Municipality of Sioux Lookout

Municipal Class Environmental Assessment for Sioux Lookout Wastewater Treatment Plant

FINAL Environmental Study Report

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Z0014279

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Project no Z0014279

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Executive Summary

Introduction

The Sioux Lookout Wastewater Treatment Plant (WWTP) provides wastewater treatment for the Town of Sioux Lookout, located approximately 400 km northwest of Thunder Bay. The plant is owned by the Municipality of Sioux Lookout (the Municipality) and operated by Northern Waterworks Inc. (Operator) with a Rated Capacity of 2,840 m^3/d as per the Environmental Compliance Approval (ECA) No. 1543-BNJR67, issued July 26, 2020. The existing WWTP was originally constructed in 1992 and upgraded from chlorine to ultraviolet (UV) disinfection in 2022. Treated effluent is discharged to Pelican Lake, located south of the WWTP.

CIMA Canada Inc. (CIMA+) was retained by the Municipality and its representative Keewatin-Aski Ltd. (KAL) to complete a Schedule C Class Environmental Assessment (EA) and detailed design for the expansion of the Sioux Lookout WWTP.

This Environmental Study Report (ESR) documents the completion of Phases 1, 2, 3, and 4 of the Schedule C Class EA process and provides a description of the preferred alternative treatment concepts and technologies for the expansion of the Sioux Lookout WWTP.

Municipal Class Environmental Assessment Process

All municipal infrastructure projects in Ontario must follow the Municipal Class EA process (Municipal Engineers Association, October 2000, last amended in 2024) in order to meet the requirements of the Environmental Assessment Act. The planning and development of preferred design concepts for the Sioux Lookout WWTP expansion has been conducted as a Schedule C undertaking under the Municipal Class EA process.

Public, Indigenous Community, and Agency Consultation

Consultation is an integral component of the Class EA study process. Review agencies, indigenous communities, and the public were regularly consulted at several points in this project to solicit input and comments. A Notice of Commencement was issued, and two (2) Public Information Centres (PICs) were held on completion of Phase 2 and Phase 3 of the Class EA process, respectively.

This ESR will be placed on the public record for at least 30 calendar days for comment by the public. Notification to the public, indigenous communities, and review agencies will be through the issuance of a Notice of Completion.

Any general concerns regarding the study during the review period should be directed to the Municipality. Unresolved concerns related to Indigenous or treaty rights during the review period should be directed to the Minister of the Environment, Conservation and

Parks as a Part II Order request. Provided that no significant issues arise during the review period, which cannot be resolved in consultation with the Municipality, and that no Part II Order requests are received, the project is then approved and may proceed to implementation.

Problem/Opportunity Statement

The existing Sioux Lookout WWTP is currently operating at 82% of its Rated Capacity based on average day flow. In the next 20 years, the population serviced by the Sioux Lookout WWTP is projected to increase by 36% to a total of 6,790 persons. Additional institutional, commercial, and industrial development is expected to further increase the volume of wastewater requiring treatment at the Sioux Lookout WWTP.

Existing and anticipated hydraulic and treatment capacity constraints at the Sioux Lookout WWTP, as well as poor condition of the effluent outfall pipe into Pelican Lake, require investigation to service planned and future growth within the urban boundary, increase resiliency to treat high flows, and to consistently achieve compliance.

Study Area and Existing Conditions

The Study Area for this Class EA Study includes the existing WWTP property, an area surrounding the existing outfall pipe routing, and a section of Pelican Lake near the outfall. The extent of the Study Area is presented in Figure ES-1.

CIMA+ completed a desktop review of natural heritage features, which documented the existing environmental conditions in the Study Area and adjacent lands. Based on the background review, the candidate natural heritage features identified were:

- Habitat of Endangered and/or Threatened Species, and
- Fish Habitat / watercourses (Fish Spawning/Nursery Area).

The desktop review concluded that although potential Species at Risk may be present in the Study Area, disturbance of their preferred habitat is unlikely for the proposed WWTP expansion project.

True North Archaeological Services Inc. performed Stage 1 and Marine Desktop Archaeological Assessments for the project that found that:

- Eight (8) archaeological sites have been registered within 5 km of the Study Area, with one (1) site situated less than 1 km from the Study Area,
- No archaeological assessments have previously been completed within 50 m of the Study Area,

- 73% of the terrestrial Study Area retained archaeological potential, with the remaining 27% identified as having been previously disturbed and no longer retaining archaeological potential, and
- The potential for submerged archaeological resources.

The need for further archaeological investigations will be determined based on the proposed land and lakebed disturbance for the preferred WWTP expansion and outfall replacement alternatives.

A Cultural Heritage Screening was completed by LHC Heritage Planning & Archaeology Inc., which found that no built heritage resources or cultural heritage landscapes were identified in the Study Area. Therefore, no further heritage studies were recommended.

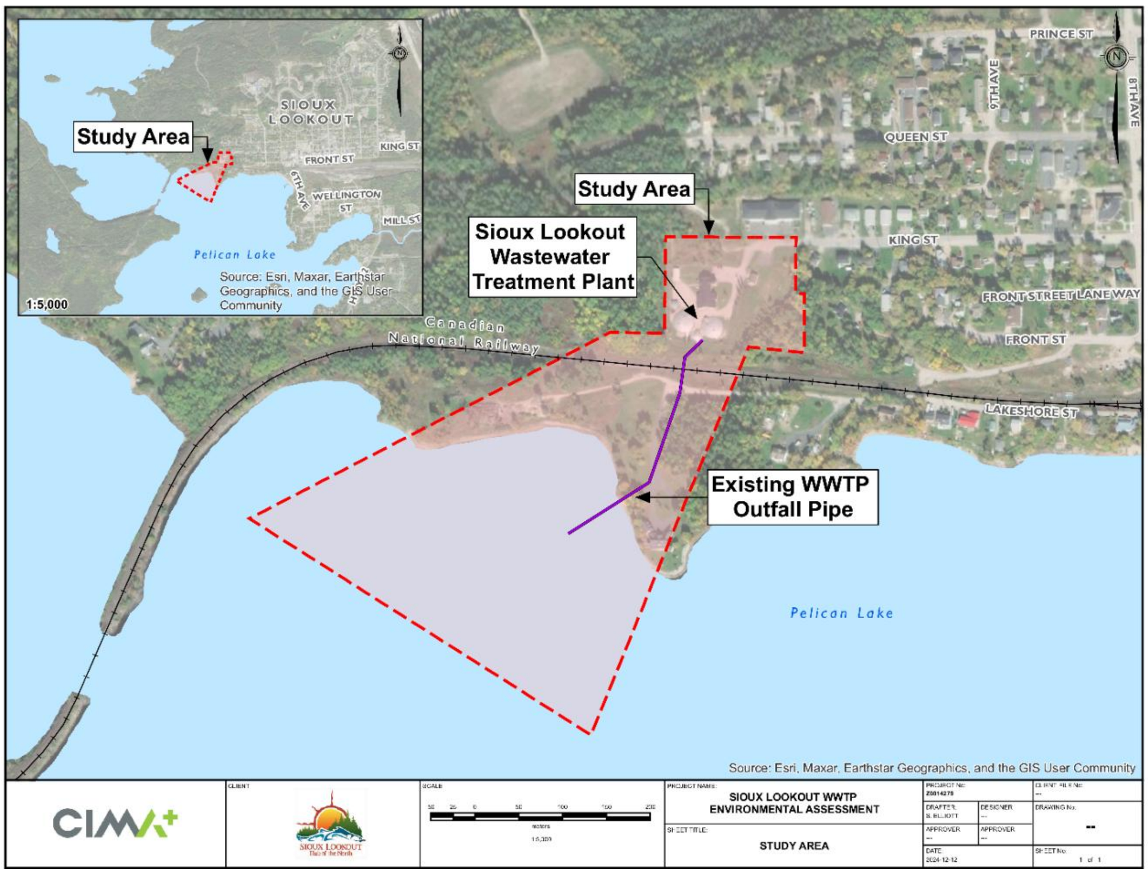

Figure ES-1: Sioux Lookout WWTP Class EA Study Area

Class EA Design Basis

Population projections were used to establish a design basis for future wastewater flows and loadings. An analysis of the population projections estimated that the population serviced by the Sioux Lookout WWTP would increase from 4,980 persons to 6,790 persons by the design year of 2046.

The estimated increase in service population of 1,810 persons was used to estimate future residential wastewater flow requiring treatment at the Sioux Lookout WWTP. A typical per capita wastewater generation rate of 350 L/cap/d and infiltration & inflow allowance of 0.025 L/s/ha were assumed for future residential contributions. Additional future wastewater flow associated with planned institutional, commercial, and industrial developments was estimated. Based on this projection, the Rated Capacity of the plant (2,840 m^3/d) will be exceeded by the end of 2035. A Rated Capacity of 3,400 m^3/d will be required to meet the projected 20-year (2046) wastewater flows to the Sioux Lookout WWTP.

Table ES-1 and Table ES-2 summarize the design basis for raw wastewater characteristics and existing vs. proposed effluent limits.

Table ES-1: Sioux Lookout WWTP Raw Wastewater Characteristic Design Basis

Parameter	Average Concentration (mg/L)	Average Loading (kg/d)	Max Month Loading (kg/d)	Max Month Loading Peaking Factor
BOD_5	116	392	545	1.4
TSS	178	601	888	1.5
TP	3.3	11	17	1.5
TKN (as N)	25	85	113	1.3
Temperature	11.4 °C	N/A	5.3 °C (min)	N/A

Table ES-2 Existing vs. Proposed Sioux Lookout WWTP Effluent Limits (HESL, 2025)

Parameter	Existing ECA Effluent Limit Concentration	Proposed ECA Effluent Limit Concentration	Existing and Proposed Effluent Limit Loading
$CBOD_5$	25 mg/L	20.9 mg/L	71 kg/d
TSS	25 mg/L	20.9 mg/L	71 kg/d
TP	1 mg/L	0.835 mg/L	2.84 kg/d
TAN	5 mg/L	4.18 mg/L	14.2 kg/d
E. coli	200 CFU/100 mL	200 CFU/100 mL	N/A
pH	6.0 – 9.5	6.0 – 9.5	N/A

Evaluation Methodology

The evaluation methodology for the Class EA consisted of the following major steps:

- Identification and Screening of the Alternative Solutions – A long list of potential alternative solutions was subjected to preliminary screening based on a set of "must-meet" criteria to shortlist feasible alternatives.
- Detailed Evaluation of Feasible Alternative Solutions – The shortlisted alternatives were evaluated against a set of detailed evaluation criteria, including technical, natural environment, socio-cultural and economic considerations.
- Selection and Recommendation of the Preferred Alternative Solution – The outcome of the detailed evaluation was the selection of the preliminary preferred solution. The preliminary preferred solutions for Phases 2 and 3 were presented to the public during the PICs and were subject to review by the public and review agencies before final recommendations were made.

Class EA Phase 2 – Identification and Evaluation of Alternative Solutions

The following long-list of alternative servicing strategies were identified:

- Alternative 1 – Do Nothing
- Alternative 2 – Limit Community Growth
- Alternative 3 – Expand the Existing WWTP
- Alternative 4a – Build a New WWTP on the Existing Site
- Alternative 4b – Build a Second WWTP on Another Site
- Alternative 5 – Send Wastewater (i.e. Export) to Other Systems for Treatment
- Alternative 6 – Decentralized Wastewater Systems for New Developments

Alternatives 3, 4a, and 4b were short-listed and carried forward into the detailed evaluation process as summarized in Table ES-3.

Table ES-3: Evaluation of Shortlisted Phase 2 Alternatives - Scoring Details

Evaluation Category	Alternative 3: Expand Existing WWTP	Alternative 4a: New WWTP on Existing Site	Alternative 4b: Second WWTP on Another Site
Social	●	◕	◔
Environment	◕	◑	◔
Technical	◕	◕	◔
Economic	◕	◑	◔
Option Ranking	**1**	2	3

The preferred alternative solution is Alternative 3, which is to expand the existing Sioux Lookout WWTP to treat a design Average Daily Flow of 3,400 m^3/d.

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

A long-list of potential alternative design concepts for the expansion of the Sioux Lookout WWTP was developed for each evaluated process area as summarized in Table ES-4.

Table ES-4: Phase 3 – Long-List of Alternatives

Process Area	Alternatives Considered
Liquid Treatment Train	• Expand existing Combined Treatment Unit (CTU) aeration zones into aerobic digesters • Third Extended Aeration CTU • New Conventional Activated Sludge Plant to supplement existing CTUs • Process Intensification using Integrated Fixed-film Activated Sludge (IFAS) • New Aerobic Granular Sludge Plant to supplement existing CTUs
Solids Treatment Train	• Lime Stabilization • Aerobic Digestion • Anaerobic Digestion • Autothermal Thermophilic Aerobic Digestion
Final Effluent Outfall	• Do Nothing • Replace and Upsize Existing Outfall • New Outfall Pipe – Parallel to Existing Outfall • New Outfall Pipe – West of Existing Outfall

The following design concepts were short-listed and carried forward into the detailed evaluation process:

- Liquid Treatment Train:
  - Third Extended Aeration CTU
  - Process Intensification using IFAS
- Solids Treatment Train
  - Aerobic Digestion

- Outfall
  - New Outfall - Parallel to Existing Outfall
  - New Outfall - West of Existing Outfall

Preferred Design Concept

Following a detailed cost-benefit analysis, the preferred design concept is shown in Figure ES-2, and includes:

- IFAS retrofit of the existing liquid treatment system,
- New aerobic digesters to be installed on the existing WWTP site, and
- A new outfall to be installed west of the existing outfall.

The benefits of the preferred design concept include:

- Limited footprint required for plant expansion with the majority of proposed infrastructure upgrades to be installed on the existing WWTP site, limiting environmental, archaeological, and cultural heritage impacts,
- Limited construction complexity with the ability to construct both the aerobic digesters and new outfall offline while existing WWTP infrastructure remains operational, and
- Flexibility to add a third CTU and size the new outfall to allow for future plant expansions, as required.

The opinion of probable cost for preferred design concept totaled $19 M (-20% to +30%, 2025 $CAD), which shall be further refined in detailed design.

A proposed implementation schedule, required permits and approvals, and potential impacts and mitigation measures for the preferred design concept were outlined.

