Archeological Assessment is recommended for all new forcemain installation, and a Stage 2 Archaeological Assessment is recommended for the WWTP site.		placement and routing of the forcemains. Archaeological impacts and mitigation measures must be confirmed before construction. A Stage 1 Archeological Assessment is recommended for all new forcemain installation, and a Stage 2 Archaeological Assessment is recommended for the WWTP site.		resources. Archaeological impacts and mitigation measures must be confirmed before construction.
Technical Environment						
Constructability and complexity of construction		Negative: Main complexity of construction will be working near the TNPI gas pipeline. Placement of required infrastructure will be influenced by TNPI and special care when working around the gas pipeline will be essential to avoid damage. Overhead power lines are also located at this crossing location so planning placement of tall or large equipment will need to be done. This alternative requires a moderate amount of linear infrastructure, but the existing river crossing will remain operational throughout construction ensure adequate treatment capacity for the City.		Positive: No constructability issues are foreseen. This alternative requires the least amount of linear infrastructure, and the existing river crossing will remain operational throughout construction ensure adequate treatment capacity for the City. As with all construction projects, special care around existing infrastructure or utilities is always important.		High Negative: The feasibility of slip lining a new forcemain inside the existing casing, while maintaining the operation of the existing forcemain, is unknown at this time. All construction efforts for the crossing would need to be managed from the existing valve chambers where space is limited. The existing forcemain may need to be temporarily taken out of service to facilitate the construction. If this is the case, a temporary bypass would need to be established to maintain function of the crossing. This alternative also requires the highest amount of linear infrastructure.
Phasing and Expandability		Positive: This alternative has some flexibility for phasing. The river crossing and required forcemains connecting McClung SPS to the new WWTP have limited ability for phasing as they are all required for basic operation of the system. However, upgrades to McClung SPS, Nairne SPS and other linear upgrades could be phased to align with projected growth. A forcemain connecting Main SPS to the new WWTP and the required capacity upgrades to Main SPS are not		Positive: This alternative has some flexibility for phasing. The river crossing and required forcemains connecting McClung SPS to the new WWTP have limited ability for phasing as they are all required for basic operation of the system. However, upgrades to McClung SPS, Nairne SPS and other linear upgrades could be phased to align with projected growth. A forcemain connecting Main SPS to the new WWTP and the required capacity upgrades to Main SPS are not		High Negative: A forcemain connecting Main SPS to the new WWTP and the required capacity upgrades to Main SPS would need to be installed upfront as that is the sole connection to the new WWTP, thus essential for basic operation. This alternative has the highest upfront capital requirements for all three alternatives.

	Alternative 1		Alternative 2		Alternative 3	
		required at this time and could phased for much later in the future.		required at this time and could phased for much later in the future.		
Regulatory Approvals	↓↓	High Negative: A large portion of the proposed construction falls within a GRCA regulated area and the floodplain. Consultation and approval from the GRCA are required. The proposed river crossing is within both the Hydro One utility easement and the TNPI Prescribed Area, therefore approval of design from both stakeholders are required. If the TNPI does not agree to the proposed work, this alternative may not be possible. Finally, the proposed southern forcemain connecting Main SPS to the New WWTP crosses the TNPI gas pipeline, therefore a new crossing permit is required. The proposed river crossing requires a Schedule A Class EA.	↓	High Negative: A large portion of the proposed construction falls within a GRCA regulated area and the floodplain. Consultation and approval from the GRCA are required. The proposed forcemain connecting the new river crossing to the new WWTP, and the forcemain connecting Main SPS to the New WWTP both crosse a TNPI gas pipeline, therefore two new crossing permits are required. The proposed river crossing requires a Schedule B Class EA because it is not within an existing utility corridor.	●	Slight Negative: Part of the proposed infrastructure upgrades fall within the GRCA regulated area and floodplain, therefore, consultation with the GRCA may be required regarding site preparation and construction. In addition, a large portion of the proposed route for the southern forcemain connecting Main SPS to the New WWTP falls within the GRCA regulated area and floodplain, so consultation and approval from the GRCA are required for these works. Finally, the route for this southern forcemain also crosses the TNPI gas pipeline, therefore a new crossing permit is required. The proposed river crossing requires a Schedule A Class EA.
Economic Environment						
Capital Costs	↑	Positive: Low capital costs relative to other options ~ $41.95M	↑	Positive: Low capital costs relative to other options ~ $37.96M	↓	Negative: Higher capital costs relative to other options ~ $47.04M
Operating and Maintenance	●	Potential Positive Number of River Crossings: 2 Total Linear Infrastructure: 4645 m New Forcemain: 4070 m Existing Forcemain: 575 m Total SPS Capacity: 795 L/s Rise/Fall/Net: + 65.5 m / - 41.5 m / + 24.0 m	↑	Positive Number of River Crossings: 2 Total Linear Infrastructure: 3720 m New Forcemain: 3145 m Existing Forcemain: 575 m Total SPS Capacity: 795 L/s Total Rise/Fall: + 64.9 m / - 45.4 m / + 19.5 m	↓	Negative Number of River Crossings: 1 Total Linear Infrastructure: 5315 m New Forcemain: 2640 m Existing Forcemain: 2675 m Total SPS Capacity: 1195 L/s Total Rise/Fall: + 65.9 m / - 54.0 m / + 11.9 m
Overall Rating	↓		↑		↓↓	

10.5 Preferred Crossing Alternative

From this evaluation, the key highlights are related to:

- **Phasing and Expandability:** Alternative 1 and 2 both present flexibility for phasing. Some linear infrastructure, like the river crossing and connecting forcemains, are required upfront, but capacity upgrades to the SPSs can be phased to align with projected growth. Alternative 3 has very limited phasing possibilities due to the linear nature of the proposed system. Upgrades to McClung SPS, Nairne SPS, and Main SPS are all required up front to ensure sufficient capacity to pump incoming flows. Linear pipe upgrades are also required between the SPSs and the current WWTP to accommodate the increased flow volumes coming from each SPS. In addition, Alternative 3 also requires the installation of a southern forcmain between the two WWTP locations since this is the only connection to the new WWTP.

- **Constructability and complexity of construction:** Alternative 1 and 2 are very similar in many aspects, but constructability is one area where they differ. Alternative 1 is proposed within the Hydro One utility corridor, where additional underground and overhead infrastructure is located. The proposed route requires working near the TNPI gas pipeline which can influence placement of required structures and require more care when working to avoid damage of the pipeline. Overhead power lines are also at the crossing location, which can affect the use of tall or large equipment. Alternative 3 has constructability issues with regards to space and installation methods. At the current crossing, work must be conducted within the existing valve chambers which may require the use of smaller, more compact equipment. In addition, the feasibility of sliplining a new forcemain into the existing casing, while maintaining the operation of the existing forcemain, is unknown at this time. This alternative may require the removal of the current forcemain followed by the reinstallation of a twin forcemain after. If this is required, a temporary bypass would be needed to ensure sewage treatment during construction.

- **Regulatory Approvals:** Alternative 1 and 2 both require extensive involvement of the GRCA as a majority of the proposed new linear infrastructure falls within the GRCA regulated area and the floodplain. Alternative 1 has additional approvals from TNPI for construction within the prescribed area of their gas pipeline. If TNPI does not agree to the proposed work, this alternative may not be possible. Alternative 3 has very minimal regulatory approvals as much of the proposed work is upgrades to existing infrastructure. All three alternatives would require some level of Class EA. Alternatives 1 and 3 require a Schedule A and Alternative 2 requires a Schedule B. We note that this study is meant to fulfill the requirements of Schedule B, and additional field studies and consultation may be required to fulfill the MCEA requirements.

Based on the evaluation the preliminary preferred alternative is **Alternative 2 – River Crossing at a New Location**. The main benefits of this alternative includes:

- Lowest capital cost at $37.96M, least required linear infrastructure (3720 m), and least required SPS capacity (795 L/s)
- Good flexibility for project phasing.
- No additional approvals from stakeholders like TNPI or Hydro One. Routine approvals including the TNPI crossing approval are still required.
- Simplest and most direct construction.

11.0 Wastewater Treatment Technology Evaluation

As identified during Phase 2 of the Class EA, the preferred solution is to build a new interim greenfield plant to enable shared treatment with the existing Caledonia WWTP. It is anticipated that the County will transition to a single plant as the existing plant approaches the end of its useful life and requires major lifecycle rehabilitation. The new greenfield plant will be expanded in phases to accommodate the flows coming from the existing Caledonia WWTP, with an ultimate rated capacity of 14,200 m^3/day. It is noted that in the Phase 2 evaluation, a design flow of 13,400 m^3/day was used to allow equal comparison of all high-level servicing alternatives. For detailed treatment technology evaluation of the selected servicing alternative, the ultimate capacity of the plant (14,200 m^3/day) has been used.

11.1 Evaluation Methodology

An evaluation methodology to identify a recommended treatment technology alternative for the new Caledonia WWTP has been developed based on methodologies and guidelines within the MCEA. The evaluation was performed on the following wastewater treatment steps:

- Liquid Train – Primary/Secondary Treatment
- Liquid Train – Tertiary Treatment
- Liquid Train – Disinfection
- Solids Train

For each treatment step, the evaluation included the following steps:

1. Develop a long list of technology alternatives.
2. Use key screening criteria to identify a short list of alternatives to be evaluated in detail.
3. Comment on relative impacts to the natural, social, and economic environment for each alternative.

Identify a preferred alternative that minimizes and mitigates environmental impacts.

11.2 Liquid Train – Primary/Secondary Treatment

Appendix I contains the long list and screening evaluation of a large number of technology solutions to meet the objectives of primary/ secondary treatment, which are to remove solids, organic matter, and nutrients from the wastewater. The short-listed alternatives are as follows:

- Conventional Activated Sludge (CAS) with Postanoxic Filter
- Modified Ludzack-Ettinger Activated Sludge (MLE)
- 4-Stage Bardenpho Activated Sludge or Step Feed

11.2.1 Alternative 1 - Conventional Activated Sludge (CAS) with Postanoxic Filter

As seen in Figure 27, the conventional activated sludge process is one of the most common secondary treatment methods in Ontario, and is the process employed at the existing Caledonia WWTP. This process has three main stages:

1. Primary Clarification, in which raw wastewater is passed through settling tanks called primary clarifiers to remove 30-50% of organic matter and suspended solids.

2. Aeration, in which naturally occurring bacteria consume organic matter and remove ammonia through conversion to nitrate in an aeration tank.
3. Secondary Clarification, in which the aeration tank effluent is passed through settling tanks called secondary clarifiers to separate the bacteria from the treated wastewater. This concentrated stream of bacteria (biologically active or “activated” sludge) is then recirculated to mix with new wastewater as it enters the Aeration stage, continuing the treatment process.

The effluent from the CAS process is typically low in organic matter, suspended solids, phosphorus and ammonia, but has elevated concentrations of nitrate, because the bacteria have converted ammonia into nitrate. Since nitrate removal is required for the new Caledonia WWTP (in contrast to the existing Caledonia WWTP), this must be accomplished in a later treatment stage. Nitrate removal is also known as denitrification and is accomplished by a specific bacterial community requiring anoxic conditions (i.e. free of dissolved oxygen) and a source of organic carbon to transform nitrate into inert nitrogen gas.

This alternative therefore incorporates the addition of a post-anoxic denitrification filter with carbon addition after the activated sludge process. Denitrifying bacteria would grow on the filter media and use an externally added source of organic carbon such as methanol to complete the denitrification process. The filter would also work to polish the wastewater to very low levels of suspended solids and phosphorus, eliminating the need for further tertiary filtration (see Section 11.2 below). This alternative would require typical screening and grit removal upstream, and chemical dosing for phosphorus precipitation.

11.2.2 Alternative 2 – Modified Ludzack-Ettinger (MLE) Activated Sludge with Advanced Filtration

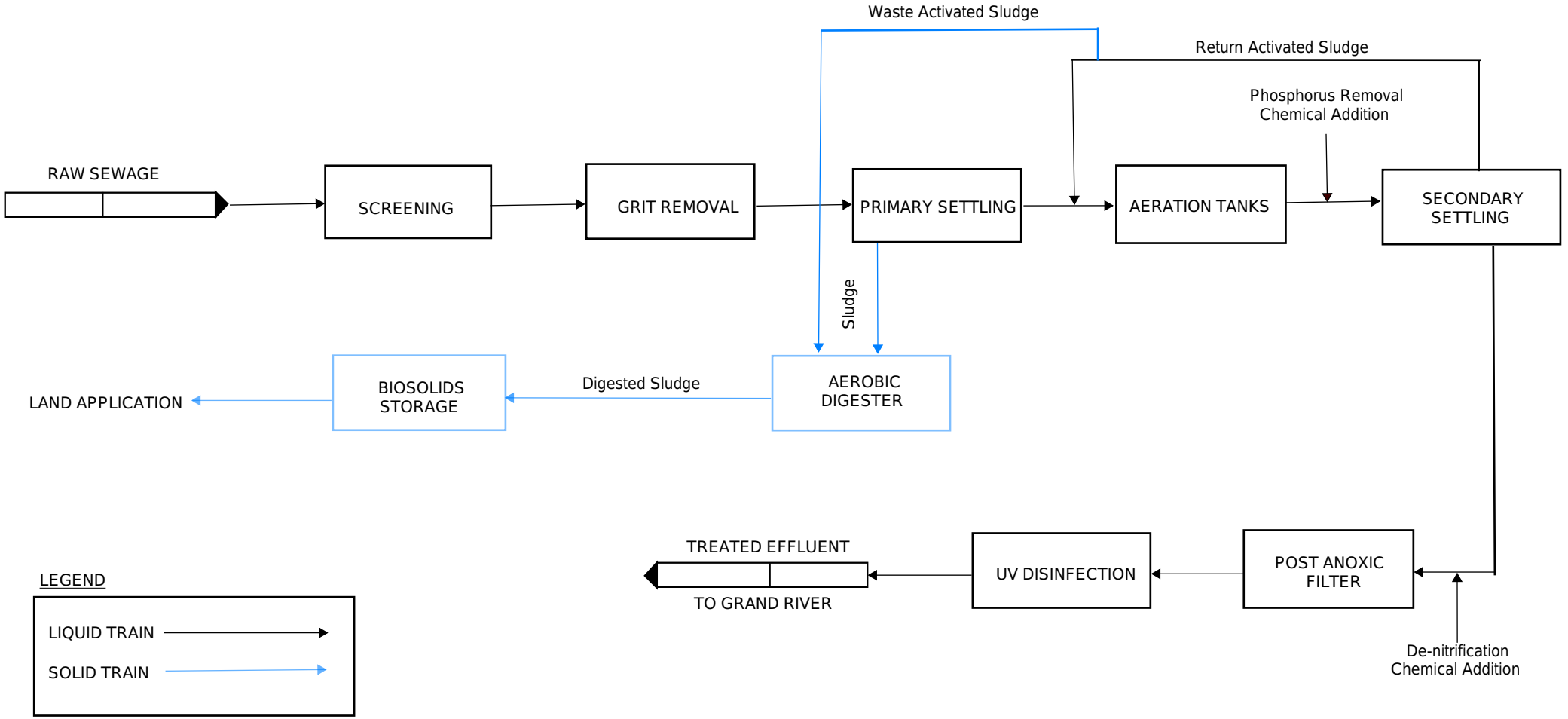
The CAS process can be modified to denitrify (remove nitrate) by adding an anoxic zone to the front of the aeration tank and recycling nitrified wastewater from the end of the aeration tank into this anoxic zone using pumps. This configuration is known as MLE and is employed at several WWTP's in Ontario including in Orangeville and Listowel. This alternative, as shown in Figure 28 has the following inherent advantages:

- Organic carbon in the wastewater is used by the denitrifying bacteria, eliminating the need for an externally added carbon source.
- Primary clarifiers are not required, eliminating the associated capital and operating costs.

This alternative would require typical screening and grit removal upstream, chemical dosing for phosphorus precipitation, and tertiary filtration downstream. A Membrane Bioreactor system incorporating recirculating to an anoxic zone utilizing in-reactor membrane filtration instead of secondary clarification and tertiary filtration would also fall under Alternative 2 and could be considered during the design phase.

11.2.3 Alternative 3 - 4-Stage Bardenpho Activated Sludge or Step Feed with Advanced Filtration

These activated sludge configurations follow a strategy similar to MLE as they use anoxic and aerobic zones. However, additional anoxic and aerobic zones are provided to enhance nitrate removal. As shown in Figure 29, this alternative would require typical screening and grit removal upstream, chemical dosing for phosphorus precipitation, and tertiary filtration downstream.



PROJECT:

CALEDONIA WASTEWATER TREATMENT PLANT CLASS ENVIRONMENTAL ASSESTMENT

CALEDONIA, ONTARIO

DRAWING:

CONCEPTUAL PROCESS DIAGRAM OF ALTERNATIVE DESIGN OPTION 1: CAS + TERTIARY FILTRATION + UV DISINFECTION + AEROBIC DIGESTION

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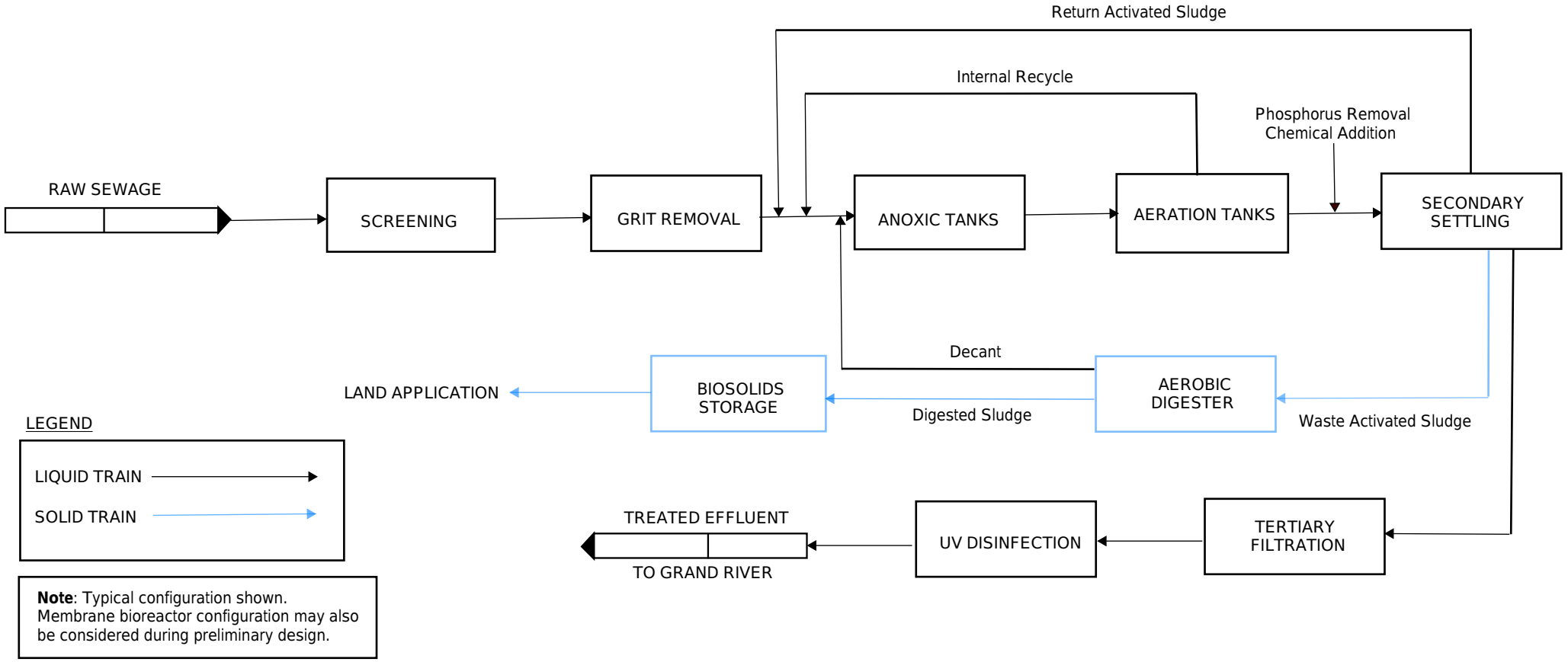
DESIGN: CC
DRAWN: CV
CHECKED: CC
JLR #: 31196-009

DRAWING #: FIGURE 27



Note: Typical configuration shown. Membrane bioreactor configuration may also be considered during preliminary design.

PROJECT:

CALEDONIA WASTEWATER TREATMENT PLANT CLASS ENVIRONMENTAL ASSESTMENT

CALEDONIA, ONTARIO

DRAWING:

CONCEPTUAL PROCESS DIAGRAM OF ALTERNATIVE DESIGN OPTION 2: MLE + TERTIARY FILTRATION + UV DISINFECTION + AEROBIC DIGESTION

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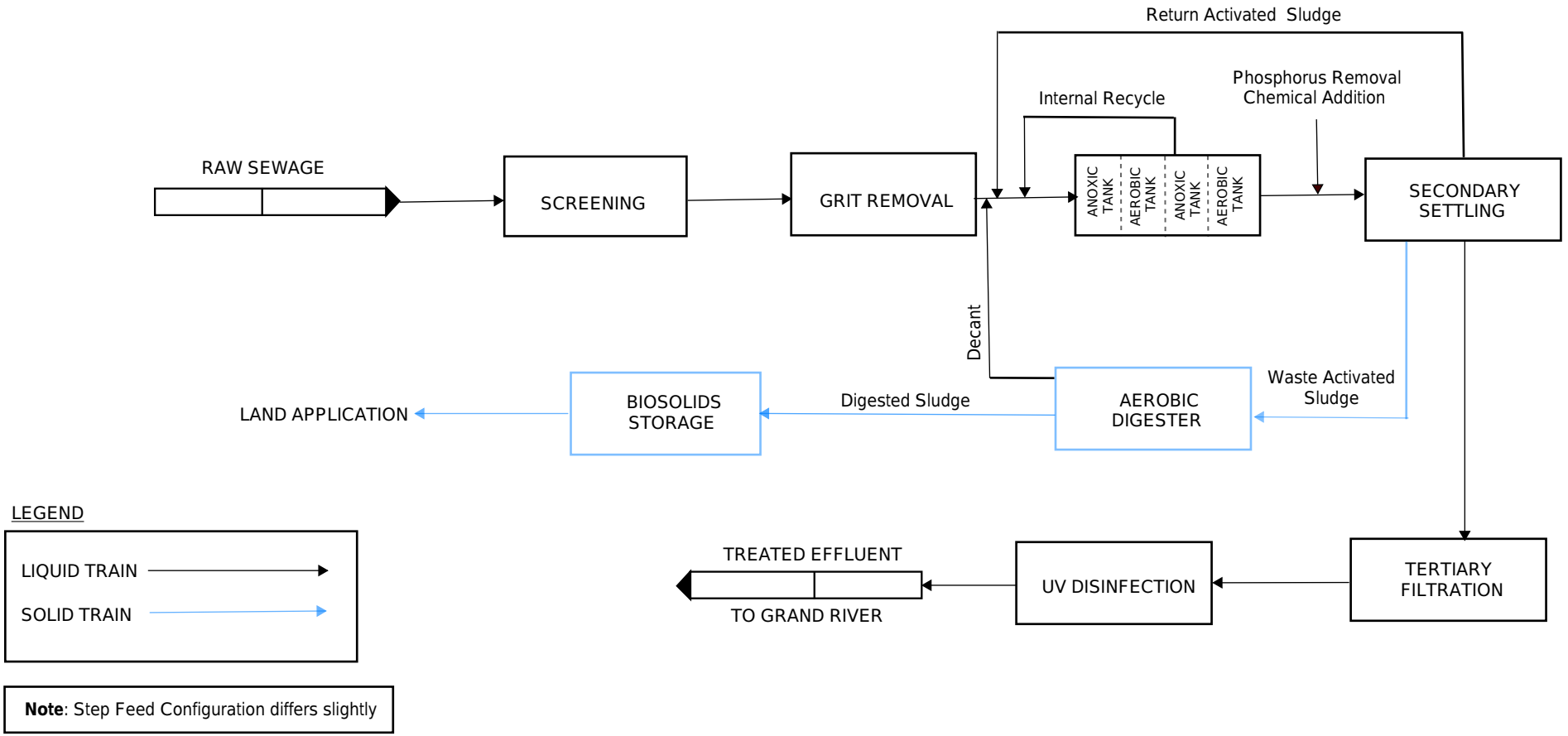
DESIGN: CC
DRAWN: CV
CHECKED: CC
JLR #: 31196-009

DRAWING #:
FIGURE 28



Note: Step Feed Configuration differs slightly

PROJECT

CALEDONIA WASTEWATER TREATMENT PLANT CLASS ENVIRONMENTAL ASSESTMENT

CALEDONIA, ONTARIO

DRAWING:

CONCEPTUAL PROCESS DIAGRAM OF ALTERNATIVE DESIGN OPTION 3: 4 STAGE BARDENPHO + TERTIARY FILTRATION + UV DISINFECTION + AEROBIC DIGESTION

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DRAWN: CV
CHECKED: CC
JLR #: 31196-009

DRAWING #:
FIGURE 29

11.3 Liquid Train – Tertiary Treatment

Tertiary filtration alternatives were also screened as shown in Appendix I, resulting in the following short-listed technologies:

- Conventional Sand Filter
- Deep Bed Up-Flow Sand Filter
- Surface Filter
- Membrane Filter

11.3.1 Alternative 1 - Conventional Sand Filter

Sand filters are systems that filter liquid suspensions (i.e. effluent from the secondary clarifiers) to the designed effluent quality by passing the liquid through a bed of sand media supported by an underdrain system, straining out particles. An automatic backwash system would periodically pump filtered effluent backward through portions of the sand to remove trapped particles, which would be returned to the head of the plant for treatment. This process is employed at the existing Caledonia WWTP.