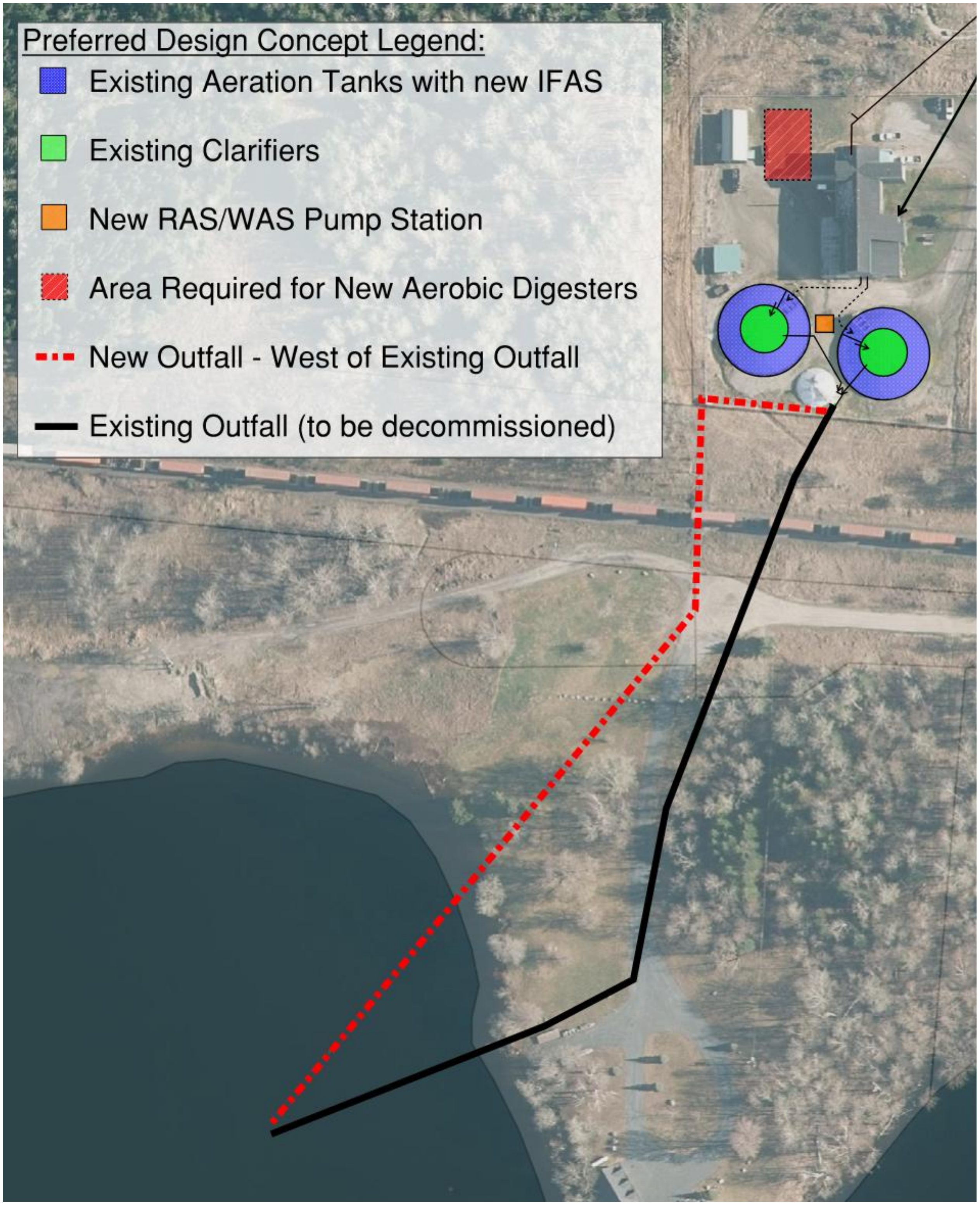

Figure ES-2: Preferred Design Concept

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List of Acronyms

ACS	Assimilative Capacity Study
ADF	Average Daily Flow
ATAD	Autothermal Thermophilic Aerobic Digestion
BOD_5	Five-day biochemical oxygen demand
cBOD	Carbonaceous biochemical oxygen demand
CCME	Canadian Council of Ministers of the Environment
CEPA	Canadian Environmental Protection Act
CN	Canadian National
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CTU	Combined Treatment Units
DFO	Fisheries and Oceans Canada
EA	Environmental Assessment
EAA	Environmental Assessment Act
ECA	Environmental Compliance Approval
ESA	Endangered Species Act
ESR	Environmental Study Report
GHG	Greenhouse Gas
I&I	Infiltration & Inflow
ICI	Institutional, Commercial, and Industrial
IFAS	Integrated Fixed-film Activated Sludge
KAL	Keewatin-Aski Ltd.
KDHS	Kenora District Housing Strategy
LCC	Life-Cycle Cost
LIO	Land Information Ontario
MBCA	Migratory Birds Convention Act
MABR	Membrane Aerated Biofilm Reactor
MBBR	Moving Bed Biofilm Reactor

MCM	Ministry of Citizenship and Multiculturalism
MECP	Ministry of the Environment, Conservation and Parks
MNR	Ministry of Natural Resources
MOB	Mobile Organic Biofilm
NPV	Net Present Value
O&M	Operation & Maintenance
OP	Official Plan
PDF	Peak Day Flow
PF	Peaking Factor
PHF	Peak Hourly Flow
PIC	Public Information Centre
PWQO	Provincial Water Quality Objectives
RAS	Return Activated Sludge
RCP	Representative Concentration Pathways
SAR	Species at Risk
SARA	Federal Species at Risk Act
SWH	Significant Wildlife Habitat
TAN	Total Ammonia Nitrogen
TKN	Total Kjedahl Nitrogen
TP	Total Phosphorous
TSS	Total Suspended Solids
UV	Ultraviolet
WAS	Waste Activated Sludge
WSER	Wastewater System Effluent Regulations
WWTP	Wastewater Treatment Plant

1. Introduction

The Sioux Lookout Wastewater Treatment Plant (WWTP) provides wastewater treatment for the Town of Sioux Lookout, located approximately 400 km northwest of Thunder Bay. The plant is owned by the Municipality of Sioux Lookout (the Municipality) and operated by Northern Waterworks Inc. (Operator) with a Rated Capacity of 2,840 m^3/d as per the Environmental Compliance Approval (ECA) No. 1543-BNJR67, issued July 26, 2020. The existing WWTP was originally constructed in 1992 and upgraded from chlorine to ultraviolet (UV) disinfection in 2022. Treated effluent is discharged to Pelican Lake, located south of the WWTP.

The Municipality is anticipating an increasing trend in wastewater generation upstream of the Sioux Lookout WWTP from projected population growth and approved developments. The Sioux Lookout WWTP has also operated at 82% of the plant's Rated Capacity based on average day flows for January 2020 through December 2024. In order to facilitate and adapt to this growth, the Municipality initiated this Schedule C Municipal Class Environmental Assessment (EA) and detailed design for the expansion of the Sioux Lookout WWTP. Through this project, the Municipality aims to review the existing WWTP, identify opportunities, and to ultimately identify the preferred solution to expand the wastewater treatment capacity to meet future wastewater demands of the Municipality.

CIMA Canada Inc. (CIMA+) was retained by the Municipality and its representative Keewatin-Aski Ltd. (KAL) to complete a Schedule C Class EA and detailed design for the expansion of the Sioux Lookout WWTP. The Class EA will determine the preferred design concepts and treatment technologies for the WWTP expansion which will provide reliable and sustainable long-term operation and performance.

1.1 Objectives of the Class EA Study

The main objectives of this Class EA Study are:

- To assess the existing status of the Sioux Lookout WWTP, identifying a problem and opportunity statement;
- To objectively evaluate alternative solutions to the problem and opportunity statement and design concepts for the expansion of the Sioux Lookout WWTP for the Municipality. The preferred design concept should be sustainable, technically, and environmentally sound and economically mindful in terms of capital and operating costs;

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

1.2 Objectives of the Environmental Study Report

This Environmental Study Report (ESR) documents the completion of Phases 1, 2, 3, and 4 of the Schedule C Class EA process and provides a description of the preferred alternative treatment concepts and technologies for the expansion of the Sioux Lookout WWTP.

The objectives of the ESR are to document the following:

- The Problem or Opportunity Statement for the Class EA,
- The evaluation methodology and criteria used to assess the different alternative solutions and design concepts,
- The development and evaluation of alternative solutions and design concepts to address the Problem or Opportunity Statement,
- The anticipated or potential impacts as well as proposed mitigation measures associated with the preferred design concept, and
- The input received from consultation with the public, indigenous communities, and agencies.

1.3 Report Outline

This report was prepared to meet the requirements of the Ontario Municipal Engineer's Association Municipal Class EA Planning Process (last amended in 2024). This report combines all phases of the planning process under one cover and includes steps that are considered essential for meeting the requirements of the Environmental Assessment Act (EAA). The report includes the following sections:

- **Section 1: Introduction** – Provides background information leading to the initiation of this study, provides the objectives for both the Class EA Study and the ESR, and describes the format of this report.
- **Section 2: Municipal Class Environmental Assessment Process** – Provides a summary description of the framework and activities to be completed to meet the Municipal Class EA process requirements.

- **Section 3: Wastewater Regulatory Framework** – Presents the Federal and Provincial legislations and policies related to the construction of the WWTP expansion.
- **Section 4: Public, Indigenous Community, and Agency Consultation Process** – Describes the consultation program with the public, indigenous communities, and agencies, and input received.
- **Section 5: Study Area and Existing Conditions** – Presents an overview of the study area, including its social and environmental characteristics, and a review of the existing WWTP unit processes.
- **Section 6: Class EA Study Design Basis** – Presents the design basis for the Class EA study.
- **Section 7: Class EA Phase 1 – Problem and Opportunity** – Presents the problem and opportunity statement for the Class EA study.
- **Section 8: Class EA Evaluation Methodology** – Presents the evaluation methodology, including evaluation criteria and scoring approach, used in this Class EA study.
- **Section 9: Class EA Phase 2 – Alternative Solutions** – Presents and evaluates the feasible alternative solutions developed to address the problem and opportunity statement.
- **Section 10: Class EA Phase 3 – Alternative Design Concepts** – Presents and evaluates the feasible alternative technologies and design concepts to further develop the preferred alternative identified in Phase 2.
- **Section 11: Climate Change Considerations** – Presents the anticipated impacts of climate change on the study area and how those impacts were considered in the decision-making process and selection of the preferred design concept.
- **Section 12: Preferred Design Concept** – Presents an overview of the preferred design concept, as determined through the previous sections, as well as a proposed implementation plan, required permits and approvals, and anticipated or potential adverse effects and mitigation measures proposed to reduce impacts.
- **Section 13: References** – Lists the key sources of information and reports that were used and consulted during the Class EA study process and in the preparation of the Class EA Report.

2. Municipal Class Environmental Assessment Process

This section describes the Class EA process and the specific requirements associated with this Study.

2.1 Environmental Assessment Act

Ontario's Environmental Assessment Act, R.S.O. 1990 (henceforth referred to as the EAA) was passed in 1975 and proclaimed in 1976. The planning of major municipal projects or activities is subject to the EAA and requires the proponent to complete an EA, including an inventory and description of the existing environment in the area affected by the proposed activity.

The EAA defines the environment broadly as:

- Air, land, or water,
- Plant and animal life, including human life,
- The social, economic, and cultural conditions that influence the life of humans or a community,
- Any building, structure, machine or other device or thing made by humans,
- Any solid, liquid, gas, odour, heat, sound, vibration, or radiation resulting directly or indirectly from human activities, or
- Any part or combination of the foregoing and the interrelationships between any two or more of them, in or of Ontario;

The purpose of the EA is the betterment of the people in the whole or any part of Ontario by providing for the protection, conservation, and wise management of the environment in the province in question.

As set out in the EAA, an EA document must include the following:

1) A description of the purpose of the undertaking including:
    a) The undertaking,
    b) The alternative methods of carrying out the undertaking, and
    c) Alternatives to the undertaking.
2) A description of:
    a) The environment that would be affected or that might reasonably be expected to be affected, directly or indirectly, by the undertaking or alternatives to the undertaking,
    b) The effects that would be caused or that might reasonably be expected to be caused to the environment by the undertaking or alternatives to the undertaking, and

   c) The actions necessary or that may reasonably be expected to be necessary to prevent, change, mitigate or remedy the effects upon or the effects that might reasonably be expected upon the environment by the undertaking or alternatives to the undertaking.
3) An evaluation of the advantages and disadvantages to the environment of the undertaking, the alternative methods of carrying out the undertaking and the alternatives to the undertaking, and
4) A description of any consultation about the undertaking by the proponent and the results of the consultation.

The Municipal Engineers Association developed and regularly updates the Municipal Class EA planning document, which sets a framework for a systemic, rational, and replicable environment planning process that is based on the following five key principles, as mentioned in Section A1 of the document:

1) **Consultation with affected parties (technical agencies, the public, property owners, interest groups, other municipalities, and Indigenous Communities) –** Proponents should seek to involve potentially affected parties as early as possible. In fact, early consultation allows for improved understanding of environmental concerns.
2) **Consideration of a reasonable range of alternatives –** Alternatives should include functionally different situations to the proposed undertaking and alternative methods of implementing the preferred solution. The "Do Nothing" alternative must be considered.
3) **Identification and consideration of the effects of each alternative on all aspects of the environment –** This includes the natural, social, cultural, technical, and economic environments. The level of detail will vary depending on the stage of the study.
4) **Systematic evaluation of alternatives –** The planning process must include distinct points where the alternatives are evaluated, and the net environmental effects are identified.
5) **Clear and complete documentation –** Should set out the approach and allow traceability of decision-making with respect to the project. The planning process must be documented in such a way that it may be repeated with similar results.

2.2 Municipal Class Environmental Assessment

The Municipal Class EA process was approved by the Minister of the Environment in 1987 to satisfy the requirements of the EAA for municipal projects having predictable and preventable impacts. The Class EA approach streamlines the planning and approvals process for municipal projects which have the following characteristics:

- Are recurring,
- Are similar in nature,
- Are limited in scale,
- Have a predictable range of environmental impacts, and
- Involve environmental impacts that can be mitigated.

The Sioux Lookout WWTP Class EA Study has been undertaken in accordance with the requirements of the Ontario Municipal Class Environmental Assessment (October 2000, last amended in 2024). The Class EA is an approved decision-making and planning process to ensure that potential effects of a project are identified and managed prior to implementation. It applies to public sector projects that have predictable and manageable environmental effects, including municipal water and wastewater projects.

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

- **Phase 1:** Problem or Opportunity
- **Phase 2:** Alternative Solutions
- **Phase 3:** Alternative Design Concepts for the Preferred Solution
- **Phase 4:** Environmental Study Report
- **Phase 5:** Implementation

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

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

- **Exempt Projects:** Primarily includes projects that were previously classified as Schedule A and A+. These projects generally include rehabilitation, operation and maintenance, minor reconstruction, etc. The environmental effects of these projects are minimal and thus, they are exempt from the requirements of the EAA.

- **Eligible for Screening to Exempt:** These projects are those that may be eligible for exemption, however, a screening process is required to ascertain this. Project proponents may proceed with the screening process outlined in the Class EA planning document to determine their eligibility for an exemption, or they may proceed with a Schedule B or C process.
- **Schedule B:** These projects require screening of alternative solutions based on their environmental impacts. Phases 1 and 2 must be completed and are typically presented in a report with a Notice of Completion from the project proponent, followed by a 30-day public review period. If no significant impacts are identified and there are no requests for an Order by the Minister under Section 16 related to Aboriginal or Treaty rights, then a Schedule B project is approved and may proceed to Phase 5.
- **Schedule C:** These projects typically have greater potential to impact the environment and must complete the full planning and documentation process outlined in the Class EA planning document. In addition to Phases 1 and 2, Phase 3 involves the assessment of alternative solutions followed by a public consultation of the preferred design concept. Phase 4 entails the preparation of the ESR to be filed for a 30-day public review period. If no significant impacts are identified and no Section 16 Order related to Aboriginal or Treaty rights is received by the Minister, then a Schedule C project is approved and may proceed to Phase 5.