11.3.2 Alternative 2 – Deep Bed Up-Flow Sand Filter

Deep bed up-flow filters work similarly to conventional sand filters; however, secondary effluent is passed upwards through a much deeper bed of sand to remove the suspended solids. There is a commercially available filter of this type that has been designed as a Postanoxic Filter for the removal of nitrate as well as TSS and TP.

11.3.3 Alternative 3 - Surface Filter (i.e. Cloth Media Filter, Disc Filter)

Surface filters are available in a variety of configurations. The most common type of surface filter is comprised of a series of discs covered with a woven cloth media attached to a central shaft. The media mounted on both sides of the partially-submerged discs separates the solids from the water, allowing filtered water to flow through into a collection tank. Once solids have accumulated on the surface of the media, the discs are cleaned by the counter-current backwash system. Disc filters are available for placement into concrete basins or as stand-alone units with stainless steel tanks included.

11.3.4 Alternative 4 – Membrane Filter

Membrane filters use semipermeable membranes to separate suspended solids from liquids in the wastewater treatment process. Permeate pumps pull liquid permeate through the membranes. Backpulsing permeate, air backwashing or scouring, intermittent permeation, and chemically enhanced cleaning can be used in various combinations to address membrane fouling.

11.4 Liquid Train – Disinfection

Disinfection alternatives were also screened as shown in Appendix I, resulting in only one short-listed technology: Ultraviolet (UV) Disinfection.

11.4.1 Ultraviolet (UV)

UV disinfection is a commonly used disinfection method to treat WWTP effluent. This system consists of a series of lamps which are electrically powered. UV light disrupts genetic material sequencing, prevents cell replication and reduces the number of pathogen counts in the wastewater effluent. UV disinfection performance is dependent on UV light intensity at the optimal 254 nm wavelength as well as the exposure time and absorbance of UV light. Unlike chemically based disinfection processes, UV disinfection does not generate any chemical byproducts or residuals.

11.5 Solid Train – Sludge /Biosolids Treatment and Management

In order to maintain clarity during this Class EA, sludge refers to wastewater solids produced during primary, secondary or advanced wastewater treatment that has not undergone any process to reduce pathogens or vector attraction (i.e., material not stabilized). Biosolids refers to wastewater solids that have been stabilized and are suitable for removal from the WWTP.

Sludge from the WWTP is collected and can either be stabilized on site or hauled off-site for treatment by a biosolids management contractor. Sludge that is stabilized on site would be hauled off-site for use and/or disposal. Haldimand County has expressed interest in having an onsite stabilization process for sludge at the Caledonia WWTP and to add on-site biosolids storage for additional flexibility.

Biosolids are a nutrient-rich product of the wastewater treatment process, with many options available for recovering and using the nutrients in a beneficial way, often termed as “beneficial reuse”. Biosolids can be treated by various methods to produce products that can be used agriculturally, commercially marketed, or used as an energy source. Some of the possible end-use options for biosolids include:

- Applied to agricultural land as fertilizer;
- Used as a soil amendment, such as with compost;
- Commercially marketable fertilizer;
- Incinerated for heat and the ash used in the cement industry.

Sludge/ biosolids treatment and management alternatives were also screened as shown in Appendix I, resulting in only one short-listed alternative: aerobic digestion with on-site storage prior to land application

11.5.1 Aerobic Digestion with On-Site Storage Prior to Land Application

Aerobic digestion is similar to the activated sludge process. Biodegradable matter and microbial cellular material are oxidized by the biologically active mass of organisms in one or more open aerated tanks for a minimum of 15 to 20 days, reducing the volume and mass of biosolids and resulting in a more stable product with reduced levels of pathogenic organisms that can be safely applied to agricultural land in accordance with provincial regulations.

Gravity settling and decanting can be used to thicken biosolids and increase sludge storage capacity within the system. Storage capacity of up to 240 days is sometimes recommended to allow the biosolids to be land applied during appropriate ground conditions; this value may be adjusted based on local climatic and market conditions.

11.6 Short-List of Alternative Design Concepts

Based on the screening analysis described above, the short-listed technologies for each process step were combined to create three alternative design concepts.

- Option 1: Conventional Activated Sludge + Tertiary Filtration + UV Disinfection + Aerobic Digestion
- Option 2: MLE + Tertiary Filtration + UV Disinfection + Aerobic Digestion
- Option 3: 4 Stage Bardenpho or Step Feed + Tertiary Filtration + UV Disinfection + Aerobic Digestion

Selection of a specific tertiary filtration technology from the short-listed technologies will take place during preliminary design.

11.7 Evaluation of Alternatives

Following a similar evaluation method as Phase 2 of the Class EA, the alternative design concepts were evaluated based on a set of criteria developed in coordination with the County. The following criteria were used for the assessment:

- Financial – Capital Cost
- Financial – Operation and Maintenance Cost
- Technical and Environmental – Phasing Flexibility
- Technical and Environmental – Climate Change Adaptation and Mitigation
- Technical and Environmental – Robustness
- Technical and Environmental – Footprint
- Operations – Availability of Technical Support
- Operations – Process Complexity
- Social/Community Well Being – Potential for Traffic and Odour Impacts.

In coordination with the County, each criterion was assigned a weighting from 1 to 5 to reflect its level of importance relative to other criteria. For each alternative design concept, scores from 0 to 4 were then assigned for each criterion. The following scoring system was followed when evaluating the options:

- 4 – Highly favorable design concept or exceeds requirement.
- 3 – Favorable design concept or meets requirement.
- 2 – Neither favorable or unfavorable design concept or partially meets requirement.
- 1 – Less favorable design concept or barely meets requirement.
- 0 – Unfavorable design concept or does not meet requirement.

Refer to Table 29 for the full summary and final scores/ranks from the evaluation of the alternative design concepts/options. Based on the evaluation of the options with the County, **the preferred design concept for the New Caledonia WWTP is Concept Option No. 2.**

Table 29 Evaluation of Preferred Treatment Alternative Design Concepts

Category	Criteria	WEIGHT (1=Low, 3=Moderate, 5=High)	Option 1: CAS + Post Anoxic Filter + UV + Aerobic Digestion		Option 2: MLE + Tertiary Filtration + UV + Aerobic Digestion		Option 3: 4 Stage Bardenpho or Step Feed + Tertiary Filtration + UV + Aerobic Digestion	
			Comment	Score	Comment	Score	Comment	Score
Financial	Capital Cost	5	Highest capital cost compared with other design options; features additional unit processes (primary clarifiers, denitrification chemical dosing.)	1	Lowest capital cost compared with other design options. Lowest volume of tanks required for biological treatment compared to other design options.	4	Moderate capital cost compared with other design options. Additional treatment tankage and mixers required for nitrate removal compared with MLE.	3
	Operation & Maintenance Cost	5	Highest operation and maintenance costs due to denitrification chemical, primary clarifiers.	1	Lower operation and maintenance costs compared to CAS.	3	Similar operation and maintenance cost to MLE.	3
Technical and Environmental	Phasing Flexibility	3	Ability to add additional treatment trains as overall rated capacity of the plant increases. All design concepts are able to accommodate phasing similarly.	2	Ability to add additional treatment trains as overall rated capacity of the plant increases. All design concepts are able to accommodate phasing similarly.	2	Ability to add additional treatment trains as overall rated capacity of the plant increases. All design concepts are able to accommodate phasing similarly.	2
	Climate Change Adaptation and Mitigation	3	Higher climate change impact due to increased energy consumption and trucking.	1	Reduced energy consumption compared to CAS. Reduced trucking related to chemical delivery.	3	Similar climate change performance to MLE.	3
	Robustness	3	No recirculation to buffer against pollutant shock loads, but primary clarifiers can protect against shock loads of fats, oils and greases.	3	Fairly robust. Recirculation to anoxic zone can help maintain good sludge settleability and buffer against pollutant shock loads.	3	Recirculation to anoxic zone can help maintain good sludge settleability and buffer against pollutant shock loads, however, complex operation can lead to performance issues.	2
	Footprint	1	CAS represents higher footprint required among all design options. Proposed site of new WWTP has a fairly large available space for new WWTP.	1	Smaller footprint required compared with CAS. Proposed site of new WWTP has a fairly large available space for new WWTP.	2	Smaller footprint required compared with CAS. Proposed site of new WWTP has a fairly large available space for new WWTP.	2

Operations	Availability of Technical Support	3	Post anoxic filter supplier will be able to provide required technical support for denitrification filtration.	3	Support from suppliers may be provided for specific processes such as tertiary treatment, depending on technology chosen during detailed design. Technical support for MLE process could be obtained from consultants.	2	Support from suppliers may be provided for specific processes such as tertiary treatment, depending on technology chosen during detailed design. Technical support for biological treatment process could be obtained from consultants.	2
	Process Complexity	5	Relatively simple operation. Operators are familiar with majority of processes at the existing Caledonia WWTP. Post Anoxic Filter will be a new process that will be introduced to operators and will require additional training.	2	Relative simple operation. Operators are familiar with majority of processes at the existing Caledonia WWTP. Recirculation to anoxic tanks will be a new process that will be introduced to operators and will require additional training.	3	More complex operation compared to other design concepts. Additional tanks or step feed passes required for biological treatment will need additional attention from operators.	1
Social/ Community Well Being	Potential for Traffic and Odour Impacts	3	Odour control will be implemented. Expected traffic near new WWTP will decrease compared to existing WWTP as new Caledonia WWTP is expected to provide sludge storage for biosolids on site. Slightly higher trucking compared to other options due to denitrification chemical.	1	Odour control will be implemented. Expected traffic near new WWTP will decrease compared to existing WWTP as new Caledonia WWTP is expected to provide sludge storage for biosolids on site.	2	Odour control will be implemented. Expected traffic near new WWTP will decrease compared to existing WWTP as new Caledonia WWTP is expected to provide sludge storage for biosolids on site.	2
Total Score and Rank:			**Rank #3**	**51**	**Rank #1**	**88**	**Rank #2**	**70**

12.0 Conceptual Design of Wastewater Treatment Plant

12.1 Design Flows

The average, maximum day, peak hour and peak instantaneous design flows used as the design basis for this conceptual design are summarized in the Table 30 below.

Table 30 Summary of Projected Design Flows and Peaking Factors

Parameter	Peaking Factor	Flow (m^3/d)	Flow (L/s)
Average Daily Flow	n/a	14,200	164
Maximum Day Flow	3.0(2)	42,600	493
Peak Hourly Flow	4.37(3)	62,095	719
Peak Instantaneous Flow	4.94	70,123	812(4)

Notes:
1) Excludes flow from potential south end developments.
2) Maximum daily flow peaking factor used in the 2020 Caledonia Wastewater Master Servicing Plan Update, per County direction.
3) Peak hourly flow peaking factor is based on the 99.5% percentile of the hourly flow data provided by the Haldimand County (August 2022 to July 2023).
4) Sum of estimated projected peak instantaneous flows from Main SPS (305 L/s), Nairne SPS (287 L/s) and McClung SPS (220 L/s). Main SPS flow was estimated by applying a factor of 1.5 to the maximum hourly flow value recorded between August 2022 and July 2023, assuming no growth within this catchment. Nairne SPS flow from existing sources was estimated by applying a factor of 1.5 to the maximum hourly flow value recorded between August 2022 and July 2023; additional flow from anticipated growth areas provided by the model was then added. McClung SPS flow was derived directly from the model. Flow monitoring in all SPS catchments is recommended prior to detailed design.

12.2 Design Influent Concentrations and Loadings

The following raw sewage concentrations and loading values were used as basis of conceptual design for the treatment system. The concentrations and loadings values are a weighted average based on the percentage of domestic sewage to industrial sewage (approximately 80:20 domestic to industrial contributions). Domestic sewage was determined by averaging Five Day Biochemical Oxygen Demand between 2018 and 2022 and industrial sewage was based on Haldimand County's Sewer Use By-Law Concentrations.

Table 31 Future Influent Concentrations and Pollutant Loading

Water Quality Parameter:	BOD_5	TKN	TP	TSS
Average Concentration (mg/L) (1)	240	50	7.0	270
Average Loading (kg/day)	3,410	710	100	3,840
Maximum Monthly Loading (kg/day) (2)	4,791	985	142	6,644

Notes:
(1) Calculated assuming future domestic sewage is equal in strength to historical values, while future industrial sewage has been pre-treated to meet the County's Sewer By-law.
(2) Calculated using historical Maximum Month Loading Factors

Note that the design basis does not include for any hauled septage or other high-strength hauled waste. Currently, the existing Caledonia WWTP does not receive any hauled sewage. Haldimand County does not plan to accept hauled sewage at the new proposed Caledonia WWTP.

12.3 Effluent Criteria for Ultimate Capacity

The effluent criteria for any new or expanded plant discharging to surface water in Ontario are determined using an Assimilative Capacity Study (ACS). Hutchinson Environmental has completed an ACS which developed proposed effluent limits and analyzed impacts to surface water quality for several scenarios. The resulting effluent limits are shown in Table 32. Accompanying effluent objectives have been suggested based on JLR experience and should be confirmed with MECP Approvals Branch prior to detailed design.

Table 32 Proposed Effluent Design Objectives and Compliance Limits

Parameter	Season	Design Objectives (mg/L) (1)	Compliance Limit (mg/L) (2)
cBOD5	All year	6	10
TSS	All year	6	10
TP	May - Nov	0.11	0.14
	Dec - Apr	0.15	0.18
TAN	May - Nov	0.75	1
	Dec - Apr	1.50	2
pH	All year	6-5-8.5	6.5-9.5
E. coli	All year	--	200
Nitrate (2)	All year	12	15

Notes:
(1) Design objectives suggested based on JLR experience, to be reviewed by MECP Approvals Branch during design.
(2) Nitrate limit accepted by MECP per the ACS and through iterative consultation with MECP (see Appendix D)

12.4 Conceptual Design Summary

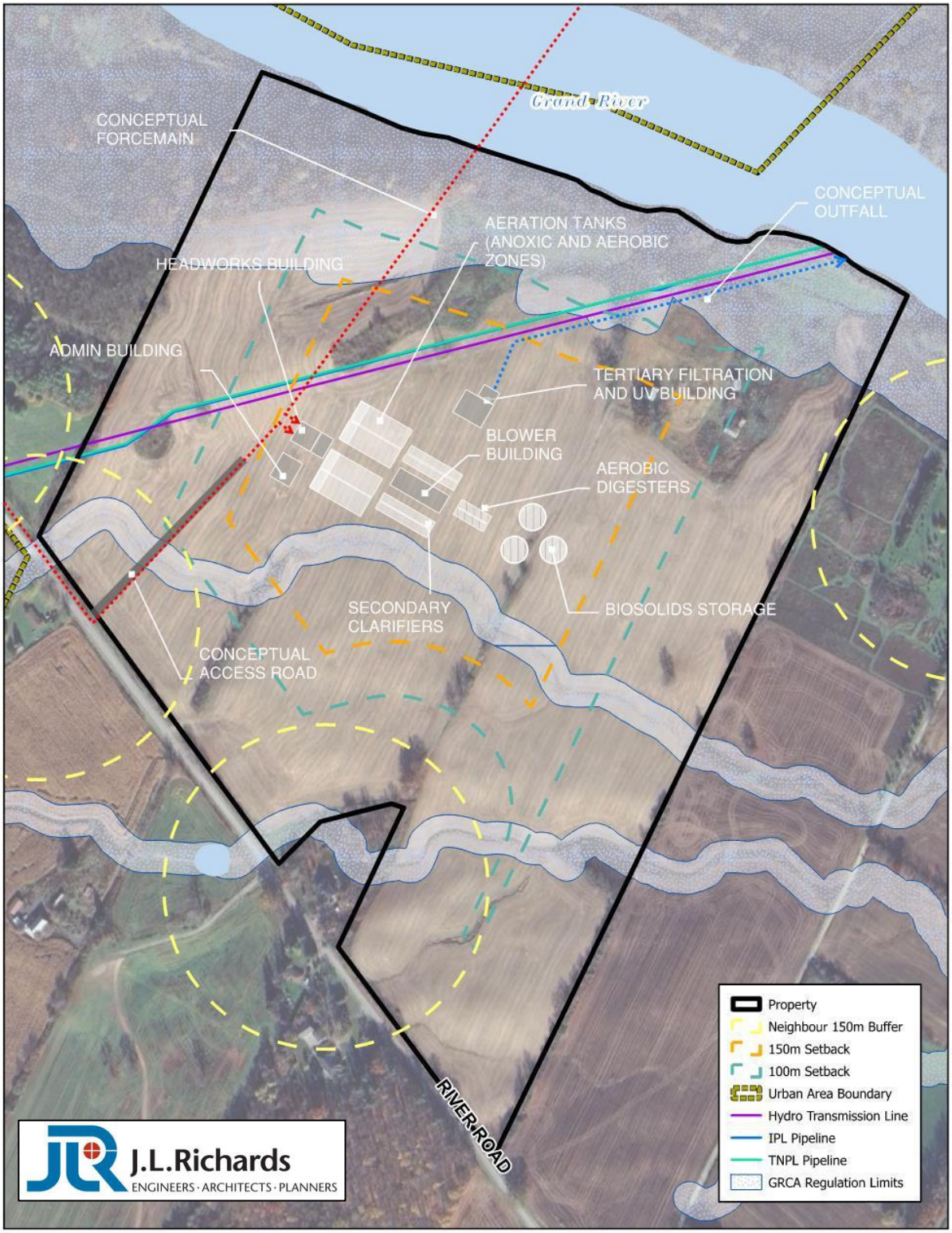
A preliminary conceptual design has been developed for the preferred design alternative based on information provided by suppliers and based on the buildout projected average daily flow of 14,200 m^3/d. It is noted that for the preferred design alternative, there are various WWTP configurations that can be explored to optimize the layout, cost, performance, etc. of the treatment systems. The conceptual design for the preferred design option, developed for the purposes of this study, is summarized in Table 33. A conceptual level site plan for the preferred design option is presented in Figure 30.

Table 33 New WWTP Conceptual Design Summary

Process Description	Conceptual Design Summary
Headworks	• Headworks building (~850 m^2) complete with odour control, sized for ultimate capacity • Two mechanical screens • One manual bypass bar screen • Two grit chambers (vortex or similar) with grit classifier • Grit bypass channel • Equalization storage tanks with return pumps
Secondary Treatment	• Four aeration tanks equipped with pre-anoxic cells, aerobic cells, and mixed liquor recycle pumps • Four secondary clarifiers (1) • Blowers and sludge pumps located in adjacent building
Tertiary Treatment, Disinfection and Phosphorus Removal	• Tertiary filters to be selected in preliminary design • Alum storage and dosing system, storage sized for 1 month usage • UV disinfection system • Building housing filters, UV and chemical systems (~1,000 m^2) (2)
Outfall	• Gravity sewer discharging to Grand River (3) • Allowance for in-river works including potential effluent diffuser system
Aerobic Digesters	• Two digester tanks equipped with two cells each for two-stage digestion (approximately 2,000 m^3 total tank volume) • Digester blowers located in secondary treatment blower building • In-tank decanters, diffusers and sludge transfer pumps
Sludge Storage	• Approximately 16,000 m^3 of storage capacity (4) • Mixing system housed in 200 m^2 building
Site Wide Works	• New site entrance c/w culvert for existing intermittent watercourse crossing • Internal roadways and parking areas • Administration building (~450 m^2) • Electrical service and substation • Outdoor standby power generator • Allowances for dewatering and shoring, air and noise provisions, landscaping and stormwater management

Notes:
(1) Secondary clarifiers not required if membrane bioreactor configuration is selected during preliminary design.
(2) Filtration units would be located within aeration tanks if membrane bioreactor configuration is selected during preliminary design.
(3) Hydraulics to be reviewed during preliminary design to determine whether effluent pumping is required.
(4) Storage requirements to be reviewed during preliminary design based on local factors (biosolids management market, climate considerations, etc.)

Figure 30 Conceptual Level Site Plan for Preferred Treatment Alternative



13.0 Phasing and OPCC for Preferred Alternative

13.1 Existing Future Sewage Flow in Caledonia by Sewershed

From Phase 2 of the Municipal Class EA (MCEA) process, it was determined that the preferred wastewater servicing alternative for Caledonia is to initially share wastewater treatment between the current Wastewater Treatment Plant (WWTP) and a new WWTP located at 4300 River Road. Once the service life of the existing plant is reached, it will be decommissioned and the new WWTP will provide all sewage treatment for Caledonia.

The Industrial Lands – North Caledonia were initially expected to be developed in full within the 10–15-year development timeline (see Section 3.7 - Table 3). However, upon discussion with County staff in November 2024 regarding anticipated growth and development in Caledonia, it was noted that the industrial lands are likely to be developed at a much slower rate. As such, the growth projections for these development lands were adjusted to allow 33% of the total anticipated development to occur within the 10–15-year development period (Phase 2 – 2038), and the remaining 66% to be developed in the 15–30-year development period (Phase 3, split between 2042 and 2047). Figure 31 illustrates the future treatment flows from 2020 to 2051 relative to the existing treatment plant capacity of 7,200 m^3/day and 85% of the rated capacity of the plant. Based on current flow estimates, the existing WWTP will reach 85% of its rated capacity in 2032.

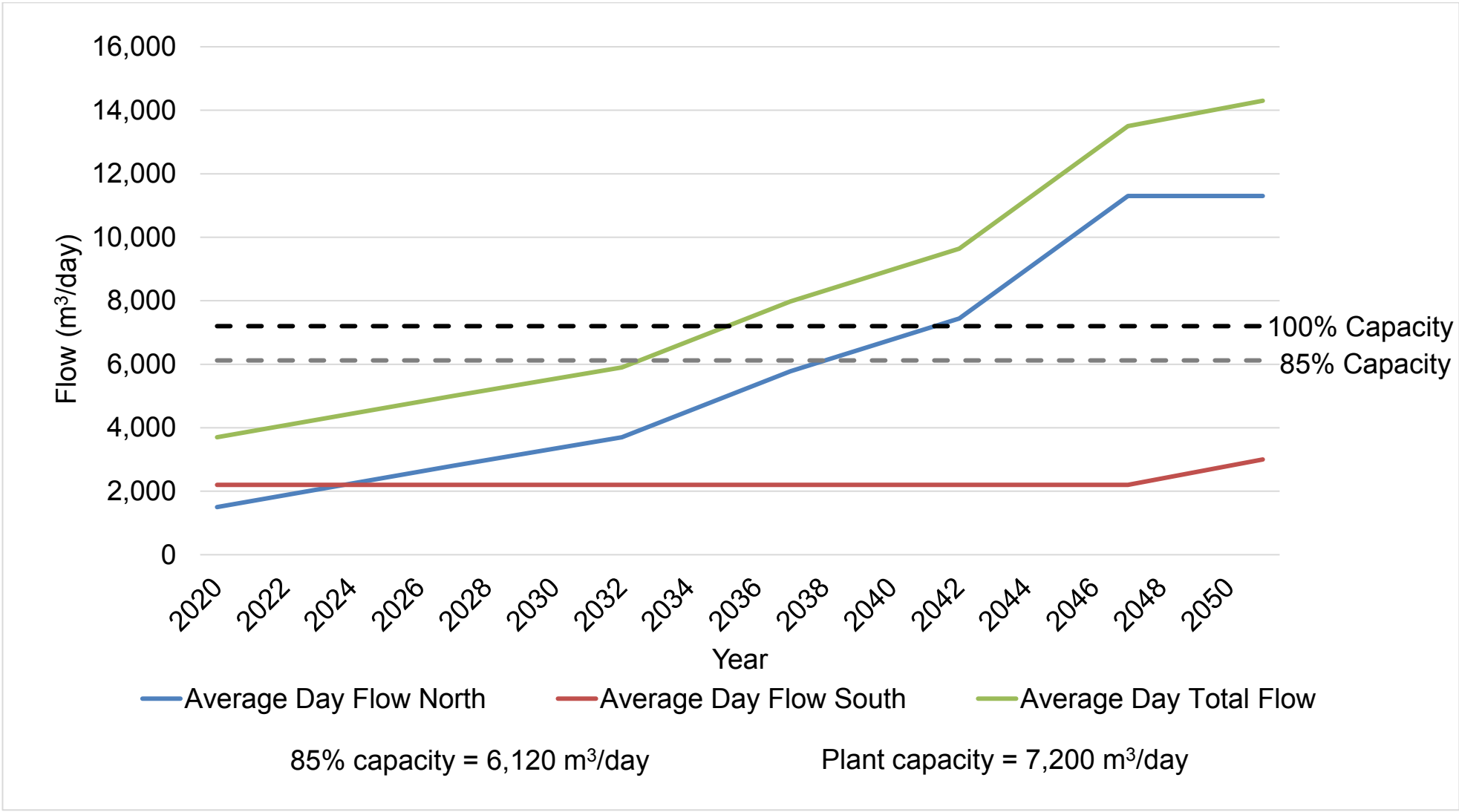
The average daily sewage flows produced in each sewershed for various development timelines, based on equivalent population and an average day treatment volume of 338 L/cap/day, are shown in Table 34.

Table 34 Average Daily Sewage Flow for Various Development Timelines in Caledonia

Average Daily Sewage Volumes (m^3/day)					
Timeline	Sewersheds			Total	Cumulative Total
	South[2]	Nairne[3][4]	McClung[5]		
Existing	2,159	1,098	444	3,701	3,701
2027	0	403	762	1,165	4,866
2032	0	630	276	906	5,771
2037	0	1,400	762	2,162	7,934
2042	0	961	626	1,587	9,520
2047	0	961	2,899	3,859	13,380
2052 & beyond [5]	*789*	*0*	*0*	*789*	*14,169*

Notes:
(1) Average sewage volumes have been calculated based on a sewage treatment volume of 338 L/cap/day.
(2) This sewershed includes flows from Beattie SPS, Main SPS, and Paisley SPS.
(3) This sewershed includes flows from Kincardine SPS, Orkney SPS, Nairne SPS, and Gateway SPS.
(4) The flow to Nairne SPS does not include the flows from McClung SPS.
(5) This sewershed includes flows from Avalon SPS and McClung SPS.