2.3 The Sioux Lookout WWTP Class Environmental Assessment Process

The planning and development of preferred design concepts for the Sioux Lookout WWTP expansion has been conducted as a Schedule C undertaking under the Municipal Class EA process. Review agencies, indigenous communities, and the public were regularly consulted at several points in this project to solicit input and comments. This document encompasses Phase 4 of the Class EA process (completion of an ESR). The ESR will be placed on the public record for at least 30 calendar days for comment by the public. Notification to the public, indigenous communities, and review agencies will be through the issuance of a Notice of Completion.

2.4 Information on Section 16(6) Order Requests

Consultation with the public, indigenous communities, and review agencies is integral to the Class EA planning process, with minimum consultation requirements established depending on the project's Class EA Schedule classification.

The Minister of the Environment, Conservation and Parks has the authority and discretion to make an Order under Section 16(6) of the EAA. A Section 16(6) Order may require that the proponent of a project going through a Class EA process:

1) Submit an application for approval of the project before they proceed (i.e. individual EA); or,
2) Meet further conditions, in addition to the conditions in the Class EA, including further study, monitoring, and consulation.

The public may request that the Minister make a Section 16(6) Order if:

1) They have outstanding concerns that a project going through a Class EA process may have a potential adverse impact on constitutionally protected Aboriginal and treaty rights; and,
2) They believe that an Order may prevent, mitigate, or remedy this impact.

Before making a Section 16(6) Order request, the public is encouraged to first try to resolve any concerns directly with the project proponent through the Class EA process. Comments and/or concerns about the proposed works related to the preferred recommended design concept or the Class EA study should be directed to the Municipality within the established 30-day review period.

The public may request a Section 16(6) Order for a project before the 30-day public comment period is complete. Additional information on how to request an Order can be found under the following link:

https://www.ontario.ca/page/class-environmental-assessments-section-16-order

Section 16(6) Order requests must be sent to the Minister of Environment, Conservation and Parks and the Director of Environmental Assessment Branch, and can be submitted by mail, email, fax, or hand delivered to:

Minister of the Environment, Conservation and Parks
Ministry of Environment, Conservation and Parks
777 Bay Street, 5th Floor
Toronto ON M7A 2J3
minister.mecp@ontario.ca;

and,

Director, Environmental Assessment Branch
Ministry of Environment, Conservation and Parks
135 St. Clair Ave. W, 1st Floor
Toronto ON, M4V 1P5
EABDirector@ontario.ca

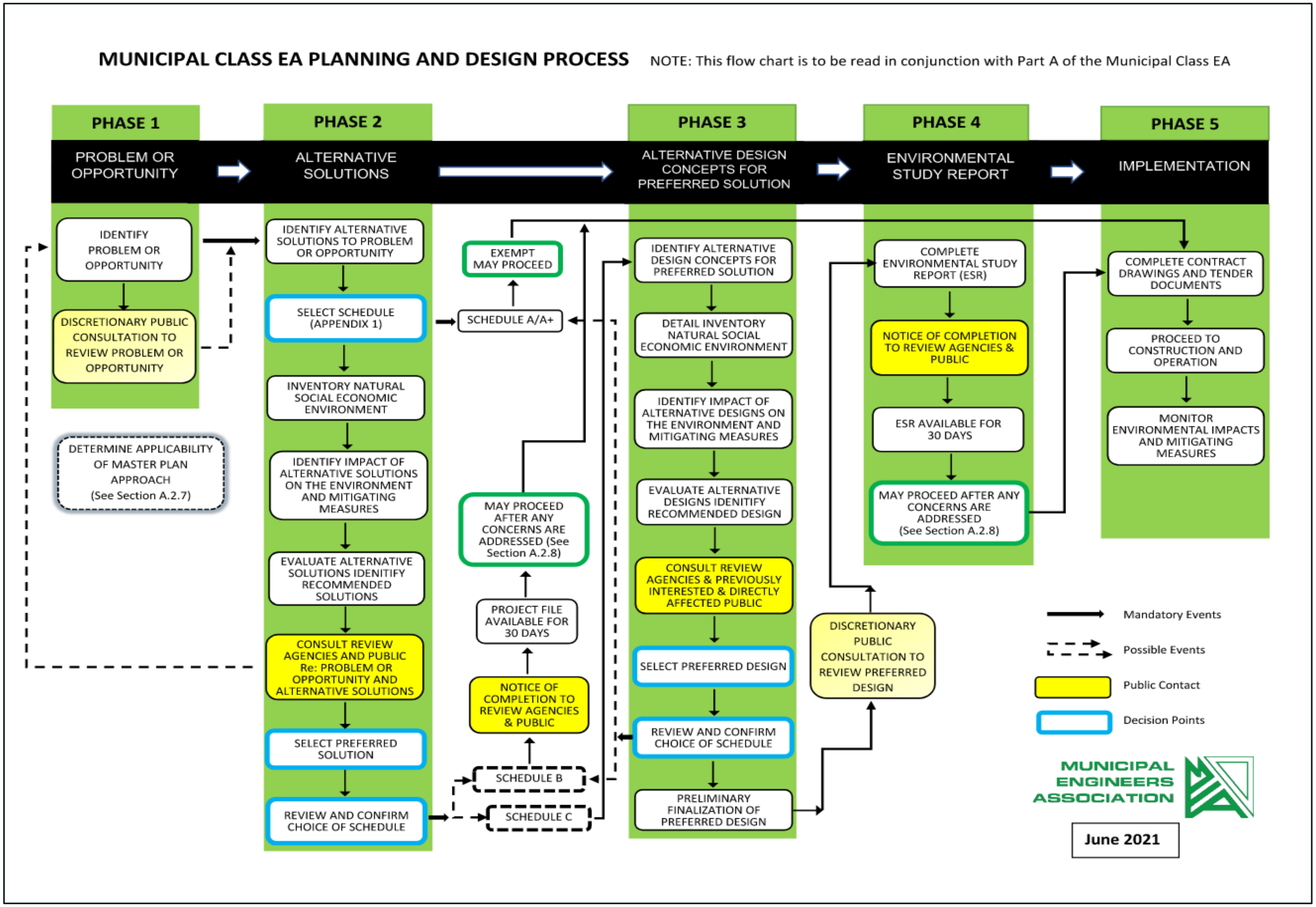

Figure 2-1: Municipal Class EA Planning and Design Process (Source: Municipal Engineers Association, 2024)

3. Wastewater Regulatory Framework

3.1 Federal Legislation and Policy

3.1.1 The Canadian Environmental Protection Act (CEPA)

The Canadian Environmental Protection Act (CEPA) was established in September of 1999 and provides the Government of Canada the power to protect the environment and human health while contributing to sustainable development. The CEPA does not directly apply to municipal wastewater treatment but helps advise and direct provincial policies. For example, it has supported stricter wastewater effluent ammonia limits for some municipal wastewater treatment facilities through its Guideline for the Release of Ammonia Dissolved in Water Found in Wastewater Effluents, released in 2004.

3.1.2 Canadian Council of Ministers of the Environment (CCME) Guidelines

The CCME was established in 1964, and is composed of environmental ministers from the federal, provincial, and territorial governments. The CCME supports evidence-based environmental policy making by researching, reporting, and developing guidelines and standards.

3.1.2.1 Canada-wide Strategy for the Management of Municipal Wastewater Effluent

The *Canada-wide Strategy for the Management of Municipal Wastewater Effluent* was developed in 2019 by the CCME. The strategy sets out a framework that addresses issues related to governance, wastewater facility performance, effluent quality and quantity and its associated risk and economic considerations in a way that provides consistency and clarity to the wastewater sector across Canada.

The Strategy requires that all facilities achieve minimum National Performance Standards and develop and manage site-specific Effluent Discharge Objectives. The Strategy also outlines risk management activities to be implemented to reduce the risks associated with combined and sanitary sewer overflows. The Strategy requires, among other elements, that overflow frequencies for sanitary sewers did not increase due to development or redevelopment. The same applies for combined sewers, unless occurring as part of an approved combined sewer overflow management plan. Neither should occur during dry weather, except during spring thaw and emergencies. Source control of pollutants is recommended and monitoring and reporting on effluent quality is required.

3.1.2.2 Wastewater Systems Effluent Regulations

The Wastewater Systems Effluent Regulations (WSER), developed under the Fisheries Act, issued in 2012 and amended in 2024, is the primary instrument that Environment Canada uses to implement the CCME Canada-wide Strategy for the Management of Municipal Wastewater Effluent. WSER governs the final discharge point of the wastewater effluent from a facility that is designed to collect an average day volume of influent of 100 m^3/d or more. The regulations outline the monthly concentration limits for the discharge of effluent to a waterbody and minimum requirements for wastewater effluent sampling. This WSER is used as a foundation for wastewater regulations set out by the province of Ontario.

3.1.3 Fisheries Act

The Fisheries Act, enacted in 1985, is a federal legislation for the protection of fish habitat from biological, physical, or chemical alterations that are harmful and/or destructive. Fisheries and Oceans Canada (DFO), in conjunction with various other agencies are responsible for the enforcement and management of fisheries resources. The following sections of the Act are relevant to this Class EA Study regarding fish and fish habitat protection and pollution prevention:

- Section 35(1): No person shall carry on any work, undertaking or activity that results in serious harm to fish that are part of a commercial, recreational, or Aboriginal fishery, or to fish that support such a fishery.
- Section 36(3): No person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish or in any place under any conditions where the deleterious substance or any other deleterious substance that results from the deposit of the deleterious substance may enter any such water.

3.1.4 Migratory Bird Convention Act

The Migratory Birds Convention Act (MBCA) was established in 1917 and amended in 1994 and more recently in 2017, to protect migratory birds, their eggs, and their nests. The MBCA was created to implement the Migratory Birds Convention between Canada and the United States.

The Act, administered by Environment Canada, lists protected families and subfamilies of migratory birds, and lays out legislation surrounding activities, such as construction, that may impact migratory birds or nests, including when and where activities may occur.

3.1.5 Species at Risk

The Species at Risk Act (SARA), established in 2002 and amended in 2024, administered by Environment Canada, focuses on restoring and maintaining populations of species that are at risk of extinction due to human activity such as habitat destruction, hunting, introduction of competing species, or other anthropogenic causes.

Species are designated at risk by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) by using biological information on a species deemed to be in danger. The COSEWIC reviews research information on population and habitat status, trends and threats and applies assessment criteria based on international standards. Once a species is part of the List of Wildlife Species at Risk, it benefits from legal protection afforded and the mandatory recovery planning required under the Act.

If a species listed is found within the study area, further effort and consultation with Environment Canada will be required to ensure that the habitat is not negatively impacted.

3.2 Provincial Legislation and Policy

All municipalities in Ontario must operate within the administrative, legislative, and financial framework established by the provincial government. The following sections summarize key provincial initiatives relevant to this Class EA Study.

3.2.1 Endangered Species Act

The Endangered Species Act (ESA) was originally written in 1971 and amended in 2024. Like the Federal SARA, the ESA aims to provide protection to animal species that are at risk of extinction or extirpation from Ontario.

Species thought to be at risk in Ontario are initially determined by the Committee on the Status of Species at Risk in Ontario, and if approved by the provincial Ministry of Natural Resources (MNR), these species are included in the provincial list of endangered and threatened species in compliance with the ESA. The ESA provides habitat protection to all species listed as threatened, endangered, or extirpated.

The ESA provides guidance on determining whether anthropogenic activities, such as construction, could impact regulated species and considers biology and behaviour of the species, details of the activity, and how the activity may affect the species’ ability to carry out its life processes.

3.2.2 Environmental Protection Act & Ontario Water Resources Act

The Environmental Protection Act, established in 1999, is the primary pollution control legislation in Ontario and is used interchangeably with the Water Resources Act described below to protect air and water quality in Ontario. The Environmental Protection Act prohibits the discharge of contaminants into the environment that are likely to cause adverse effects, by establishing limits for air emissions and wastewater effluent that must not be exceeded. ECAs are issued under this Act. ECAs sets out rules of operation of a WWTP and Water Treatment Plant such as effluent limits that are intended to protect the natural environment. This Act also controls the removal, transport, and disposal of excess soils, if they are deemed to be contaminated.

The Ontario Water Resources Act focuses on the protection of groundwater and surface water in Ontario. The Act regulates the approval, construction, and operation of wastewater treatment facilities, including ensuring that effluent discharges to receiving waters meet Provincial Water Quality Objectives (PWQOs). Permits-to-take-water from the ground or surface water sources of more than 50,000 liters of water per day are also regulated under the Water Resources Act.

3.2.2.1 Water Management – Policies, Guidelines, PWQO

To support municipalities in meeting the Environmental Protection and Ontario Water Resources Act, the Ministry of Environment, Conservation and Parks (MECP) has developed water management guidelines. The two most relevant to this Class EA study are described below:

MECP Procedure F-5-1

Procedure F-5-1 outlines treatment requirements for municipal and private sewage treatment works discharging to surface waters. Effluent requirements are established on a case-by-case basis considering the characteristics of the receiving water body. All sewage treatment works shall provide secondary treatment or equivalent as the "normal" level of treatment unless individual receiving water assessment studies indicate the need for higher levels of treatment. Existing works not complying with the guideline are required to upgrade as soon as possible.

MECP Procedure B-1-5

Procedure B-1-5 establishes receiving-water based effluent requirements for point source discharges to surface waterbodies. The procedure specifies the use of PWQO as a starting point in determining effluent criteria to be enforced within an ECA for new and expanded effluent discharges. This procedure states that by incorporating receiving water quality-based limits into enforceable control documents such as the ECA, the guidelines for water quality management become legally enforced. Violations of an effluent limit typically lead to a requirement for the discharger to undertake a study and report on the causes and impacts of the violations. Surface waters in Ontario can be subject to the requirements of five Policies depending on their water quality conditions:

- **Policy 1** applies to water bodies with quality that is better than PWQO and specifies that water quality must be maintained at or above the PWQO.
- **Policy 2** applies to water bodies with quality that does not currently meet PWQO and shall not be further degraded. Policy 2 states that “all practical measures shall be taken to upgrade the water quality to the Objectives.”
- **Policies 3 and 4** prohibit the release of banned hazardous substances and to minimize the release of no-hazardous substances, respectively.
- **Policy 5** addresses mixing zone effects; the mixing zone is defined as an area where the receiving water quality is degraded at the point of discharge and may hinder beneficial use of the water body. Policy 5 prescribes that mixing zones should be as small as possible to limit effects on beneficial use and shall not be used in lieu of reasonable and practical treatment.