Figure 31 Caledonia Future Treatment Flows Revised



13.2 Proposed WWTP Phasing

For the preferred routing alternative (see Figure 25), it was assumed that all wastewater flows from the McClung sewershed (via McClung Sewage Pumping Station (SPS)) would be routed to the new WWTP through a new forcemain crossing below the Grand River. All remaining flows (Nairne sewershed via Nairne SPS and South Caledonia sewershed via Main SPS) would be directed to the existing WWTP through existing infrastructure. The existing plant has a capacity of 7,200 m^3/day. However, as part of the ACS (Appendix D), phased implementation scenarios were considered wherein it was determined that for the optimal phasing scenario, the existing plant will be downgraded to 6,100 m^3/day before being decommissioned. Table 35 shows the cumulative average daily sewage flows being routed to each WWTP, considering the capacity downgrade at the existing WWTP.

Table 35 Average Daily Sewage Flow to the WWTPs with Operational Capacity Limit

Cumulative Average Daily Sewage Flow (m^3/day)			
Growth Timeline (Year)	**Current WWTP (1)**	**New WWTP (2)**	**Total**
2025	3,257	444	3,701
2027	3,659	1,206	4,866
2032	4,290	1,482	5,771
2037	5,690	2,244	7,934
2038 (3)	**6,100**	**2,470**	**8,570**
2042	6,100	3,420	9,520
2047	6,100	7,280	13,380
2052 & beyond (4)	*6,100*	*8,069*	*14,169*

Notes:

(1) The current WWTP receives flows from the South Caledonia and Nairne sewersheds.
(2) The new WWTP receives flows from the McClung sewershed.
(3) Estimated timeline to reach the operational capacity of the current WWTP (85% capacity). The values in this row have been interpolated based on the 2032 and 2037 data points.

Based on this analysis, the current WWTP will reach the downgraded operational capacity of 6,100 m^3/day by 2038. However, the 2038 growth timeline is dependent on a large increase in sewage flows from the Industrial Lands – North Caledonia. Given the revisions to these growth projections, as discussed with the County (see Section 13.1), it is expected the new WWTP will reach the operational capacity closer to 2045 instead of the initial estimation of 2038. At this time, any excess flows will need to be directed to the new WWTP for treatment. The proposed phasing for the new and existing WWTPs, as imposed by the ACS (see Appendix D), are summarized in Table 36.

Table 36 Summary of Preferred Phasing Option

Phase	Estimated In Service Date	Existing WWTP Capacity (m^3/day)	New WWTP Capacity (m^3/day)
Phase 1	2028	7,200	5,800
Phase 2	2045	6,100	7,300
Phase 3	Beyond 2052	0	14,200

Additional details regarding the proposed phasing and implementation plan for the new WWTP is shown in Figure 32 and summarized in Table 37.

13.3 Sewage Pumping Station Design Considerations and Phasing

13.3.1 Main SPS

Given that majority of the proposed southern development falls within the '2052 & beyond' development timeline the existing firm capacity at Main SPS is sufficient to support southern Caledonia through 2047.

13.3.2 New South SPS

To convey sewage from the existing WWTP to the new WWTP, a SPS is required. Given there are space limitations at the Main SPS, it was assumed that a new SPS (here after called South SPS) will be designed and constructed at the existing WWTP for the purpose of sewage transfer to the new WWTP. This new South SPS will be designed to align with pumping requirements of Phase 2 and 3 of the new WWTP.

13.3.3 Nairne SPS

For buildout conditions (2052 & beyond) Nairne SPS requires a firm capacity of approximately 230 L/s to support peak demands (calculated with the inclusion of the northern industrial lands). A hydraulic study was completed in September 2024, to assess the potential to increase capacity at the Narine SPS (see full report in Appendix J). Excluding contributions from the industrial area, a firm capacity of 128 L/s is required to meet the remaining demands. Since Nairne SPS has an existing firm capacity of 138 L/s, no major capacity upgrades will be required until the development of the northern industrial lands.

13.3.4 McClung SPS

The current firm capacity at McClung SPS is 115 L/s, however, the SPS was predesigned to allow for a simple capacity expansion (through an additional pump) to increase the firm capacity to 160 L/s. For buildout conditions, McClung SPS requires a firm capacity of 220 L/s to support peak demands. Based on anticipated population growth and peak sewage rates in the McClung sewershed, McClung SPS should currently have adequate capacity to support growth until 2042. To support further growth, it is recommended that the capacity of McClung SPS be expanded to meet buildout requirements of 220 L/s prior to 2042. If a portion of the proposed developments forecasted in the 2047 development timeline were to get deferred until further in the future, the interim capacity expansion to 160 L/s could be considered.

Details regarding the proposed phasing and implementation plan for the sewage pumping stations is shown in Figure 32 summarized in Table 37.

13.4 Overall Capital, Infrastructure, and Phasing Plan

Figure 32 details the overall phasing and anticipated in-service dates for all infrastructure associated with the project including the treatment plants, sewage pump stations, and conveyance infrastructure.

To assist with capital planning, the anticipated construction phasing and triggers are summarized in Table 37. The actual timing of upgrades will be contingent on the rate of development in Caledonia.

An Opinion of Probable Costs (OPCC) with a Class 'D' (Indicative Estimate) level of accuracy was developed for the new WWTP, conveyance infrastructure, and pumping stations and includes allowances for design elements that have not fully been developed. Class 'D' OPCCs developed for this assignment are presented in Table 37 and are expected to be within +/= 30%. The OPCCs were developed based on experience on similar projects, professional judgement, and equipment costs provided by suppliers. Design completed as part of this MCEA are conceptual in nature for the purpose of obtaining Class 'D' cost estimates. All design parameters (e.g., pump capacity, watermain diameter, etc.) should be confirmed during detailed design. All costs were reviewed and refined in November 2024 in consultation with County technical and financial staff. Refer to Haldimand County Development Charges (DC) Bylaw for further details on costing allocations.

The expected sensitivity of this analysis (+/- 30%) is connected to less volatile economic conditions than what we have experienced in recent years. Any provided cost estimates or budget is an OPCC that is based on historic construction data and does not include labour, material, equipment, manufacturing, supply, transportation or any other cost impacts related to high inflation rates and ongoing supply chain challenges. JLR shall not be responsible for any variation in the estimate caused by foregoing factors but will notify the Client of any conditions which JLR believes might cause such variation upon delivery of the estimate.

Cost estimates are provided in 2024 dollars. It is not possible to ascertain future price escalation, however, by industry best practices escalation should be considered likely between a baseline date of January 2024 and the implementation of these projects. A cost escalation rate should be applied once implementation timing is known.

Figure 32 Anticipated Infrastructure In-Service Dates

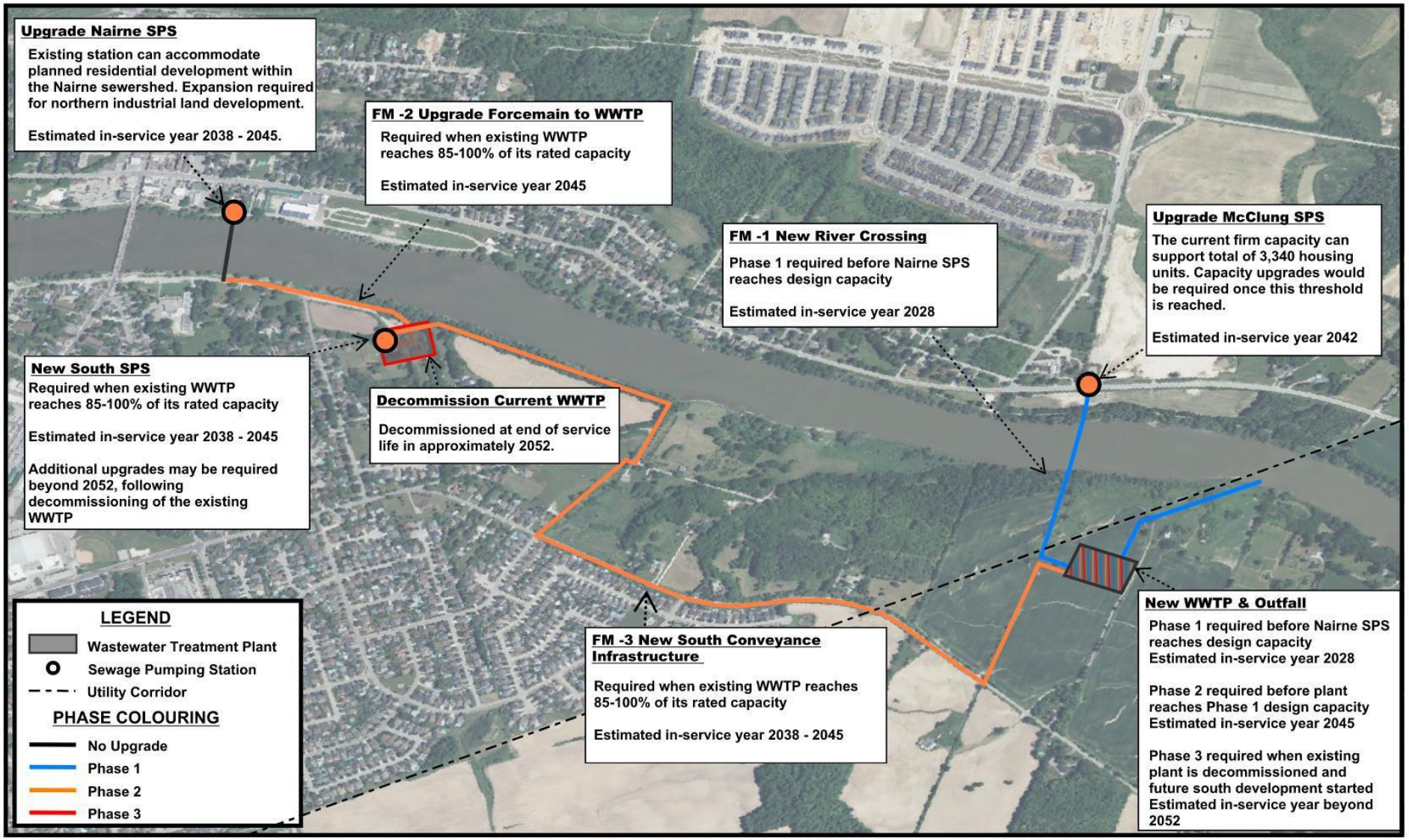


Table 37 Summary of Anticipated Capital Costs and Funding

Item	Description	Cost Estimate (2024$)	Funding		Estimated Budget Year	Estimated in Service Year	Construction Phasing	Trigger	EA Schedule	Funding Rationale
			County	DC						
New Wastewater Treatment Plant										
Land Acquisition	Land acquisition and design of new Phase 1 WWTP	$8,500,000	0%	100%	2024	2024/25	Phase 1	-	Schedule C	Additional Treatment Capacity
Phase 1A	Construction Phase 1A of New WWTP 3,200 m3/day	$32,000,000	0%	100%	2027	2028	Phase 1	Before Nairne SPS reaches design capacity	Schedule C	Additional Treatment Capacity
Phase 1B	Construction Phase 1B of New WWTP 5,800 m3/day	$25,000,000	0%	100%	2033	2036	Phase 1	Before Nairne SPS reaches design capacity	Schedule C	Additional Treatment Capacity
Phase 2	Construction Phase 2 of new WWTP (total 7,300 m3/day)	$15,000,000	0%	100%	2042	2045	Phase 2	Before plant reaches Phase 1 design capacity	Schedule C	Additional Treatment Capacity
Phase 3	Decommission existing Caledonia WWTP and construction Phase 3 of New WWTP (total 14,200 m3/day)	$45,000,000	88%	12%	2052	Beyond 2052	Phase 3	When existing plant is decommissioned, and future south development started.	Schedule C	Replacement of Existing Infrastructure & Additional Treatment Capacity
Wastewater Treatment Plant Subtotal		**$125,500,000**	**$39,600,000**	**$85,900,000**						
Conveyance										
FM-1	Construction of New River Crossing from McClung SPS to new WWTP	$6,900,000	0%	100%	2026	2028	Phase 1	Before Nairne SPS reaches design capacity	Schedule B	Downstream Capacity Improvement Servicing Multiple Basins
FM-2	Upgrade Forcemain from Existing River Crossing to Existing WWTP	$2,700,000	30%	70%	2042	2045	Phase 2	When existing plant reaches 85-100% of its rated capacity	Exempt	Downstream Capacity Improvement Servicing Multiple Basins & Replacement of Existing Infrastructure
FM-3	New Southern Forcemain from New South Sewage Pump Station to New WWTP	$10,400,000	0%	100%	2042	2045	Phase 2	When existing plant reaches 85-100% of its rated capacity	Schedule B	Downstream Capacity Improvement Servicing Multiple Basins
Conveyance Subtotal		**$20,000,000**	**$810,000**	**$19,190,000**						
Pumping Stations										
Main SPS	Upgrade Main SPS	$1,400,000	0%	100%	Already approved and some work completed					
McClung SPS	Modifications to SPS to Accommodate New River Crossing	$800,000	0%	100%	2027	2028	Phase 1	-	ASP/ Schedule B	Capacity Improvement to SPS Servicing Multiple Basins
New South SPS	New South Sewage Pumping Station at Existing WWTP	$6,670,000	0%	100%	2042	2045	Phase 2	When existing plant reaches 85-100% of its rated capacity Upgrades may be required beyond 2052 once existing plant is decommissioned	ASP/ Schedule B	Capacity Improvement to SPS Servicing Multiple Basins
McClung SPS	Upgrade McClung SPS - 220 L/s	$1,600,000	0%	100%	2039	2042	Phase 2	Once firm capacity is reached (maximum of 3,340 housing units)	ASP/ Schedule B	Capacity Improvement to SPS Servicing Multiple Basins
Nairne SPS	Upgrade Nairne SPS - 230 L/s	$7,000,000	0%	100%	2042	2045	Phase 2	Once northern industrial development begins.	ASP/ Schedule B	Capacity Improvement to SPS Servicing Multiple Basins
Pumping Stations Subtotal		**$17,470,000**	**$0**	**$17,470,000**						
Total Wastewater Cost		**$162,970,000**	**$40,410,000**	**$122,560,000**						

14.0 Cumulative Effects and Potential Impacts to Treaty Rights

An analysis of the Class EAs cumulative effects and impacts on treaty rights and the inherent rights of Indigenous Peoples in the project study area and surrounding areas was conducted. The United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP), and Canada's commitment to implement these rights under the UNDRIP Act (UNDRIPA), was used as reference to determine the potential impacts to the rights of Indigenous Peoples. A summary of the potential rights impacts of the Caledonia WWTP Class EA and some potential mitigation methods can be found in Appendix A.