4. Public, Indigenous Community, and Agency Consultation Process

Consultation is an integral component of the Class EA study process. Successful consultation programs build and maintain community trust and credibility, improve project decision-making, and identify community issues far enough in advance so that they can be effectively addressed. For the purposes of the public, indigenous community and agency consultation program, a notice of commencement was issued, and two (2) Public Information Centres (PICs) were held on completion of Phase 2 and Phase 3 of the Class EA process, respectively.

This section provides a summary of consultation activities that were undertaken at key stages of the Sioux Lookout WWTP Expansion Project Class EA. For further reference, detailed information regarding consultation can be found in **Appendix A**.

4.1 Goals and Objectives of Consultation

The objectives of consultation for this project were to:

- Inform the public, stakeholders, Indigenous Communities, and review agencies of the project,
- Offer educational information regarding the project,
- Obtain input on project components at key decision-making points, and
- Meet or exceed the consultation requirements of the Class EA process.

4.2 Audience

The audience for Sioux Lookout WWTP Class EA consultation included:

- Residents: all Sioux Lookout area residents currently serviced by the existing municipal wastewater system,
- Property owners and caretakers of properties near the existing Sioux Lookout WWTP site,
- Review agencies such as Provincial Ministries and Agencies, Federal Departments and Agencies,
- Transportation companies (ex. CN),
- Utilities (natural gas, cable, telephone, etc.),
- Indigenous Communities, including:
    - IFNA Tribal Council,

  - Anishinaabeg of Kabapikotawangag Resource Council,
  - Anishinaabeg of Naongashiing,
  - Sagkeeng Anicinabe Nation,
  - Ojibway Nation of Saugeen,
  - Kenora Chiefs Advisory Ogimaawabiitong,
  - Grand Council Treaty #3,
  - Lac Seul First Nation,
  - Slate Falls Nation,
  - Cat Lake First Nation,
  - Windigo First Nation Council,
  - Shibogama First Nations Council, and
  - Keewaytinook Okimakanak.
- Other local agencies and stakeholders.

4.3 Consultation and Communication Activities

The following outlines the specific consultation and communication activities undertaken to support the Sioux Lookout WWTP Class EA:

- **Project Contact List:** A project contact list, including individuals representing the audience noted in Section 4.2, was developed. Interested members of the public were added to the project contact list if requested and kept informed of project developments via written notifications. All individuals on the project list were contacted at the appropriate stages of the study to inform them of meetings and events.
- **Notice of Study Commencement:** A Notice of Study Commencement was developed to briefly outline the purpose and justification for the Study for distribution to the project audience. The Notice was placed on the Municipality's website and sent to all in the project contact list on July 31, 2024. The Notice was also issued in local newspapers.
- **Two Public Information Centres (PICs)**: PICs were held to obtain public input for the Class EA process. PIC#1 was held on the completion of Phase 2 and PIC#2 was held on the completion of Phase 3.
  - PIC #1 – October 10, 2024:
    - The purpose of the PIC#1 was to introduce the study problem and opportunity statement, present the alternative solutions to the problem and opportunity statement, present the results of the

Phase 2 evaluation process, and present the preliminary preferred alternative solution with potential anticipated impacts.

    - The Notice of PIC#1 was issued via email to the project contact list individuals on September 12, 2024, posted on the Municipality's website, and published twice in a local newspaper (September 26, 2024, and October 3, 2024).

  - PIC #2 – November 13, 2025:
    - The purpose of the PIC#2 was to present the alternative technologies and design concepts considered for the expansion of the Sioux Lookout WWTP, the results of the Phase 3 evaluation process, the preliminary preferred design concept, and the potential anticipated impacts and mitigation measures for the preliminary preferred design concept.
    - The Notice of PIC#2 was issued via email to the project contact list individuals on October 23, 2025, posted on the Municipality's website, and published twice in a local newspaper (October 30, 2025, and November 6, 2025).

- **Notice of Study Completion:** A Notice of Study Completion was prepared and issued via email to the project contact list individuals and posted on the Municipality's website at the commencement of the 30-day review period for the ESR.

4.4 Summary of Public Issues & Comments

At the PICs, comment sheets were distributed for attendees to provide feedback. Comments and responses that were received throughout the course of the study are summarized in the Table 4-1.

Table 4-1: Summary of Comments & Responses

Comment Description	Response Description
Comment regarding if the proposed development forecast will be realized and concern regarding the existing lack of housing in the Sioux Lookout community.	Future development projections were based on high economic growth scenario outlined in the Kenora District Housing Strategy and refined based on the development interest that the Municipality is experiencing.

Completed comment sheets from the PICs are attached in **Appendix A**.

4.5 Agency Consultation

4.5.1 Ministry of the Environment, Conservation and Parks (MECP)

At the commencement of the project, the MECP was notified directly through filing of the Notice of Commencement. In response, the MECP identified key indigenous communities for study consultation.

Two (2) pre-consultation meetings (March 26, 2025, and August 8, 2025) with the MECP have taken place throughout the course of the study to discuss the proposed scope of work, preliminary results of the Assimilative Capacity Study (ACS), and proposed effluent discharge limits. Meeting minutes can be found in **Appendix A**.

Additionally, the draft ESR was provided for MECP review via email on March 16, 2026, ahead of the 30-day review period. Comments from the MECP dated May 15, 2026, were received via email and have been provided in **Appendix A**. These comments and feedback have been incorporated into this ESR.

4.5.2 Ministry of Natural Resources (MNR)

At the commencement of the project, the MNR was notified directly through filing of the Notice of Commencement. In response, the MNR requested further information on the scope of the project, including any proposed construction on Crown lands.

One (1) pre-consultation meeting (January 21, 2025) with the MNR has taken place to discuss the study objectives and proposed outfall replacement in Pelican Lake. Meeting minutes can be found in **Appendix A**.

4.5.3 Ministry of Citizenship and Multiculturalism (MCM)

In response to the Notice of Commencement, MCM sent a letter providing guidance on incorporating cultural heritage considerations into the EA process, emphasizing the identification and mitigation of potential impacts on cultural heritage resources (**Appendix A**). The letter outlined requirements for identifying archaeological and built heritage resources, conducting cultural heritage assessments, and engaging with Indigenous communities. It also stressed the importance of community input and technical heritage studies and encouraged ongoing consultation with the Ministry throughout the EA process.

A Stage 1 Archaeological Assessment and Marine Archaeological Assessment as well as a Cultural Heritage Impact Assessment were prepared for the Sioux Lookout WWTP Expansion Project Class EA. The findings and recommendations of these assessments were incorporated in the development and evaluation of the Sioux Lookout WWTP expansion design concepts, as described in subsequent sections of this report. The reports were filed with the MCM during Phase 3 of the Class EA.

4.5.4 Canadian National (CN) Railway Company

CN was a key stakeholder for the Sioux Lookout WWTP Expansion Class EA because the existing outfall crosses under the CN tracks between the WWTP site and Pelican Lake. With the proposed outfall replacement as part of this Class EA, the project team contacted CN to inquire about the permitting and approvals process for installation of a new buried pipe below the rail tracks. CN advised the project team of the width of the CN right-of-way, offset requirements for boring pits, and requirements for CN representation onsite during construction to inform detailed design. Email correspondence with CN can be found in **Appendix A**.

4.6 Indigenous Community Consultation and Engagement

To coordinate the engagement of Indigenous Community members, a list of Indigenous Communities was developed, including communities with existing or asserted rights or claims within the study area based on similar projects in the area and the list provided by MECP after the Notice of Commencement was released. The following indigenous communities and groups have been consulted during this Class EA study to determine their interest and desired level of communication:

- IFNA Tribal Council,
- Anishinaabeg of Kabapikotawangag Resource Council,
- Anishinaabeg of Naongashiing,
- Sagkeeng Anicinabe Nation,
- Ojibway Nation of Saugeen,
- Kenora Chiefs Advisory Ogimaawabiitong,
- Grand Council Treaty #3,
- Lac Seul First Nation,
- Slate Falls Nation,
- Cat Lake First Nation,
- Windigo First Nation Council,
- Shibogama First Nations Council, and
- Keewaytinook Okimakanak.

The identified Indigenous Communities were notified about the Class EA (Notices emailed and mailed) as well as the consultation activities (e.g., PICs) proposed as part of the project. Additional project information was provided by the Project Team, when required, and follow up phone calls were made by CIMA+ to confirm receipt of the Project Notices and to solicit feedback on the project.

No comments or concerns were received from Indigenous Communities throughout the study.

4.6.1 Summary

Consultation efforts were undertaken as part of this Class EA, through methods such as email notifications of all Project Notices, and invitations to all Public Information Centres. Efforts were also made to contact First Nation groups via phone calls to inform them of Notices and Public Information Centres and to source inputs and feedback.

Throughout the course of the project, although replies acknowledging consultation effort were received from Indigenous communities, the project team has not received any comments and/or concerns from such consultations, and can conclude that the project considers Indigenous communities do not have any concerns, and as such, are satisfied with the outcome of the study.

A log documenting the consultation activities that took place with Indigenous Communities and groups as part of the Sioux Lookout WWTP Expansion Project Class EA is included in **Appendix A**. An excerpt of the log is provided below for reference, as a consultation brief for engagement with indigenous communities.

4.6.1.1 IFNA Tribal Council

- Notice of Commencement sent via email to Matthew Hoppe (CEO) on July 31, 2024
- CIMA+ called on August 14, 2024 and left a voicemail requesting confirmation of receipt of Notice of Commencement via email
- Notice of Commencement mailed on August 27, 2024
- Notice of PIC1 sent via email to Matthew Hoppe (CEO) on September 13, 2024
- Notice of PIC1 mailed on September 26, 2024
- CIMA+ called on October 2, 2024. Mr.Hoppe was unavailable. Reception provided a direct phone number, but that was not in service. Reception re-directed to Ms. Gale. She re-directed to the Thunder Bay office, and asked us to speak to the Technical Services Office in charge of water. No one answered.
- Notice of PIC2 sent via email to Matthew Hoppe (CEO) on October 23, 2025
- Notice of PIC2 mailed on November 3, 2025

4.6.1.2 Anishinaabeg of Kabapikotawangag Resource Council

- Notice of Commencement sent via email to Rhonda Nash (Director of Operations) on August 14, 2024
- CIMA+ called on August 14, 2024 and left a voicemail requesting confirmation of receipt of Notice of Commencement via email
- Notice of Commencement mailed on August 27, 2024
- Notice of PIC1 sent via email to Rhonda Nash (Director of Operations) on September 13, 2024
- Notice of PIC1 mailed on September 26, 2024
- CIMA+ called on October 2, 2024. No answer. No option to leave a message.
- Notice of PIC2 sent via email to Rhonda Nash (Director of Operations) on October 23, 2025
- Notice of PIC2 mailed on November 3, 2025

4.6.1.3 Anishinaabeg of Naongashiing

- Notice of Commencement sent via email to Kari Larson (Environmental Monitor) on July 31, 2024
- CIMA+ called on August 14, 2024 requesting confirmation of receipt of Notice of Commencement via email.
- Notice of Commencement mailed on August 27, 2024
- Notice of PIC1 sent via email to Kari Larson (Environmental Monitor) on September 13, 2024
- Notice of PIC1 mailed on September 26, 2024
- CIMA+ called on October 2, 2024. No answer. Left a message regarding PIC1 at the Reception number.
- Notice of PIC2 sent via email to Kari Larson (Environmental Monitor) on October 23, 2025
- Notice of PIC2 mailed on November 3, 2025

4.6.1.4 Sagkeeng Anicinabe Nation

- Notice of Commencement sent via email to Jason Fontaine (Director of Operations) on July 31, 2024
- CIMA+ called on August 14, 2024. Left a message with reception to ask Jason to confirm receipt of NOC via email and if he had any questions about the project. Also, confirmed mailing address.
- Notice of Commencement mailed on August 27, 2024
- Notice of PIC1 sent via email to Jason Fontaine (Director of Operations) on September 13, 2024

- Notice of PIC1 mailed on September 26, 2024
- CIMA+ called on October 2, 2024. Mr. Fontaine was in a meeting. Left a message regarding PIC1 with the receptionist.
- Notice of PIC2 sent via email to Jason Fontaine (Director of Operations) on October 23, 2025
- Notice of PIC2 mailed on November 3, 2025

4.6.1.5 Ojibway Nation of Saugeen

- CIMA+ called on August 14, 2024 to confirm mailing address.
- Notice of Commencement mailed on August 27, 2024
- Notice of PIC1 mailed on September 26, 2024
- CIMA+ called on October 2, 2024. No answer. No option to leave a message.
- Notice of PIC2 mailed on November 3, 2025

4.6.1.6 Kenora Chiefs Advisory Ogimaawabiitong

- Notice of Commencement sent via email to Front Desk on August 14, 2024
- CIMA+ called on August 14, 2024 to confirm email and mailing address.
- Notice of Commencement mailed on August 27, 2024
- Notice of PIC1 sent via email to Front Desk on September 13, 2024
- Notice of PIC1 mailed on September 26, 2024
- CIMA+ called on October 2, 2024. Reception redirected to Garry Tang, Env Health Officer. He did not answer, left a message for him regarding PIC1.
- Notice of PIC2 sent via email to Front Desk on October 23, 2025
- Notice of PIC2 mailed on November 3, 2025

4.6.1.7 Grand Council Treaty #3

- Notice of Commencement sent via email to Charity Lax (Receptionist) on August 14, 2024
- CIMA+ called on August 14, 2024 to confirm mailing address and updated email address to Charity Lax.
- Notice of Commencement mailed on August 27, 2024
- Notice of PIC1 sent via email to Charity Lax (Receptionist) on September 13, 2024
- Notice of PIC1 mailed on September 26, 2024
- CIMA+ called on October 2, 2024. Charity Lax (Receptionist) confirmed receipt of Notice of PIC1 email.
- Notice of PIC2 sent via email to Charity Lax (Receptionist) on October 23, 2025
- Notice of PIC2 mailed on November 3, 2025

4.6.1.8 Lac Seul First Nation

- Notice of Commencement sent via email to Chief Clifford Bull and Derek Bull (Public Works) on July 31, 2024
- Notice of Commencement mailed on August 27, 2024
- Notice of PIC1 sent via email to Chief Clifford Bull and Derek Bull (Public Works) on September 13, 2024
- Notice of PIC1 mailed on September 26, 2024
- CIMA+ called on October 2, 2024. Chief Clifford Bull was unavailable. Spoke to the receptionist and left a message with her about Notice of PIC and details. She provided updated mailing address.
- **CIMA+ (A.Seymour) (2024-10-03) follow up email to Chief Clifford Bull:**
  Sioux Lookout WWTP Expansion EA - Notices of Commencement and Public Information Centre
  Good Morning, Chief Clifford Bull:
  Please find attached for your information, the Notice of Study Commencement for the Schedule C Municipal Class Environmental Assessment (Class EA) Study that the Municipality of Sioux Lookout is initiating for the proposed expansion of the Sioux Lookout Wastewater Treatment Plant. The Notice is also posted on the Municipality's website (www.siouxlookout.ca).
  Also attached, please find the Notice of Public Information Centre (PIC) 1 that the Municipality of Sioux Lookout is holding for the Class EA study. You are invited to attend the upcoming PIC on Thursday October 10, 2024, where key findings of our work and preliminary study recommendations will be presented. The details of the PIC, including location and time, are included in the attached Notice.
  Hard copies of the attached Notices have been mailed to the Red Lake Office of Lac Seul First Nation. However, we spoke with your Frenchman's Head Band Office reception on the phone and will update your mailing address to PO Box 100 c/o Frenchman's Head Band Office, Hudson, ON, P0V 1X0. Please indicate if you wish to receive project notifications in digital format (via email) only moving forward.
  Kindly, let either of the project team members listed in the Notices know of any questions, comments or concerns you have in association with the Class EA or if you wish to schedule a separate meeting to review study materials and provide input.
- Notice of PIC2 sent via email to Chief Clifford Bull and Derek Bull (Public Works) on October 23, 2025
- Notice of PIC2 mailed on November 3, 2025

- CIMA+ called on November 11, 2025. Unable to reach reception or Chief Bull's extension and unable to leave a message.

4.6.1.9 Slate Falls First Nation

- Notice of Commencement sent via email to Elsie Sakakeesic (Band Manager) on July 31, 2024
- Notice of Commencement mailed on August 27, 2024
- Notice of PIC1 sent via email to Elsie Sakakeesic (Band Manager) on September 13, 2024
- Notice of PIC1 mailed on September 26, 2024
- **A.Seymour (CIMA+) (2024-09-30) email of Notice of Commencement and PIC1 to Chief Lorraine Crane:**
  Good Morning, Chief Lorraine Crane:
  Please find attached for your information, the Notice of Study Commencement for the Schedule C Municipal Class Environmental Assessment (Class EA) Study that the Municipality of Sioux Lookout is initiating for the proposed expansion of the Sioux Lookout Wastewater Treatment Plant. The Notice is also posted on the Municipality’s website (www.siouxlookout.ca). Also attached, please find the Notice of Public Information Centre (PIC) 1 that the Municipality of Sioux Lookout is holding for the Class EA study. You are invited to attend the upcoming PIC on Thursday October 10, 2024, where key findings of our work and preliminary study recommendations will be presented. The details of the PIC, including location and time, are included in the attached Notice. Hard copies of the attached Notices have been mailed to Slate Falls Nation; however, our apologies, we did receive a return to sender on the Notice of Commencement envelope. We hope that future mailed correspondence will reach your Band Office, but please indicate if you wish to receive project notifications in digital format only moving forward. Kindly, let either of the project team members listed in the Notices know of any questions, comments or concerns you have in association with the Class EA or if you wish to schedule a separate meeting to review study materials and provide input.
- CIMA+ called on October 2, 2024. No answer. Could not leave a message as the inbox was full.
- Notice of PIC2 sent via email to Chief Lorraine Crane and Elsie Sakakeesic (Band Manager) on October 23, 2025
- Notice of PIC2 mailed on November 3, 2025

4.6.1.10 Cat Lake First Nation

- Notice of Commencement mailed on August 27, 2024
- Notice of PIC1 mailed on September 26, 2024
- CIMA+ called on October 2, 2024. Left a message with the Receptionist. Confirmed that the mailing address was correct. Receptionist did not know if they received the post.
- **CIMA+ (A.Seymour) (2024-10-02) email of Notice of Commencement and PIC1 to Chief Russell Wesley:**
  Sioux Lookout WWTP Expansion EA - Notices of Commencement and Public Information Centre
  Good Morning, Chief Russell Wesley:
  Please find attached for your information, the Notice of Study Commencement for the Schedule C Municipal Class Environmental Assessment (Class EA) Study that the Municipality of Sioux Lookout is initiating for the proposed expansion of the Sioux Lookout Wastewater Treatment Plant. The Notice is also posted on the Municipality's website (www.siouxlookout.ca).
  Also attached, please find the Notice of Public Information Centre (PIC) 1 that the Municipality of Sioux Lookout is holding for the Class EA study. You are invited to attend the upcoming PIC on Thursday October 10, 2024, where key findings of our work and preliminary study recommendations will be presented. The details of the PIC, including location and time, are included in the attached Notice.
  Hard copies of the attached Notices have been mailed to the Cat Lake First Nation Office (PO Box 81); however, please indicate if you wish to receive project notifications in digital format only moving forward.
  Kindly, let either of the project team members listed in the Notices know of any questions, comments or concerns you have in association with the Class EA or if you wish to schedule a separate meeting to review study materials and provide input.
- Notice of PIC2 sent via email to Chief Russell Wesley on October 23, 2025
- Notice of PIC2 mailed on November 3, 2025

4.6.1.11 Windigo First Nation Council

- Notice of Commencement mailed on August 27, 2024
- Notice of PIC1 mailed on September 26, 2024
- CIMA+ called on October 2, 2024. Frank McKay was not in. Reception transferred the call to Ms. Myrna Quedent. She noted the details of PIC1, and provided an email address for future notices.

- **CIMA+ (A.Seymour) (2024-10-02) email of Notice of Commencement and PIC1 to Frank McKay (Council Chair/CEO):**
  Sioux Lookout WWTP Expansion EA - Notices of Commencement and Public Information Centre
  Good Morning, Frank McKay:
  Please find attached for your information, the Notice of Study Commencement for the Schedule C Municipal Class Environmental Assessment (Class EA) Study that the Municipality of Sioux Lookout is initiating for the proposed expansion of the Sioux Lookout Wastewater Treatment Plant. The Notice is also posted on the Municipality's website (www.siouxlookout.ca). Also attached, please find the Notice of Public Information Centre (PIC) 1 that the Municipality of Sioux Lookout is holding for the Class EA study. You are invited to attend the upcoming PIC on Thursday October 10, 2024, where key findings of our work and preliminary study recommendations will be presented. The details of the PIC, including location and time, are included in the attached Notice.
  Hard copies of the attached Notices have been mailed to the Windigo First Nation Council Office (PO Box 299); however, please indicate if you wish to receive project notifications in digital format only moving forward.
  Kindly, let either of the project team members listed in the Notices know of any questions, comments or concerns you have in association with the Class EA or if you wish to schedule a separate meeting to review study materials and provide input.
- Notice of PIC2 sent via email to Reception on October 23, 2025
- Notice of PIC2 mailed on November 3, 2025

4.6.1.12 Shibogama First Nations Council

- Notice of Commencement mailed on August 27, 2024
- Notice of PIC1 mailed on September 26, 2024
- CIMA+ called on October 2, 2024. Informed Mr. Matthew Angees about PIC1, and he provided his email address for future notices
- **CIMA+ (A.Seymour) (2024-10-02) email of Notice of Commencement and PIC1 to Matthew Angees (Executive Director / Education Liaison Officer):**
  Sioux Lookout WWTP Expansion EA - Notices of Commencement and Public Information Centre
  Good Morning, Matthew:
  Please find attached for your information, the Notice of Study Commencement for the Schedule C Municipal Class Environmental Assessment (Class EA) Study that the Municipality of Sioux Lookout is initiating for the proposed expansion of the Sioux Lookout Wastewater Treatment Plant. The Notice is also posted on the

Municipality's website (www.siouxlookout.ca). Also attached, please find the Notice of Public Information Centre (PIC) 1 that the Municipality of Sioux Lookout is holding for the Class EA study. You are invited to attend the upcoming PIC on Thursday October 10, 2024, where key findings of our work and preliminary study recommendations will be presented. The details of the PIC, including location and time, are included in the attached Notice.
Hard copies of the attached Notices have been mailed to the Windigo First Nation Council Office (PO Box 299); however, please indicate if you wish to receive project notifications in digital format only moving forward.
Kindly, let either of the project team members listed in the Notices know of any questions, comments or concerns you have in association with the Class EA or if you wish to schedule a separate meeting to review study materials and provide input.

- Notice of PIC2 sent via email to Matthew Angees (Executive Director / Education Liaison Officer) on October 23, 2025
- Notice of PIC2 mailed on November 3, 2025

4.6.1.13 Keewaytinook Okimakanak

- Notice of Commencement mailed on August 27, 2024
- Notice of PIC1 mailed on September 26, 2024
- CIMA+ called on October 2, 2024. Spoke to Ms. Heather. She confirmed receipt of the mail by post for Notice of PIC1. She informed that they prefer mail over email, hence did not provide an email address.
- Notice of PIC2 mailed on November 3, 2025

4.7 Private Property Owner Consultation

During Phase 3 of the study, the project team consulted, via phone and email, with the owner of the private property through which the existing WWTP outfall traverses. Preliminary routings for the two shortlisted new outfall options (as discussed in Section 10.2.4) were shared with the private property owner. The private property owner indicated that his preference for the new outfall routing and easement would be through the lawn portion of his property. This feedback was incorporated into the evaluation of the new outfall routing alternatives in Section 10.3.3.

5. Study Area and Existing Conditions

5.1 Study Area Location and Site Features

The Study Area for this Class EA Study includes the existing WWTP property, an area surrounding the existing outfall pipe routing, and a section of Pelican Lake near the outfall. The Study Area includes area zoned for Open Space (OS) (existing WWTP property), Heavy Industrial (M2) (CN tracks and right-of-way), and Residential Shoreline (RS) (private property).

The extent of the Study Area is presented in Figure 5-1.

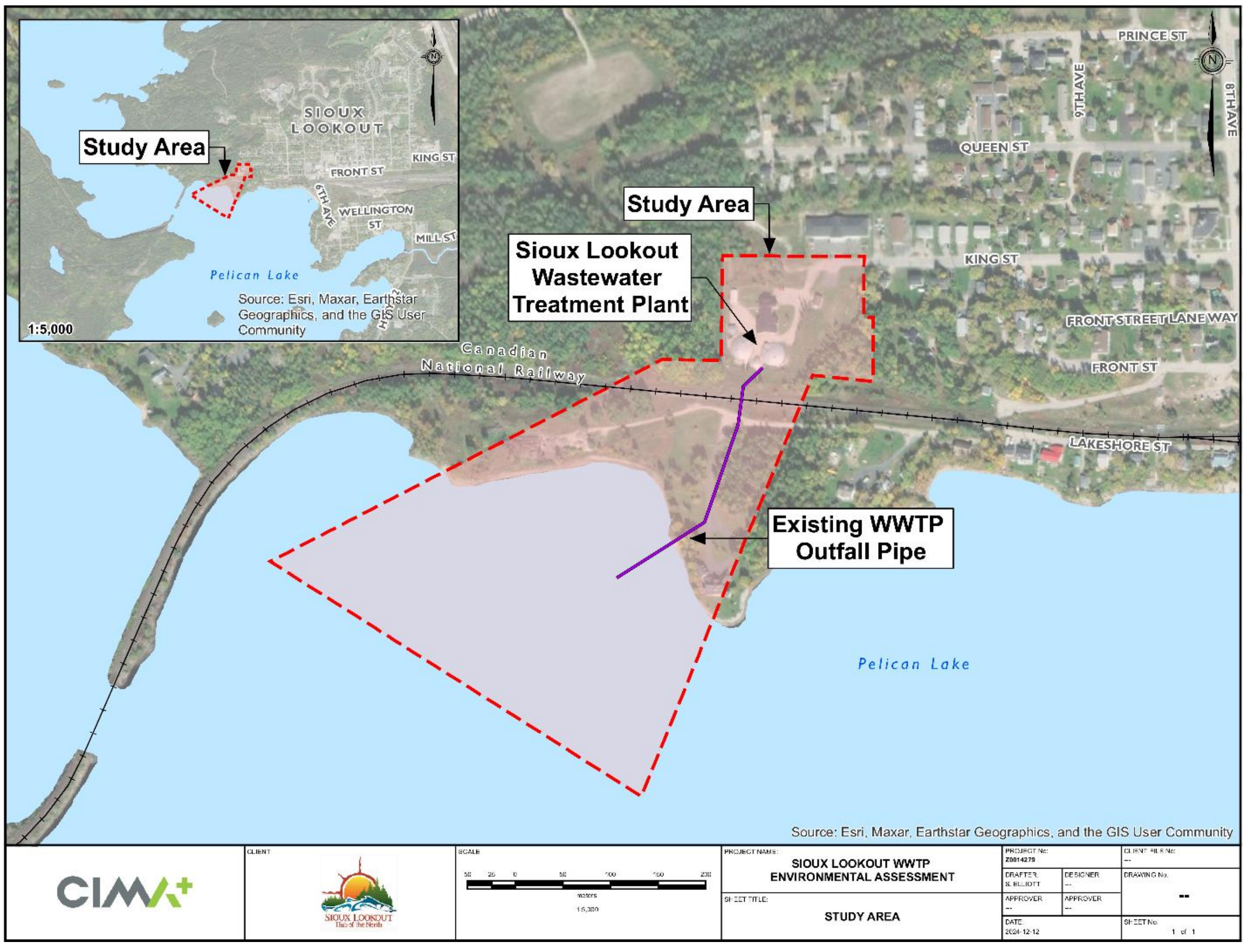

Figure 5-1: Sioux Lookout WWTP Class EA Study Area

5.2 Existing Wastewater Treatment Plant

The Sioux Lookout WWTP is located at 159 King Street, in close proximity (approximately 200 m) to the shore of Pelican Lake. The existing plant is an extended aeration plant, constructed in 1992 and upgraded in 2022 from chlorine disinfection to

UV disinfection. The plant currently operates in accordance with ECA No. 1543-BNJR67, issued July 26, 2020 with a Rated Capacity of 2,840 m^3/d and peak daily flow rate capacity of 9,230 m^3/d. The WWTP does not have the ability to bypass influent flows to mitigate washout events during periods of peak flow to the plant. An overview of the existing WWTP infrastructure is presented in Figure 5-2. A process diagram depicting the treatment train for the existing Sioux Lookout WWTP is presented in Figure 5-3.