15.0 Summary of Environmental Effects and Proposed Mitigation Measures

Table 38 Potential Impact and Proposed Mitigation

Potential Impact	Construction Mitigation
Short-term Construction Related Impacts	A plan to mitigate adverse impacts within the study area during construction activities will be developed. The construction site will be managed to prevent attracting wildlife to the area. Construction will be scheduled to minimize wildlife disturbance and nighttime light use will be minimized. Exclusion fencing will be installed and inspected on a regular basis.
Noise and Vibration Control – During Construction	A plan to incorporate noise and vibration control measures to mitigate adverse impacts within the study area during construction activities will be developed, including enclosing equipment known to cause noise and vibrations.
Noise and Vibration Control – During Plant Operation	A plan to incorporate noise and vibration control measures to mitigate adverse impacts within the study area during operation activities will be developed, including an appropriate buffer zone to neighbouring properties and tree-lining of the property to minimize travel of noise and vibration.
Odour	The new WWTP will be designed with high-level technology that should mitigate odours to a higher level than the existing plant. A plan to incorporate odour control measures to mitigate adverse impacts will be developed, including enclosing equipment known to cause odours, including an appropriate buffer zone to neighbouring properties, and tree-lining of the property to minimize the travel of odours.
Visual Impacts and Effects on Fishing – Outfall Pipe	Methods to reduce the visual impacts and impacts on local fishing practices caused by the outfall in the Grand River will be considered in the final design. The project team will consider the possibility of fluctuation in the Grand River throughout the design process to ensure impacts are minimized.
Traffic	Relocating the site entrance will be considered during design to improve sight lines and road safety and to produce an increased buffer to the nearest neighbouring property.

Potential Impact	Construction Mitigation
Road Quality	Considerations regarding the existing condition of River Road and its capacity to convey construction trucks will be considered during construction. Restoration of the road will be considered if required, following construction.
Sediment Deposition	An Erosion and Sediment Control plan will be implemented during construction.
Vegetation	HESL identified a provincially rare species of significance in good condition, the Northern Pin Oak, at the north site. HESL recommended any development in the northern site be shifted to avoid the provincially rare Pin Oak tree. Vegetation removed during construction will be replaced with native species. Topsoil management will be implemented during these re-vegetation efforts.
Wetlands	No provincially significant wetlands were identified in the study area (HESL, Nov 2023).
Wildlife, including Migratory Birds	No amphibious species at risk were recorded by HESL, and there is no amphibian habitat in the proposed WWTP footprint. HESL identified 45 bird species including two species at risk and three area sensitive species.
Natural Heritage Features	No provincially significant woodlands or ANSIs were identified in the study area (HESL, Nov 2023). HESL preferred the north site to the south site as the south site has a higher quality of surrounding habitat.
Fish and Aquatic Habitat	HESL assessed watercourses on both sites, excluding the Grand River. Consultation with the GRCA will be required regarding site preparation and construction of the WWTP to determine if permitting is necessary. Once an outfall location for the WWTP is selected a background review, aquatic habitat assessment, and impact assessment will need to be conducted for the Grand River. HESL also completed additional natural heritage studies to inform the outfall location for the WWTP and works associated with the new sanitary forcemain. This included input into the EA process and an updated aquatic background screening (full report in Appendix K). It was noted that the reach of the Grand River within the study area provides habitat for a variety of fish species and mussels, including some SAR and critical habitat identified by DFO. Once the preferred location of the new outfall is determined, site specific aquatic habitat assessments may be required during the detailed design phase. A Request for Review Form was submitted to the DFO on March 5, 2025. Once the preferred location of the new outfall is determined, authorization may be required under the Fisheries Act for works potentially impacting fish and fish habitat as part of the project. If the appropriate timing windows for all project activities below the High Water Mark cannot be followed, additional consultation with DFO will be required.

Potential Impact	Construction Mitigation
Groundwater Resource Management	There are no groundwater Permits to Take Water (PTTW) within the study area. A PTTW will be required from the MECP if dewatering exceeding 50,000 L/day takes place during construction. A hydrogeological investigation will be required prior to construction.
Species at Risk	The HESL study found that the Grey Ratsnake had possible habitat at the south site that may be impacted by the WWTP development. Three Species at Risk were observed at the north site and two at the south site. The HESL study found that both sites contain Significant Wildlife Habitat for Monarch Butterfly and Grasshopper Sparrow that is susceptible to impact from construction. An Information Gathering Form (IGF) is in progress. It will determine if an overall benefit permit is needed to proceed.
Cultural Heritage	The Cultural Heritage Assessment Report by Detritus confirmed there are no Built Heritage Resources or Cultural Heritage Landscapes within the study area.
Archeological Resources	The Stage 1 Archeological Assessment determined the study area had some areas with moderate to high archaeological potential. Detritus recommended these areas be subject to a Stage 2 property assessment. Subsequent to the Stage 1 Archaeological Assessment, it was determined that additional lands would be required for the project that were not included in the 2022 Stage 1 Archaeological Assessment. As such, ARA began a Stage 1 and Stage 2 Archaeological Assessments for these lands in 2024. The Marine Archaeological Assessment has been completed for the preferred site, revealing no archaeological concerns in the area (see full report in Appendix F). Stage 2 land archaeological assessment are currently ongoing.
Indigenous Interests	Refer to stakeholder consultation in Section 16.4
Source Water Protection/Sensitive Surface Water Features	There are no Intake Protection Zones or Wellhead Protection Areas in Caledonia. The Assimilative Capacity Study determined the Grand River is a Policy 1 receiver for all parameters except TP which is above PWQO. HESL recommended bathymetric mapping and CORMIX modelling be completed once the site is selected to define the outfall location. HESL recommended the new outfall should include a diffuser to encourage mixing. Additional studies of aquatic habitat characteristics and impacts will be required during the detailed design process. Consultation with the GRCA, MECP, and DFO will be needed to determine permitting requirements. Effluent limits recommended by HESL are included in Appendix D.

Potential Impact	Construction Mitigation
Climate Change – Greenhouse Gas (GHG) Emissions	Construction of a new WWTP may alter the landscape's ability to store carbon or remove carbon dioxide from the atmosphere. Methods to reduce direct, indirect, and process GHG emissions through reducing energy consumption and other methods will be explored in detail during the design process.
Climate Change – Resiliency	The impacts of climate change on the WWTP, including precipitation and ambient temperature changes will be explored in detail during the design process.

16.0 Public, Agency, and First Nations Consultation

16.1 Notice of Study Commencement

Per Phase 1 requirements of the MCEA process, the consulting team prepared a Notice of Study Commencement (provided in Appendix L). A project mailing list was developed that identified developer and review agency stakeholders. A copy of this list is provided in Appendix M.

The Notice of Study Commencement was:

- Placed on the County's website starting August 25, 2022.
- Mailed or emailed to developers and review agencies on November 9 and 11, 2022.
- Placed in The Sachem on December 7 and 21, 2022.
- Placed in the Haldimand Press on December 7 and 14, 2022.

A summary of responses received to the Notice of Commencement are included in the remainder of this section.

16.2 Public Open Houses

16.2.1 Public Open House No. 1

The first Public Open House for the Caledonia Wastewater Treatment Plant (WWTP) Schedule C Class EA was held at the Caledonia Public Library on December 6, 2023, from 4:00 p.m. to 6:00 p.m. The purpose of the Public Open House was to provide insight into the system's existing problems and/or opportunities and to identify the preferred solution.

A Notice of Public Open House was prepared by the consulting team and distributed prior to the Public Open House. A copy of the Public Open House Notice is provided in Appendix O. The Notice was issued via the following means:

- Placed on the County's website the week November 13, 2023.
- Mailed and e-mailed to review agencies, developers, Indigenous communities, and other stakeholders the week of November 13, 2023.
- Placed in the local newspaper (Haldimand Press) starting the week of November 23, 2023.
- Circulated to members of the Haldimand County Council the week of November 13, 2023.

During the Public Open House, boards presenting the project information were on display (provided in Appendix O). Representatives from the consulting team and County staff were

available to answer questions through the duration of the Public Open House. The Public Open House was attended by 14 members of the public and/or developers in addition to several Haldiman County Staff. Table 39 includes a summary of the comments received during the Public Open House 1.

Table 39 Comments Received During Public Open House 1

Comment No.	Comment	Follow up Required/Action
1	An attendee whose land is adjacent to the proposed site asked if they would be reimbursed if their property value decreased due to the proposed WWTP, and does the County provide any legal counsel regarding an affected property?	A County staff member acknowledged these concerns but were unaware of any property reimbursement programs that pertain to situations like this.
2	An attendee whose residence is in proximity to the proposed site was concerned about the water quality of their well and asked if it would be affected by the proposed WWTP.	A County staff member indicated that the effluent loadings to the Grand River would have to remain the same as before, and that all tanks onsite would be designed to fully contain the sewage, making a leak extremely unlikely.
3	Some attendees expressed concerns about how the County will address concerns from Indigenous groups, specifically regarding the proposed location on the south side of the river.	It was mentioned that the project team has already commenced consultation with Mississaugas of the Credit First Nation, Six Nations and Haudenosaunee Development Institute. It was noted that the County and their consultant will continue to consult with them and welcome any input they may have on this project.
4	Several attendees expressed concerns about odor and noise control for the proposed WWTP. They also noted that they feel the current wastewater treatment plant has significant odor issues.	It was explained that a newly designed WWTP that is properly managed and optimized should not produce significant noise and odor, but these concerns will be addressed and mitigated through the design process. It was also noted that there are several success stories of WWTPs that have been developed in communities with smaller boarders than this proposed plant. A County staff member also suggested that touring a WWTP is a good way to get a better idea about the process that goes on at a plant.
5	Some residents were concerned about truck traffic to and from the proposed WWTP. They noted that the road (River Rd.) leading to the	It was explained that from time to time there would be extra truck traffic on this road. There would most likely be weekly chemical deliveries needed for plant operation but one goal for the proposed WWTP is to provide additional biosolids storage on site, to limit the need for shipping it to another location. This not only reduces truck traffic in and

Comment No.	Comment	Follow up Required/Action
	proposed site is notorious for speeding infractions.	out of the plant, but also saves money. It is also important to note that a traffic management plan is something that will be refined further in the design process.
6	Some residents expressed their disappointment that they did not receive a notice in their mailbox and have not been involved in the process. They suggested forming a Land-Owners Association (LOA) and mentioned legal intervention.	The County reassured that the purpose of the Public Open House was to avoid this and is intended to allow for their involvement and for them to voice any concerns before moving forward to the next phase. Stakeholders will be contacted as the project progresses.
7	There were significant concerns about this Public Open House announcement to the public. Several people verbalized that they felt they were not properly informed about the event and would prefer a notice in the mail. These attendants also noted that they own the adjacent properties to the proposed site. Some attendees felt that more people would have showed up to the Public Open House if they had known about it.	It was explained that everyone who signed into the Public Open House will be personally distributed on future notices for the project. For subsequent communications the County will put notices in the mailboxes of the surrounding neighbours.
8	Several attendees expressed their disappointment with the land chosen on the south side of the river. They asked for it to be moved to the north side of the river where the development is going to be.	It was explained that the project team did look at options on the north side of the river, but there were too many constraints (including undermined areas, ecological constraints, flood plain and utility corridors) to provide a suitable site in proximity to the Grand River that could account for future growth beyond the 25year horizon. The south side was deemed as the better option. The County noted of the reasons for selecting the proposed location on the south side, including: • The new WWTP needs to be close to the river as this is where it will discharge into • The recommended location is directly across from McClung sewage pump station, which receives the flows from the new north developments, So conveyance infrastructure can take a fairly direct route;