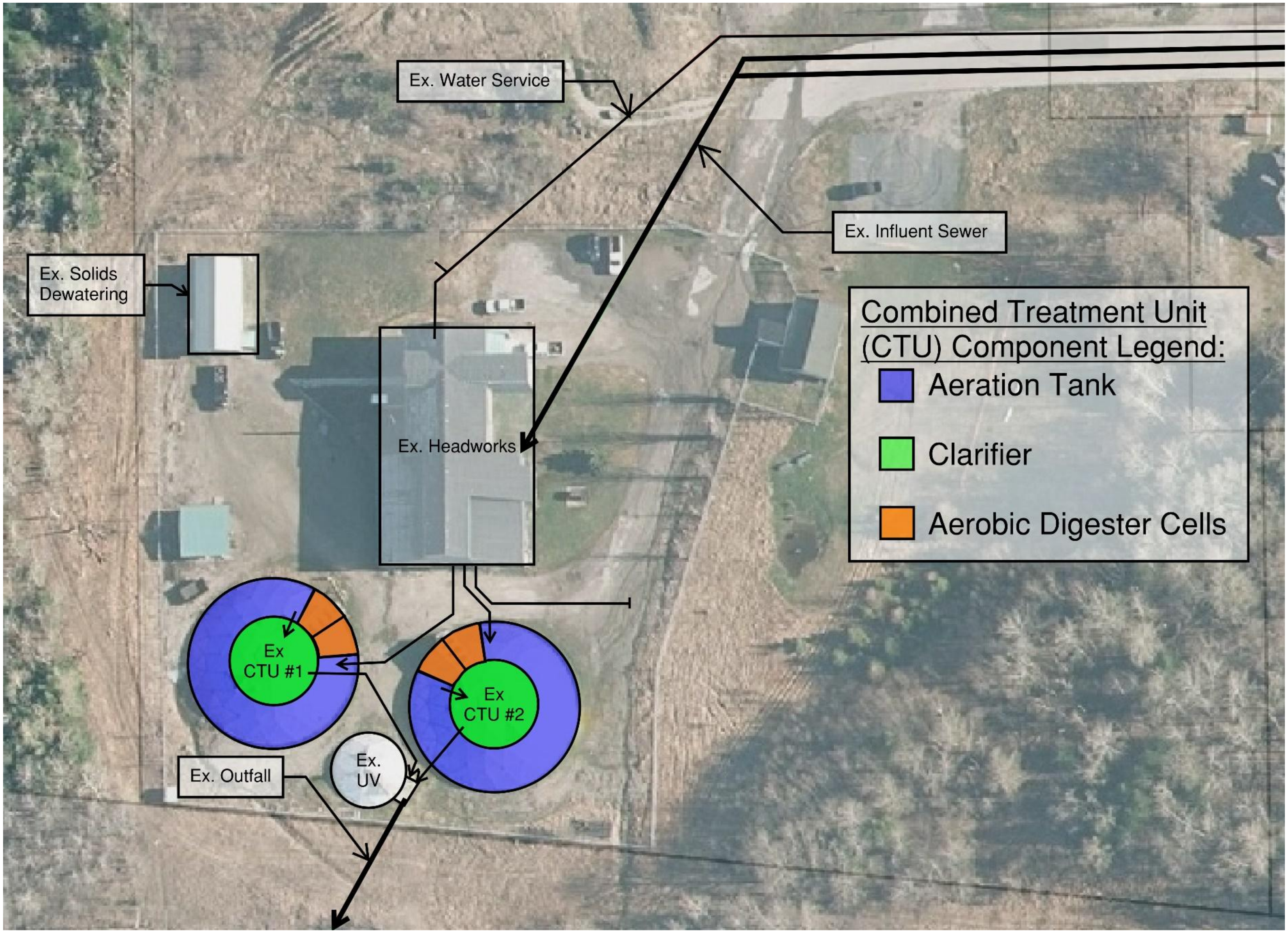

Figure 5-2: Existing Sioux Lookout WWTP Infrastructure

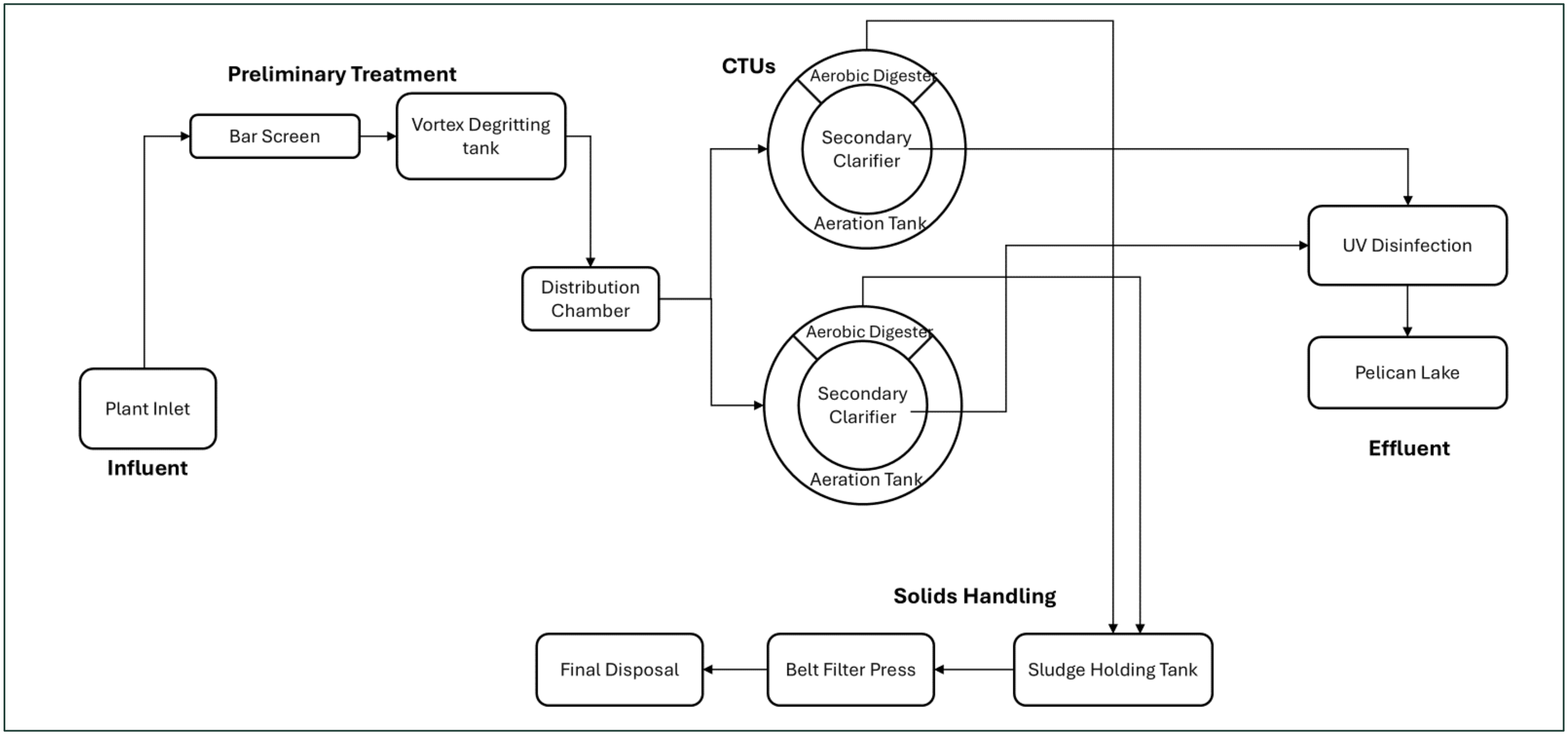

Figure 5-3: Process Flow Diagram for the Existing Sioux Lookout WWTP

The main treatment processes for the Sioux Lookout WWTP are further described in the sections below:

5.2.1 Headworks

Wastewater enters the Sioux Lookout WWTP through a 450mm diameter inlet gravity sewer. The raw influent first flows through the preliminary treatment processes, where it is screened by a 20mm mechanical bar screen and grit is removed by a vortex grit tank. A bypass channel containing a manual bar screen is available to bypass the mechanical bar screen; however, the bypass channel contains a stop gate with no passive overflow capabilities to the manual bar screen. Downstream of the degritting tank, a Parshall Flume provides influent flow measurement, after which wastewater flows to a Distribution Chamber where it is split and flows to the two (2) Concentric Secondary Combined Treatment Units (CTUs).

5.2.2 Extended Aeration Tanks and Clarifiers

Secondary treatment consists of two (2) CTUs, each containing one (1) extended aeration reactor on the outer ring and one (1) central clarifier. Both extended aeration tanks are equipped with fine bubble diffusers with air supplied by three (3) centrifugal process blowers (2 duty, 1 standby) each rated at 637 L/s at 55 kPa. The aeration tanks provide biological oxygen demand (BOD) removal and nitrification. Mixed liquor from the aeration tanks flows into the clarifier in each CTU for solids settling and removal.

5.2.3 UV Disinfection

The clarified secondary effluent flows to the disinfection system which consists of one (1) disinfection channel with two (2) UV banks. The disinfected effluent then flows through the plant outfall to Pelican Lake.

5.2.4 Outfall

Treated final WWTP effluent flows by gravity through the 300-380 mm diameter, 230 m long outfall pipe to Pelican Lake.

When the WWTP was built in 1992, portions of the original 300mm concrete outfall pipe, which extended from the original WWTP to Pelican Lake, were retained. The age of the existing 300mm concrete pipe is unknown. The existing 300mm concrete outfall pipe crosses under the CN railway with existing maintenance holes on the north and south sides of tracks within CN right-of-way.

According to the 1994 record drawings, 380mm corrugated metal pipe with three (3) 150mm diameter nozzle diffusers were installed to extend the outfall discharge location approximately 55 m into Pelican Lake.

In January 2016, CCTV video of the existing outfall pipe was reviewed by KAL and they concluded that:

- An approximately 76 m section of the original 300mm pipe between the CN railway and Pelican Lake had been replaced with PVC,
- Further repairs to the concrete pipe sections were required to address longitudinal/spiral cracking, broken pipe sections, root/sediment deposition and a displaced joint, and
- The maximum flow capacity of the outfall pipe is 100L/s.

5.2.5 Aerobic Digestion

In the CTUs, the solids removed from the secondary clarifiers are air lifted and diverted using a manual 3-way plug valve to either Return Activated Sludge (RAS) or Waste Activated Sludge (WAS). RAS is returned to the input of each CTU's aeration tank, while WAS is sent to the respective CTU's two-stage aerobic digester.

In the digesters, WAS is further stabilized with coarse bubble aeration prior to dewatering.

5.2.6 Sludge Management

The digested sludge from the aerobic digesters is pumped to the sludge storage tank prior to being dewatered using the belt filter press to reduce its water content and volume. The water removed through dewatering is returned to the plant raw influent for treatment. The dewatered sludge is hauled offsite for final disposal.

5.3 Existing Environmental Conditions

CIMA+ completed a desktop review of natural heritage features report, which documents the existing environmental conditions in the Study Area and adjacent lands. The following sections summarise the natural heritage report's existing environmental conditions findings. The full report is provided in **Appendix B**.

5.3.1 Natural Environment

The Study Area is in the Ecodistrict English River (4S-3), Ecoregion in the Ontario Shield. Land use and habitat in both the Study Area and the adjacent lands consist of a mix of natural and developed area. The potential for candidate natural features is reviewed below in Table 5-1 and available mapping is found in **Appendix B**.

Table 5-1: Assessment of Significant Natural Heritage Features

Natural Heritage Feature	Observations
Habitat of Endangered and Threatened Species (SAR)	Potential for endangered or threatened species needs to be determined following assessment of the suitable habitats in or near the Desktop Study Area. List developed of potential SAR is based on a review of the satellite imagery and background information on potential species.
Fish Habitat	Fish habitat is present in the Study Area: Pelican Lake The Municipality's Official Plan (OP) identifies fish spawning and nursery area within and adjacent to the Study Area. The area identified is consistent with the Walleye spawning area identified by the province on Land Information Ontario (LIO). MNR confirmed that Pelican Lake is not a designated Lake Trout lake, and therefore the Lake Trout Lake Policy does not apply.
Provincially Significant Wetlands	There are no wetlands, significant or otherwise, depicted in the provincial databases or identified by the Municipality's OP.
Significant Valleylands	None identified by the Municipality's OP. No potential for valleylands present in imagery. Not discussed further.
Significant Woodlands	No significant woodlands were identified in or adjacent to the Study Area.
Significant Wildlife Habitat	None identified by the Municipality's OP. OP does not require evaluation of Significant Wildlife Habitat if none have been identified on the Schedules. The MNR confirmed that they do not require significant wildlife habitat information to complete their reviews.
Environmental Protection Areas and Values	An Environmental Protection Area is present at the southwest corner of the Study Area, extending into the adjacent lands. Schedule B identifies this as Fish Spawning/Nursery Area (Walleye spawning area (LIO)).
Areas of Natural and Scientific Interest	None have been identified in the Municipality by MNR.

5.3.2 Terrestrial Environment

The Study Area was reviewed and classified using available satellite imagery and images from various site visits. In the imagery, the topography appears relatively flat, with a slight incline towards Pelican Lake. Much of the Study Area is manicured lawn or developed land. The naturally vegetated areas appear to be young communities dominated by early successional plants. Existing communities based on the desktop review are described below and in **Appendix B**.

5.3.3 Surface Water & Aquatic Environment

The Study Area lies within the Pelican Lake watershed. Pelican Lake is a large, irregularly shaped lake that flows from south to north within the English River Watershed. It is approximately 8.5 km long and 6.5 km wide and lies at an elevation of 356 metres. The lake has a maximum depth of 35 m and an average depth of around 10.5 m.

The shoreline within the Study Area includes residential developments. Review of available contours from Garmin Marine Maps database, indicates that the shoreline within the Study Area, is shallow, reaching depths of 1.5 m, within 40 to 110m, with a gentle slope for the remainder of the Study Area with a maximum depth of ±18 m.

Pelican Lake falls within the Fisheries Management Zone 4, and under the fisheries management plan, Pelican Lake is considered Specially Designated Waters. This designation applies more intensive management practices to the lake. The lake is yet to be surveyed, but with fishing guide data and commercial fishing data, MNR has concluded that Walleye, Northern Pike and Lake Whitefish are in overall good health and that all in-place management practices are sufficient.

In addition to the recent management plans from MNR, several stocking events were carried out on Pelican Lake between 1900 and 1973. During this period, Walleye were stocked 15 times, Lake Trout 8, Muskellunge twice, and both Smallmouth Bass and Northern Pike once.

Although stocking has been undertaken for Lake Trout, there are no current sources to confirm presence at the time of this desktop study. In addition, the Municipality's OP does not designate Pelican Lake as a Lake Trout Lake nor has Lake Trout been recorded on the databases. Thus, they are not listed on the list of potentially occurring fish in the background review.

5.3.4 Species at Risk Screening

Endangered and threatened SAR are protected under the provincial ESA. For this Study, the federal SARA applies only to fish and bird species with defined residences on private land. Together, both provincially and federally protected species are referred to as SAR herein. The Study Area is situated on municipal and provincial Crown land and as such, the evaluation of presence was completed following provincial guidelines.

A list of potential endangered and threatened species was compiled using various sources (see **Appendix B** for details). The resulting list includes ten (10) potential SAR:

- 4 birds (American White Pelican, Lesser Yellowlegs, Bank Swallow, and Bobolink)
- 6 mammals (Little Brown Myotis, Northern Myotis, Silver-haired Bat, Eastern Red Bat, Hoary Bat, Caribou [Boreal population])

An initial desktop review was completed to assess the likelihood of the potential SAR habitats being present in the Study Area using guidance provided by the government and available literature to determine if the above SARs are brought forward for further assessment. The desktop review concluded that although potential SAR may be present in the Study Area, disturbance of their preferred habitat is unlikely for the proposed WWTP expansion project.