Comment No.	Comment	Follow up Required/Action
		The recommended site is large enough to accommodate future growth and allow for ample separation distance and buffer from neighboring properties.
9	Some attendants asked for a map of the proposed location of the WWTP.	A copy of the presentation slides was provided to these individuals, which included a map. Providing a map will be a component of Public Open House No.2.
10	An attendee asked; “Instead of developing in Caledonia why don’t they develop in Townsend or elsewhere?”	It was explained that where developers are attracted to is not necessarily controlled by the County. Planning within the County is guided by the Provincial Policy Statement and settlement areas are established though many formal processes including the Official Plan.
11	A resident asked who currently owns the proposed land?	County staff explained that a private company owns the land. Their initial intention was to develop the property, however, the land is not within the Urban Boundary of Caledonia so they would be unable to construct a subdivision here.
12	An attendee asked if the County is going to purchase the land?	Yes, the intention is that the County will purchase and own this parcel of land. There are opportunities for the surrounding land such as farming, which will be further refined and evaluated during the design.
13	A follow up question was asked about who will pay for this land purchase.	It was explained that new development in the area would ultimately pay for the additional infrastructure needed to support this new development. As a result, the development charges will pay the cost of the new WWTP construction as well as the land purchase.
14	Some residents wanted to know why the County approved new developments in the area before building the proposed WWTP?	A County staff member explained that the existing WWTP has not reached its full capacity, so there is room to accommodate new development, however, in order to ensure the new WWTP will be built at the right time to be funded by developers the County must plan for it in advance. It was noted that the proposed WWTP is planned to be phased to match expected growth in the area to ensure the cost of this new infrastructure does not fall on the current tax base.
15	Based on the presentation, an attendee asked why the option to pump sewage to the Nanticoke WWTP was not further considered if it posed less impact to the community?	It was explained (referencing the costing page) that the Nanticoke option is cost prohibitive due to the length of pipeline needed to utilize this option. It was also noted that it is uncertain whether the Nanticoke WWTP will be realized, as its construction is dependent on the approval of a new community in Nanticoke.
16	There was some interest from attendants on knowing	It was explained that the actual plant has not been designed yet. The Public Open House No.1 is only

Comment No.	Comment	Follow up Required/Action
	the size of the proposed WWTP.	part of the beginning stages of the study. The purpose of this meeting was to explain that the recommended option for supplying additional wastewater capacity to the area is to construct a new WWTP, and the parcel of land at 4300 River Road is the recommended location for the new WTTP. The County demonstrated during the Public Open House to the attendees the proposed location and approximate footprint of the plant based on a conventional/typical WWTP configuration.
17	One resident questioned why they can't sever a lot on their property because the land is designated farmland, yet the County can build a WWTP on this farmland.	County staff encouraged the attendee to submit the comment to obtain a more accurate response from a County's planner. A planner from the County was not in attendance at the Public Open House.
18	A citizen expressed their concerns about the change in demographics due to new developments (high density rentals) and the new plant's capacity to accommodate these extra flows.	It was explained that the proposed new WWTP capacity will be designed to accommodate the future development flows based on population estimates provided from the planning department and best available information.

16.2.2 Public Open House No. 2

The second Public Open House for the Caledonia Wastewater Treatment Plant (WWTP) Schedule C Class EA was in the Remax Room at the Caledonia Arena on November 19, 2024, from 4:00 p.m. to 6:00 p.m. The purpose of the open house was to provide an update on the planning process for the new WWTP and solicit feedback on the recommended design concepts for the preferred solution.

A Notice of Public Open House was prepared by the consulting team and distributed prior to the Public Open House. A copy of the Public Open House Notice is provided in Appendix N. The Notice was issued via the following means:

- Placed on the County's website the week of November 1, 2024.
- Mailed and e-mailed to review agencies, developers, Indigenous communities, and other stakeholders the week of November 1, 2024.
- Placed in two (2) issues of the local newspaper (Haldimand Press) starting the week of November 1, 2024.
- Circulated to members of the Haldimand County Council the week of November 1, 2024.
- Notices were also hand delivered and/or mailed by County staff to adjacent properties and those located up to 1 km downstream on both sides of the Grand River.

During the Public Open House, boards presenting the project information were on display (refer to Appendix N). Representatives from the consulting team and County staff were available to

answer questions through the duration of the Public Open House. The Public Open House was attended by 20 members of the public and/or developers in addition to Haldimand County staff, Mayor and area Councillor. Table 40 includes a summary of the comments received during Public Open House 2.

Table 40 Comments Received During Public Open House 2

Comment No.	Comment	Follow up Required/Action
1	Some attendees expressed concerns regarding the location of the new driveway for the WWTP, and if it will be in close proximity to their driveways.	The location of the driveway is conceptual at this stage and depends on the results of the archaeology studies that are ongoing and future plant design. It was explained that options are being considered to move the driveway to a more optimal location, and that buffer limits for driveways will be considered during design.
2	Several attendees expressed concerns about odour and noise control for the new plant. Specifically, concerns were raised about the odour of the plant and the biosolids removal trucks, as well as concerns regarding the noise of pumps and blowers at the plant. One attendee noted that their property is extremely quite as it is rural with nothing around, so even a pump would be a noticeable difference compared to existing conditions. Another attendee who lives close to the existing WWTP noted that they find it to be extremely quiet.	The new WWTP is designed with high-level technology that should mitigate odours to a higher level than the existing plant. It was noted that the buffer zone and ongoing tree planting along the property line should help with these issues. Additionally, it was confirmed that equipment known to cause noise and odour will be enclosed where possible.
3	An attendee asked if the new plant would require construction of renewable energy systems, such as windmills or solar panels that would be visible to nearby neighbours.	Renewable energy sources have not been considered at this stage, however they could be considered in the future to reduce the carbon footprint of the new WWTP.
4	A few attendees asked about the noise already ongoing at the site, mentioning there have been disruptions in the evening/overnight.	The site is currently being plowed by a local farmer to allow for the archaeology studies to take place, noting that this is only a temporary disturbance.

5	Several attendees raised concerns about disruption of the Grand River and noise during construction of the preferred river crossing.	The pipe will be directionally drilled underneath the river, which will cause minimal disturbances compared with crossing above the river. There will be noise during construction, which will be mitigated using industry standard mitigation measures.
6	Many attendees raised concerns about the visibility and location of the outfall. Two attendees noted that the conceptual location is in a very popular fishing spot for the community, with others worried about the aesthetic impact of the outfall pipe. The attendees mentioned that the river elevation rises and falls.	This information is very valuable and the location of the outfall is still conceptual in nature, these concerns will be considered in the final design. The project team is aware of the possibility of fluctuation in the Grand River and discharge criteria for the plant were developed based on the possibility that it may be impractical to construct a long diffuser.
7	Some attendees asked about the tree planting that is underway along the site boundary, and what kinds of species will be planted. There were suggestions for planting native and flowering species that support honeybees and other local wildlife. A close neighbour to this stie has honeybees and wishes to be consulted when tree species are being chosen.	County staff noted the comments and will consider any recommendations provided with the County's arborists, and efforts will be made to consult with the interested neighbours living close by.
8	A few attendees were confused about the project phasing and why the existing plant is not immediately closing.	A County staff member explained that the existing plant still has significant life remaining, and that closing the plant immediately would impact the funding rationale for the project.
9	One attendee asked if residents in the un-serviced area near the preferred conveyance route would be receiving wastewater servicing with the new infrastructure.	A County staff member indicated that there are currently no plans to service these lands, however this could be considered moving forward, and the conveyance route referred to would be constructed in Phase 2.
10	One attendee mentioned that his grandmother grew up on the property adjacent to the site and he is a descendant of the person buried at the property. He indicated that he	The archeologist on the site has been informed and the County will consult with them to identify what precautions can be taken to locate and avoid disturbing the potential second burial site. An existing gravesite had previously been identified

	believes there is another, unmarked gravesite on the property, in addition to the already identified gravesite. The location of the second grave is thought to be near the existing, but this is uncertain.	and staked by the County, and the archaeology company has a 10m buffer surrounding the site to avoid any disturbance during field investigations. Bereavement Authority of Ontario was notified of the grave on site and the County will continue consultation with them regarding this new information.
11	There were concerns regarding funding for the new plant and how the development charges work. One attendee was concerned that funding might run out and the project won't get completed.	A County staff member explained that the first phase of the new plant is required for growth in Caledonia and therefore is being funded by Development Charges, which are collected from new developments within the County. The staff member further explained that the County has done a thorough review of their anticipated budget through the Development Charges background study, and the project has been approved, ensuring sufficient funds have been allocated to ensure completion with no impact to the existing ratepayers for the initial phase.
12	Some attendees expressed concerns about how the County will address concerns from Indigenous groups.	It was mentioned that the project team has already commenced consultation with Mississaugas of the Credit First Nation, Six Nations and Haudenosaunee Development Institute, and all three of these groups are attending the current archaeology investigations. It was noted that the County and their consultant will continue to consult with them and welcome any input they may have on this project.
13	An attendee whose residence is in proximity to the proposed site was concerned about the water quality of their well and asked if it would be affected by the proposed WWTP. Specifically, there were concerns regarding overflows and bypasses with the new technology, and if that would impact their groundwater quality.	A County staff member indicated that the effluent to the Grand River would be treated to more strict limits than the existing plant, and that the construction of the new plant should help mitigate overflows and bypasses due to increased capacity and a more advanced design. Additionally, it was noted that overflows can occur at sewage pump stations, but that the infrastructure is being designed to consider long-term storm scenarios that might be caused by increased precipitation. The staff member noted that a geotechnical investigation will be required to ensure the design and operation of the new WWTP does not

		impact the water quality of nearby well systems.
14	Many attendees raised concerns about increased noise and traffic during construction and the frequency expected.	A County staff member indicated that construction will take place only during the day, and that the County will work with the Contractors to develop a construction schedule to mitigate traffic impacts on River Road.
15	Several concerns were raised about the existing condition of River Road and whether it is sufficient to handle the increased truck traffic during construction.	A County staff member indicated that these considerations are ongoing and that if the condition of the road deteriorates, it will be fully restored following construction.
16	A few attendees asked if the selected site will continue to be used for agriculture prior to or following construction of the new plant. An attendee asked if the area that was recently plowed would be maintained so weeds do not take over.	A County staff member explained that there is an opportunity to continue agricultural activity but that it would be dependent on the final footprint and layout of the plant. A County staff member confirmed that the site would be maintained appropriately.
17	An attendee raised concerns regarding the website for the project, indicating the link is broken and the site was hard to find.	The concern was noted, and the website link was broken during a recent update to the County webpage and has been restored. The new website has a search function which should make it easier to find the project website.
18	An attendee expressed concern regarding the volume of water in the Grand River and if there is sufficient volume for the mixing of the effluent.	A County Staff member explained that an assimilative capacity assessment was completed and noted that methods for enhanced mixing of the effluent in the outfall are being considered as part of the design.
19	An attendee commented that they do not want the driveway relocated to be directly across from theirs, as they live on the other side of River Rd.	The location of the driveway will be determined during detailed design and will depend on archaeological findings, but the County does not anticipate locating it directly across from another entrance, as efforts will be made to minimize impacts on our neighbours when considering the driveway location.

16.3 Agency Consultation

Table 41 summarizes agency comments received to date regarding the Study. Refer to Appendix O for a copy of the written correspondence received from agencies.

Table 41 Summary of Agency Comments

Stakeholder	Comment	Action
Grand River Conservation Authority (GRCA)	November 16, 2022 – The GRCA identified that portions of the proposed study area include lands and features regulated by GRCA and noted that any development or site alteration in regulated areas would require a permit from GRCA (Ontario Regulation 150/06). The GRCA provided resource mapping to assess each option's potential impacts on natural hazards and features. The GRCA recommended consulting the Ministry of Natural Resources and Forestry (MNRF), Ministry of the Environment, Conservation and Parks (MECP), and Federal Department of Fisheries and Oceans (DFO). The GRCA requested to remain on the mailing list. December 2, 2024 – A member of the GRCA contacted JLR to request a copy of the slides from Public Open House No. 2 in response to the Notice. December 11, 2024 – GRCA provided additional comments resulting from information presented during the second Public Open House. The recommendations included: • For the forcemain between the McClung Sewage Pump Station (SPS) and the new WWTP, GRCA recommends a below-grade option to reduce risks and complexity of GRA+CA approvals. • For the conceptual outfall, GRCA recommends the detailed design process addresses potential impacts to gully formation (north of the existing dwelling) and the river slope, as well as potential erosion and ice damage at the outlet structure. • Where there is a road crossing the watercourse, GRCA recommends a crossing structure with a sufficient hydraulic opening and minimizing	A Notice of Study Commencement was emailed to MNRF, MECP and GRCA on November 9, 2022. The GRCA will remain on the mailing list. JLR added Natural Hazards and Features to the evaluation criteria under Natural and Cultural Environment. A notice of the Public Open House No.1 was emailed to the GRCA November 17, 2023. The presentation from Public Open House No.1 were forward to the GRCA on January 9, 2024 following a request from GRCA to obtain additional information. A notice of the Public Open House No. 2 was emailed to the GRCA November 1, 2024. The presentation from Public Open House No. 2 were forward to the GRCA on December 3, 2024. The comments following Public Open House No.2 will be considered moving

Stakeholder	Comment	Action
	grading to ensure no impacts to drainage. GRCA recommended generally to avoid interference with the watercourse and that proposed realignments be consistent with GRCA Policy 8.9.16. • Additionally, it was noted that other Phase 2 and 3 works may require review and approval if proposed in a GRCA regulated area.	forward during the detailed design.
Ministry of the Environment, Conservation, and Parks (MECP)	November 17, 2022 – The MECP provided a list of communities that require consultation and outlined steps that must be followed in relation to this consultation. The MECP noted that the County must address all areas of interest, including the following: • Planning and Policy • Source Water Protection • Climate Change • Air Quality, Dust and Noise • Ecosystem Protection and Restoration • Species at Risk • Surface Water • Groundwater • Excess Materials Management • Contaminated Sites • Servicing, Utilities and Facilities • Mitigation and Monitoring • Consultation • Class EA Process • Amendments to the Environmental Assessment Act (EAA) through the Covid-19 Economic Recovery Act, 2020 September 30, 2024 – The MECP provided a Tech Support Review for the Caledonia WWTP Nitrate Limits in response to the summary memorandum provided July 4, 2024. Generally, the MECP agreed with the recommendations for effluent limits, with minor modifications recommended.	These communities were consulted. Refer to Section 16.4 for a summary of consultation with HDI, MCFN, and SNGR. Areas of interest were incorporated into the Phases 1 and 2 work and will continue to be incorporated into later stages of the MCEA process. A notice of the Public Open House No.1 was emailed to the MECP November 17,2023. A Memorandum summarizing changes to the ACS considering new Proposed Effluent Criteria for Nitrate was provided to the MECP on July 4, 2024. A notice of the Public Open House No. 2 was emailed to the MECP November 1, 2024.
Ministry of Natural Resources (MNR)	December 3, 2023 – MNR provided information to guide the identification and assessment of natural features and resources as required by applicable policies and	A notice of the Public Open House No.1 was emailed to MNR November 17,2023.

Stakeholder	Comment	Action
	legislation, and recommendations for engagement with the Ministry. November 22, 2024 – MNR requested a copy of the Public Open House materials.	A notice of the Public Open House No. 2 was emailed to MNR November 1, 2024. The presentation from Public Open House No. 2 were forward to the GRCA on November 22, 2024.
Ministry of Transportation (MTO)	November 21, 2022 – The MTO requested to add three contacts to the mailing list. November 28, 2023 – The MTO requested to add a contact to the mailing list. November 6, 2024 – The HTO noted that the location of the new WWTP is located outside of MTO Permit Control Area, and as such MTO review and permits are not required. They suggested that should the WWTP require any sewer upgrades or new sewer installations within MTO's Permit Control Area, further MTO review or permits may be required.	MTO contacts added to mailing list. A notice of the Public Open House No.1 was emailed to MTO November 17,2023. MTO contact was added to the mailing list November 28, 2023. A notice of the Public Open House No. 2 was emailed to the MECP November 1, 2024.
Ministry of Citizenship and Multiculturalism (MCM)	November 28, 2022 – The MCM noted that the responsibility for administering the Ontario Heritage Act and matters related to cultural heritage transferred from the Ministry of Tourism, Culture, and Sport (MTCS) to the MCM. Archaeological Resources The MCM recommends determining if an archeological assessment will be required using the MCM's Criteria for Evaluating Archaeological Potential and Criteria for Evaluating Marine Archaeological Potential. Built Heritage Resources and Cultural Heritage Landscapes The MCM indicated that a Cultural Heritage Report should be undertaken by licensed consultants and submitted to the MCM for review and incorporated into the ESR.	A Stage 1 Archaeological Assessment and Cultural Heritage Report were completed for 4300 River Rd or 1730 Haldimand Hwy 54. Refer to Sections 4.3 and 4.4 for findings. A Stage 2 Archaeological Assessment may be completed before project implementation or during Phase 3 of the MCEA. The proponent will advise the MCM of any technical studies that were completed for this MCEA and provide them to MCM before issuing a Notice of Completion.

Stakeholder	Comment	Action
		A notice of the Public Open House No.1 was emailed to MCM November 17,2023. A notice of the Public Open House No. 2 was emailed to the MCM November 1, 2024.
Hydro One Networks Inc.	November 24, 2022 – Hydro One confirmed that high voltage transmission facilities exist in the study area. An EA will be required in the event a Hydro One expansion, replacement, or relocation is needed. They requested further consultation as the project progresses. December 10, 2024 - Hydro One further confirmed that high voltage transmission facilities exist in the study area. An EA will be required in the event a Hydro One expansion, replacement, or relocation is needed. They requested further consultation as the project progresses.	Hydro One to remain on the mailing list. A notice of the Public Open House No.1 was emailed to Hydro One November 17,2023. A notice of the Public Open House No. 2 was emailed to the MECP November 1, 2024.
Enbridge Gas	November 29, 2023 – Enbridge gas confirmed the existence of a 12” Steel High Pressure Vital gas main in the proposed new greenfield WWTP. In addition, there is also the presence of a 8” steel High Pressure Vital gas main knows as Dunnville Line. Both pipes are located within Enbridge easements (formerly Union gas). December 10, 2024 – Enbridge gas responded to the Notice of Public Open House No. 2, providing suggestions and recommendations for any required modifications that would impact Hydro one infrastructure. They requested that appropriate lead-time in the project schedule be considered to collaboratively work through potential conflicts with Hydro One.	Future consultation with Enbridge Gas will be required to evaluate existing easement crossings with gas lines.

16.4 Consultation with HDI, MCFN, and SNGR

Table 42 provides a summary of comments from the Haudenosaunee Development Institute (HDI), the Mississaugas of the Credit First Nation (MCFN), and the Six Nations of the Grand River (SNGR) regarding this MCEA. Refer to Appendix O for a copy of written correspondence received

from these groups. Refer to Appendix A for a memo detailing the impacts of the project on Treaty Rights.

Table 42 HDI, MCFN, and SNGR Comments and Consultation

Stakeholder	Comments	Actions
Haudenosaunee Development Institute (HDI)	Comments from consultation meeting held on October 19, 2022. • Desire for Haudenosaunee culture to be represented in new buildings and project information. • Desire for project to support prosperity of the Haudenosaunee people. Request to consider servicing needs of the needs of the Haudenosaunee people. • Concerns regarding the cumulative effects of development and potential impacts to traditional places for hunting and treaty rights in the study area.	Applications for consideration and engagement submitted by County to HDI on August 18, 2022. Notice of Commencement was emailed on November 9, 2022. Comments by HDI during consultation will be included in analysis. Follow up email to HDI was sent on November 23,2023, to investigate any further comments related to the Caledonia wastewater Class EA. A Project Notification letter with information about the change in study area and scope of work was emailed on Oct 4, 2024. The notice of Public Open House No.2 was forwarded to the MCFN on November 1 2024, along with an invitation to meet with Haldimand County to further discuss the advancement to the project up to date.
Mississaugas of the Credit First Nation (MCFN)	Comments from consultation meeting held on October 4, 2022. • MCFN main areas of interests include work in or around water, species at risk, archaeological studies, and environmental and ecology studies. • Proponent to circulate Stage 1 Archaeological Assessment and Ecology Studies. Comments from consultation meeting held on November 27, 2024. • Proponent to circulate summary of test pitting	Archaeological Review Agreement between MCFN and Haldimand County signed on May 31, 2022. Notice of Commencement was emailed on September 15 and November 9, 2022. JLR added Species at Risk to the evaluation criteria under Natural and Cultural Environment. The notice of Public Open House No.1 was forwarded to the MCFN on November 16 2023, along with an invitation to meet with Haldimand County to further discuss the advancement to the project up to date.

Stakeholder	Comments	Actions
	completed to date as part of the Stage 2 Archaeological Assessment, with preliminary mapping of discovered archaeological resources. • MCFN indicated the preference for avoidance of archaeological resources where possible when determining the location of the facility at the site. December 4, 2024 – MCFN sent an email requesting updates to the email distribution list due to changes in personnel.	A presentation with the content of the Public Open House No.1 was forwarded to the MCFN on December 22, 2023. A Project Notification letter with information about the change in study area and scope of work was emailed on Oct 4, 2024. The notice of Public Open House No.2 was forwarded to the MCFN on November 1 2024, along with an invitation to meet with Haldimand County to further discuss the advancement to the project up to date. A presentation with the content of the Public Open House No.2 was forwarded to the MCFN on December 10, 2024. The project mailing list was updated.
Six Nations of The Grand River (SNGR)	Comments from consultation meeting held on December 11, 2023. • The Six Nations main areas of interests include the potential impacts of the new greenfield field WWTP to the terrestrial and aquatic ecosystems. • Desire for project to support prosperity of the Six Nations people. Request to consider servicing needs of the Six Nations people. November 1, 2024 – SNGR responded the notice of Public Open House requesting a meeting, noting they were not available on the proposed dates and that they would be in touch to reschedule. They also requested updated to the project mailing list.	*Six Nations of the Grand River Elected Council Archaeological Monitoring Agreement* signed by Haldimand County on July 20, 2022. The Notice of Commencement was emailed on September 15 and November 9, 2022. A presentation with an overview of the Caledonia WWTP MCEA was circulated via email to SNGR on November 17, 2022, for comment. The notice of Public Open House No.1 was forwarded to SNGR, along with an invitation to meet with Haldimand County on November 16, 2023. The Stage 1 archeological assessment report, natural heritage report and Assimilative capacity study reports were sent to the SNGR on December 20, 2023

Stakeholder	Comments	Actions
		New contacts from the SNGR were added to the mailing list on January 3, 2024. A Project Notification letter with information about the change in study area and scope of work was emailed on Oct 4, 2024. The notice of Public Open House No.2 was forwarded to the MCFN on November 1 2024, along with an invitation to meet with Haldimand County to further discuss the advancement to the project up to date. A new contact from the SNGR was added to the mailing list and one contact was removed. The presentation from Public Open House No. 2 were forward to the SNGR on November 25, 2024.

16.5 Public and Developer Stakeholder Comments

Table 43 summarizes public and developer comments received to date regarding the Study. Refer to Table 43 for a copy of the written correspondence received from the public and developers.

Table 43 Summary of Public and Developer Stakeholder Comments

Stakeholder	Comment	Action
Developer 1 (REMAX)	November 12, 2022 – Expressed interest in project.	Filed comment.
Developer 2 (Stovel and Associates Inc.)	January 25, 2023 – Requested to be added to the mailing list and asked about the proposed serviced area.	Contact added to the mailing list. The service area includes all lands north and south of the Grand River within the urban boundary of Caledonia.
Member of the Public 1	Member of the public asked to meet with the Mayor, along with other members of the public with neighboring properties. December 28, 2023 – A meeting with the mayor along with a representative of the	On January 16, 2024, Haldimand County hand-delivered a package to the residents of the neighboring properties of the new proposed WWTP. The package delivered to the residents included a letter from Haldimand County, the

Stakeholder	Comment	Action
	County took place. The public's main concerns are regarding to groundwater quality and increased traffic at the proposed location of the New Caledonia WWTP. The members of the public expressed their high interest in receiving any further communication regarding the study	Notice of Public Open House No.1, and a copy of the slide deck presented during the Public Open House No.1 (Appendix N). On the week of February 5, 2024, Haldimand County mailed out a letter and the Notice of Public Open House No.1 to the residents located further down River Road to Snyders and additional properties along HWY 54.
Member of the Public 2	November 22, 2024 - Member of the public wasn't able to make it to Public Open House No. 2 and asked for a copy of the PIC slides. The individual then followed up November 23, 2024, noting that his property is visible on the conveyance route mapping, and asked if an offer to grant easement would be forthcoming from the County for the conveyance infrastructure and what the expected timing is for the land acquisitions.	On November 22, 2024, the County provided a copy of the Public Open House presentation, and the individual was added the to the mailing list for future correspondence. The County also explained that the recommended south conveyance route to the new WWTP would follow existing road right-of-way's and utilize easements already in place.

17.0 Limitations

This report has been prepared by J.L. Richards & Associates Limited for Haldimand County's exclusive use. Its discussions and conclusions are summary in nature and cannot properly be used, interpreted or extended to other purposes without a detailed understanding and discussions with the client as to its mandated purpose, scope and limitations. This report is based on information, drawings, data, or reports provided by the named client, its agents, and certain other suppliers or third parties, as applicable, and relies upon the accuracy and completeness of such information. Any inaccuracy or omissions in information provided, or changes to applications, designs, or materials may have a significant impact on the accuracy, reliability, findings, or conclusions of this report.

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