5.4 Existing Social & Cultural Resources

5.4.1 Stage 1 and Marine Desktop Archaeological Assessments

True North Archaeological Services Inc. performed Stage 1 and Marine Desktop Archaeological Assessments for the project to:

- Identify known archaeological resources within and in the vicinity of the Study Area,
- Provide information on relevant previous archaeological investigations conducted in the area,
- Assess the archaeological potential of the Study Area, and
- Provide recommendations as to whether any additional archaeological investigations are required.

The Stage 1 and Marine Desktop Archaeological Assessment reports are provided in **Appendix C**. The assessments included desktop review of accessible references as well as a visual property and shoreline inspection, completed on May 19, 2025. As shown in Figure 5-4 and Figure 5-5, the archaeological assessments found that:

- Eight (8) archaeological sites have been registered within 5 km of the Study Area, with one (1) site situated less than 1 km from the Study Area,
- No archaeological assessments have previously been completed within 50 m of the Study Area,
- 73% of the terrestrial Study Area retained archaeological potential, with the remaining 27% identified as having been previously disturbed and no longer retaining archaeological potential, and
- The potential for submerged archaeological resources.

The need for further archaeological investigations will be determined based on the proposed land and lakebed disturbance for the preferred WWTP expansion and outfall replacement alternatives.

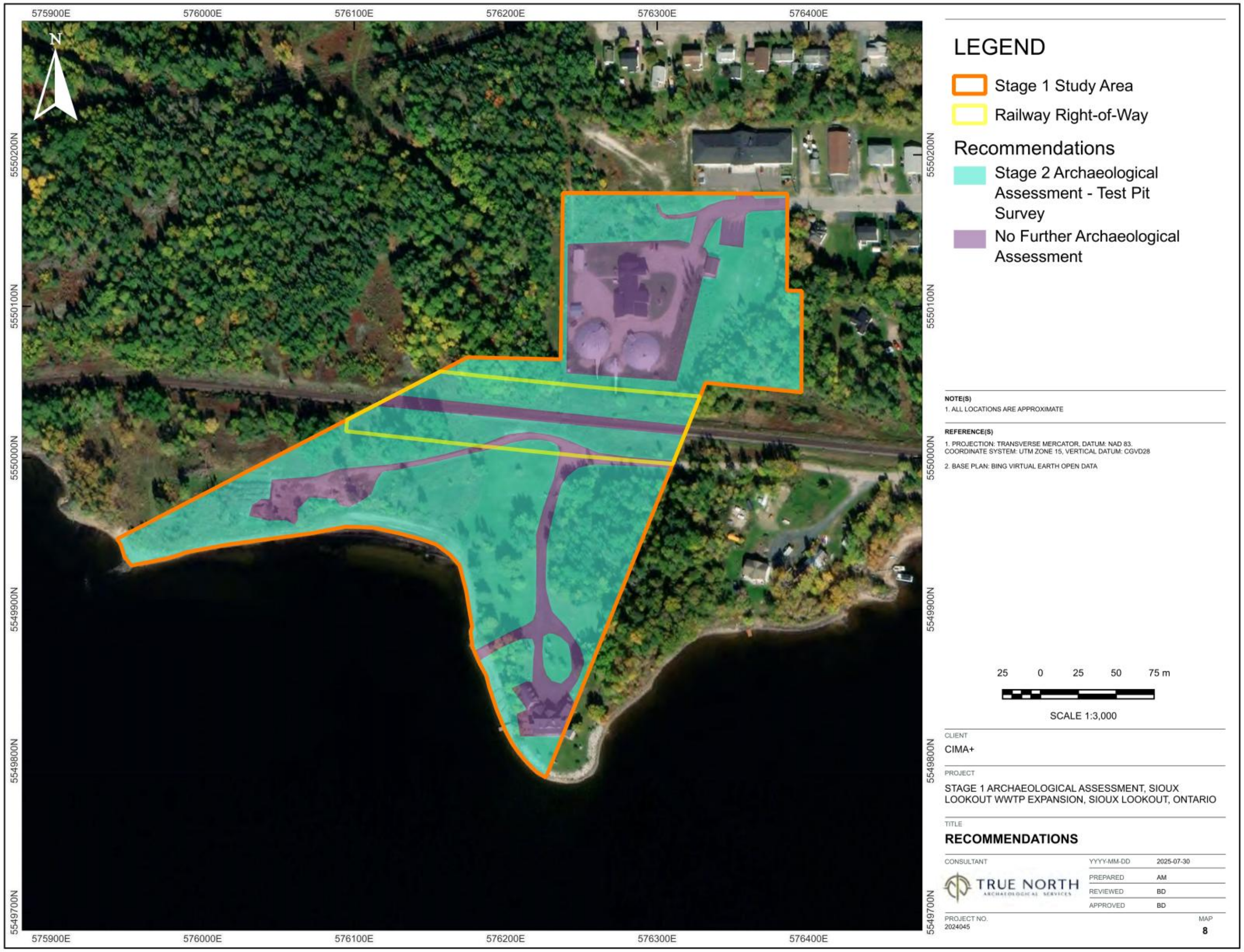

Figure 5-4: Stage 1 Archaeological Assessment Findings (True North 2025)

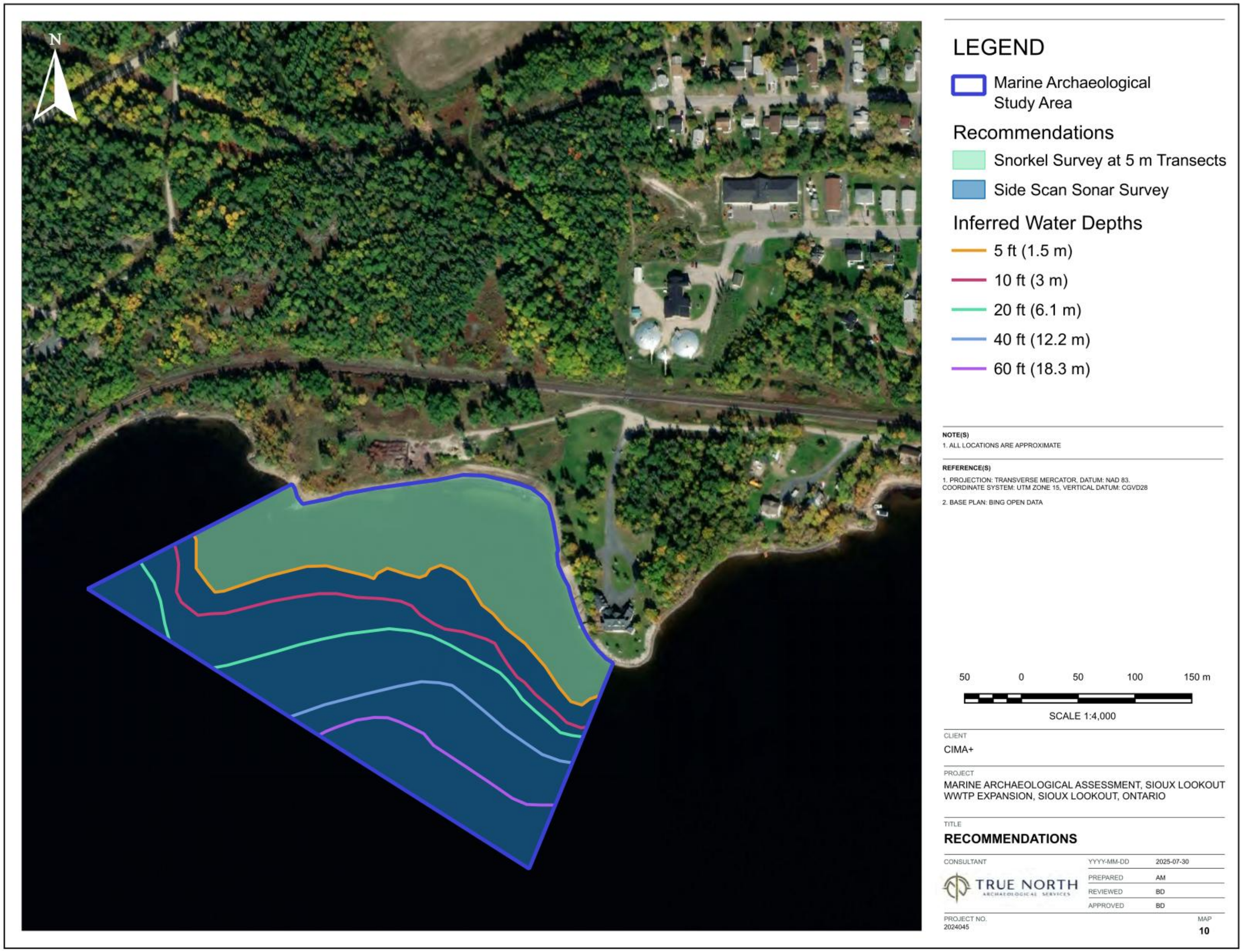

Figure 5-5: Marine Archaeological Assessment Findings (True North 2025)

5.4.2 Cultural Heritage Screening Report

A Cultural Heritage Screening was completed by LHC Heritage Planning & Archaeology Inc. to support the Class EA study. The report for the Cultural Heritage Screening is provided in **Appendix C**. No built heritage resources or cultural heritage landscapes were identified in the Study Area. Therefore, no further heritage studies were recommended.

6. Class EA Study Design Basis

6.1 Population Projections & Future Growth

Population projections were used to establish a design basis of future wastewater flows and loadings. The April 2023 Kenora District Housing Strategy (KDHS) was provided by the Municipality and was used to establish current and future populations for the Municipality of Sioux Lookout. The population projections in the KDHS were compared with census data and additional studies (including the 2021 Sioux Lookout Community Profile and the June 2020 Sioux Lookout Socio-Economic Profile) and were found to be consistent. Through discussion with the Municipality, it was confirmed that the KDHS was the most up-to-date population projection for the Study Area, and that the high economic growth scenario was to be used as the basis for this project.

Based on the population data in the KDHS and the number of accounts for sewer service connections, the current population serviced by the Sioux Lookout WWTP was estimated to be 4,980 persons. An analysis of the population projections in the KDHS estimated that the population serviced by the Sioux Lookout WWTP would be 6,790 persons in the design year of 2046. The design basis technical memorandum has been provided in **Appendix D**.

Figure 6-1 shows the projected growth in population serviced by the Sioux Lookout WWTP. The design basis technical memorandum has been provided in **Appendix D**.

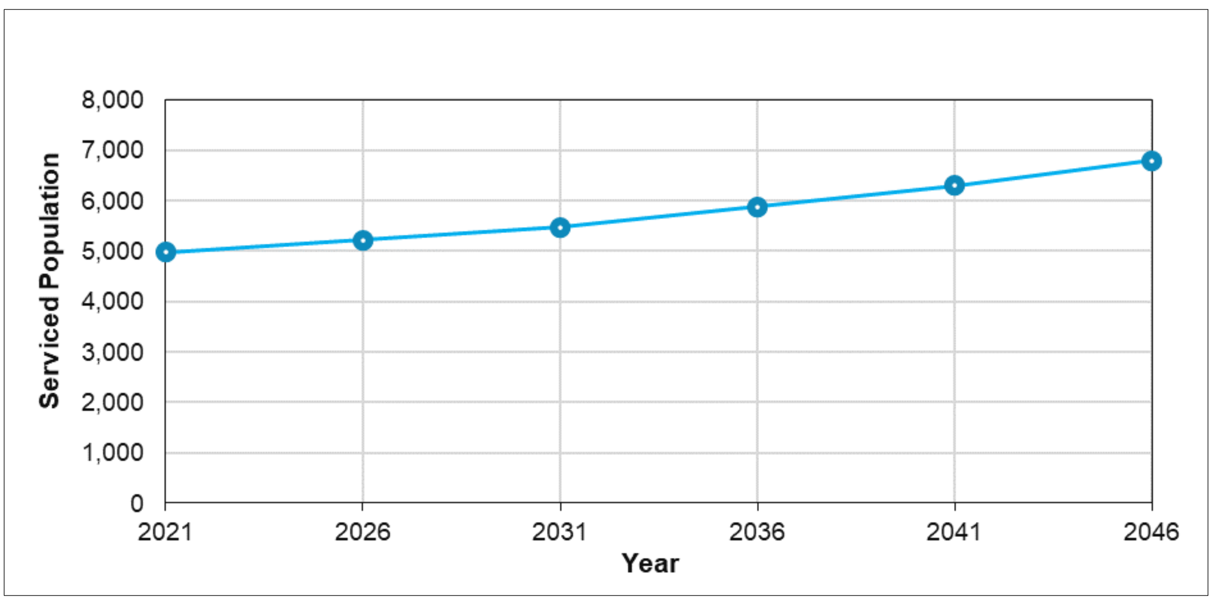

Figure 6-1: Projected Serviced Population Growth

6.2 Historical Wastewater Data Analysis

6.2.1 Historical Raw Wastewater Flows

Historical wastewater flow data from January 2020 to December 2024 were analyzed and current flows for the existing Sioux Lookout WWTP were established, as shown in Table 6-1, which also includes historical average daily flow (ADF), peak day flow (PDF), and peak hourly flow (PHF).

Table 6-1: Sioux Lookout WWTP Historical Raw Influent Flows (January 2020 – December 2024)

Parameter	Historical Value	Historical Peaking Factor (PF)	Typical Peaking Factor [1]
ADF	2,329 m^3/d	-	-
PDF	6,044 m^3/d	2.59	2.5
PHF	98.6 L/s	3.65	3.0

Table Note:

1) Typical peaking factors adapted from Metcalf & Eddy, 2014.

According to the data, the historical ADF corresponds to a per capita flowrate of 468 L/cap/d based on the current serviced population of 4,980 persons. This is greater than typical per capita wastewater flows of 420 L/cap/d (Metcalf & Eddy, 2014).

Figure 6-2 shows the historical daily influent wastewater flows (2020-2024) plotted with the Rated Capacity (2,840 m^3/d) and Peak Daily Flow Capacity (9,230 m^3/d) of the Sioux Lookout WWTP. In recent years, the plant has had several instances where it exceeded its Rated Capacity. Exceedances are seen to occur most often in the spring months (April – May), during which flows have historically remained elevated for significant periods of time. This is suspected to result from snowmelt that increases the infiltration & inflow (I&I) in the collection system, thus inducing a higher base flow to the Sioux Lookout WWTP. This effect was most pronounced in April and May of 2022, during which the plant received daily flows in excess of its Rated Capacity for a period of 56 consecutive days.

Overall, outside of the spring periods of sustained elevated flows, the Sioux Lookout WWTP has historically experienced few isolated peak flow events. The plant did not exceed its Peak Daily Flow Capacity within the timeframe analyzed but is operating at an average of 82.1% of its Rated Capacity with multiple daily exceedances occurring annually in recent years.

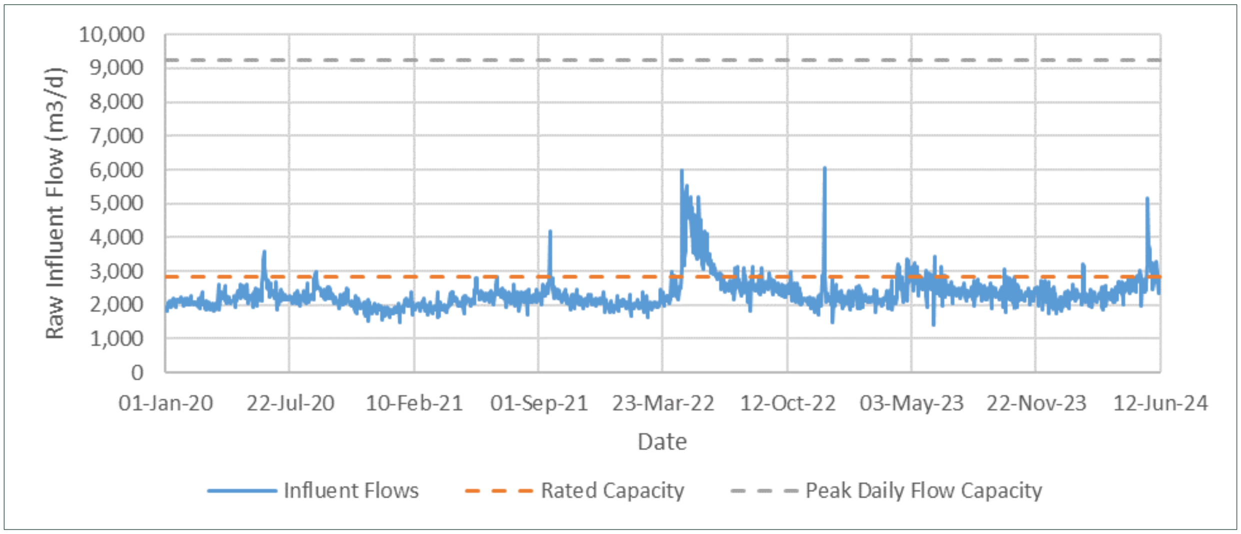

Figure 6-2: Historical Daily Raw Influent Flows (January 2020 – June 2024)

6.2.2 Historical Raw Wastewater Characteristics

Table 6-2 summarizes the historical raw wastewater (raw influent) characteristic data in terms of concentrations and loadings for five-day biochemical oxygen demand (BOD_5), total suspended solids (TSS), total phosphorus (TP), and total Kjeldahl nitrogen (TKN). The historical raw influent wastewater can be characterized as low strength with respect to BOD_5 and TP, and medium strength with respect to TSS and TKN (Metcalf & Eddy, 2014). Additionally, the average temperature of the final effluent wastewater was 11.4 °C, with a minimum temperature of 5.3 °C. The maximum month loading peaking factors were calculated after excluding outlier values.

Table 6-2: Sioux Lookout WWTP Historical Raw Wastewater Characteristics (January 2020 – June 2024)

Parameter	Average Concentration (mg/L) [1]	Average Loading (kg/d) [1]	Maximum Month Loading (kg/d) (PF) [1,2]	Estimated Per Capita Contribution (g/cap/d) [3]	Typical Per Capital Contribution (g/cap/d) [4]
BOD_5	112	256	369 (1.4)	51.4	70 – 110
TSS	190	429	664 (1.3)	86.1	60 – 115
TP	3.3	7.5	12.5 (1.8)	1.5	2 – 5
TKN (as N)	26	61	82 (1.3)	12.3	9 – 14

Table Notes:

1) Average and Maximum Month Concentrations and Loadings are based on raw wastewater data from January 2020 to June 2024.
2) Maximum Month Loadings are based on single data points per month, excluding outliers.
3) Based on historical average load divided by the current total service population of 4,980 persons.
4) Typical per capita loadings adapted from Metcalf & Eddy (2014).

6.2.3 Historical Final Effluent Characteristics

Table 6-3 summarizes the historical final effluent characteristic data in terms of concentrations and loadings discharged to Pelican Lake. Generally, the plant has historically met its ECA objectives for carbonaceous biochemical oxygen demand ($CBOD_5$), TSS, TP, Total Ammonia Nitrogen (TAN), E. coli, and pH.

Table 6-3: Sioux Lookout WWTP Historical Final Effluent Characteristics (January 2020 – June 2024)

Parameter	Average Concentration & Loading	Max Month Concentration & Loading	ECA Effluent Objective (Concentration and Loading)	ECA Effluent Limit (Concentration and Loading)
$CBOD_5$	3.37 mg/L 7.89 kg/d	19.6 mg/L 44.5 kg/d	15.0 mg/L 28.4 kg/d	25.0 mg/L 71 kg/d
TSS	8.61 mg/L 20.1 kg/d	36.9 mg/L 83.3 kg/d	15.0 mg/L 28.4 kg/d	25.0 mg/L 71 kg/d
TP	0.28 mg/L 0.65 kg/d	0.85 mg/L 1.91 kg/d	0.5 mg/L 1.42 kg/d	1.0 mg/L 2.84 kg/d
TAN	0.59 mg/L 1.43 kg/d	4.61 mg/L 13.4 kg/d	<5.0 mg/L 14.2 kg/d	5.0 mg/L 14.2 kg/d
E. coli	37 MPN/100mL	220 MPN/100mL	150 MPN/100 mL	200 MPN/100 mL
pH	6.49	5.60 *(Minimum)*	6.5 – 8.5	6.0 – 9.5

6.3 Sioux Lookout WWTP Expansion Design Basis

6.3.1 Hydraulic Design Basis

The estimated increase in service population of 1,810 persons was used to estimate future residential wastewater flow requiring treatment at the Sioux Lookout WWTP. Typical per capita wastewater generation rate of 350 L/cap/d and I&I allowance of 0.025 L/s/ha were assumed for future residential contributions. Additional future wastewater flow associated with planned ICI developments was estimated. The average per capita flow to the WWTP is projected to increase due to the influence of increased ICI development allocation. The overall wastewater flow design basis is summarized in Table 6-4.

Table 6-4: Sioux Lookout WWTP Hydraulic Design Basis

Parameter	Service Population	ADF (m^3/d)	Per Capita ADF (L/cap/d)	PDF (m^3/d) (PF)	PHF (L/s) (PF)
Existing Conditions (2020–2024)	4,980 cap.	2,332	468	6,044 (2.6)	98.6 (3.7)
Existing WWTP Rated Capacity	N/A	2,840	N/A	9,230 (3.3)	N/A
Future Residential Contributions	1,810 cap.	713	394	1,783 (2.5)	24.8 (3.0)
Future ICI Contributions	N/A	323	N/A	808 (2.5)	11.2 (3.0)
Design Basis Conditions	6,790 cap.	3,400 (1)	496	9,230 (2.7)	134.6 (3.4)

Table Note: 1) Value is rounded.

Figure 6-3 below shows the estimated ADF of the Sioux Lookout WWTP based on the future service population growth presented in Figure 6-1 and assuming a linear increase of future ICI flow contributions over the study period. Based on this projection, the Rated Capacity of the plant (2,840 m^3/d) will be exceeded by the end of 2035.

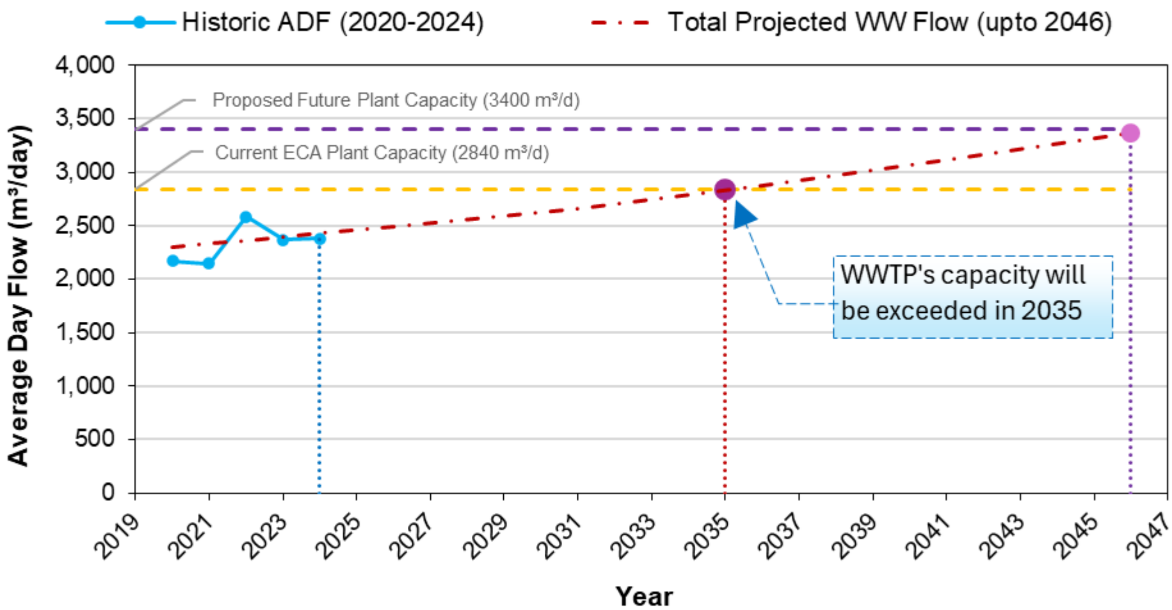

Figure 6-3: Projected Average Day Influent Wastewater Flows

6.3.2 Raw Wastewater Characteristic Design Basis

The design loadings for the Sioux Lookout WWTP were based on the historical loadings and the design service population. To be consistent with planning guidelines, the future design loadings were allocated using typical per capita loadings. Due to the unknown composition of the wastewater from future ICI developments, typical per capita loadings of 75 g BOD_5/cap/d, 95 g TSS/cap/d, 2.0 g TP/cap/d, and 13.0 g TKN-N/cap/d were applied to future flow contributions. These are slightly higher than existing, however, are within the lower to middle bound of typical per capita raw wastewater loadings, as outlined in Table 6-2.

Design maximum month loadings were calculated by applying historical loading peaking factors to future contributions. Table 6-5 summarizes the raw wastewater characteristic design basis.

Table 6-5: Sioux Lookout WWTP Raw Wastewater Characteristic Design Basis

Parameter	Average Concentration (mg/L)	Average Loading (kg/d)	Maximum Month Loading (kg/d)	Maximum Month Loading Peaking Factor
BOD_5	116	392	545	1.4
TSS	178	601	888	1.5
TP	3.3	11	17	1.5

Parameter	Average Concentration (mg/L)	Average Loading (kg/d)	Maximum Month Loading (kg/d)	Maximum Month Loading Peaking Factor
TKN (as N)	25	85	113	1.3
Temperature [1]	11.4 °C	N/A	N/A	N/A

Table Note:

1) The historical minimum final effluent temperature of 5.3 °C will also be considered in identification and evaluation of alternative treatment processes.

6.3.3 Future Effluent Criteria

Hutchinson Environmental Sciences Ltd. was retained to perform an ACS for Pelican Lake to propose future effluent limits to be implemented for the plant expansion. The proposed ECA effluent concentration limits, summarized in Table 6-6, were developed by maintaining the existing ECA's effluent loading limits.

Consultation meetings with the MECP have been held during the Class EA to review the proposed effluent limits. The ACS Report has been provided in full in **Appendix E**.

Table 6-6 Existing vs. Proposed Sioux Lookout WWTP Effluent Limits (HESL, 2025)

Parameter	Existing ECA Effluent Limit Concentration	Proposed ECA Effluent Limit Concentration	Existing and Proposed Effluent Limit Loading
$CBOD_5$	25 mg/L	20.9 mg/L	71 kg/d
TSS	25 mg/L	20.9 mg/L	71 kg/d
TP	1 mg/L	0.835 mg/L	2.84 kg/d
TAN	5 mg/L	4.18 mg/L	14.2 kg/d
E. coli	200 CFU/100 mL	200 CFU/100 mL	N/A
pH	6.0 – 9.5	6.0 – 9.5	N/A

7. Class EA Phase 1 – Problem and Opportunity

As part of the Municipal Class EA planning process, the proponent of an undertaking is required to first document factors leading to the conclusion that the improvement is needed and develop a clear statement of the problem/opportunity to be investigated.

The problem/opportunity statement for this Class EA study is defined as follows:

The existing Sioux Lookout WWTP is currently operating at 82% of its Rated Capacity based on average day flow. In the next 20 years, the population serviced by the Sioux Lookout WWTP is projected to increase by 36% to a total of 6,790 persons. Additional institutional, commercial, and industrial development is expected to further increase the volume of wastewater requiring treatment at the Sioux Lookout WWTP.

Existing and anticipated hydraulic and treatment capacity constraints at the Sioux Lookout WWTP, as well as poor condition of the effluent outfall pipe into Pelican Lake, require investigation to service planned and future growth within the urban boundary, increase resiliency to treat high flows, and to consistently achieve compliance.

The preferred solutions shall:

1) Comply with applicable regulations to provide:
    a) Safe and reliable management and treatment of wastewater, and
    b) Environmentally minimal impacts that will be identified and mitigated wherever possible.
2) Address stakeholder comments and concerns,
3) Be financially viable,
4) Be operationally sustainable,
5) Include climate change considerations, and
6) Align with the Municipality’s social and environmental objectives.

The preferred solutions will be prioritized and implemented in phases to address immediate needs, intermediate goals, and the long-term vision. Implementation of the preferred solutions will be subject to financial viability and approval of the Municipality.

7.1 Key Constraints

The key constraints associated with the Sioux Lookout WWTP were identified, as follows:

- The existing Rated Capacity of the facility (2,840 m^3/d) is expected to be exceeded by 2035 based on projected growth.

- The existing outfall is insufficiently sized for future flows and is in poor condition.
- The location of the existing WWTP is in close proximity to the CN railway tracks, with the outfall routing passing underneath. If outfall modifications or a new outfall are deemed necessary, special measures to traverse the railway path will be required.

8. Class EA Evaluation Methodology

8.1 Overview

The evaluation methodology for the Class EA Phase 2 and Phase 3 alternatives was developed based on a comprehensive and systematic approach and performed in consecutive steps. The aim for this approach was to implement decision making that is built on the foundation of being sound, defensible, traceable, and consistent with the specific objectives of the project.

8.2 Evaluation Methodology

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

1) Identification and Screening of the Alternative Solutions – This first step allowed the project team to identify a long list of all potential alternative solutions, select only those that were considered feasible, and eliminate the alternatives that were not. This first step led to the preliminary identification of shortlisted feasible alternatives and avoided the need to carry unrealistic or incompatible alternatives through the detailed evaluation step. Preliminary screening was based on a set of “must-meet” criteria.
2) Detailed Evaluation of Feasible Alternative Solutions – The shortlisted alternatives identified in the preliminary screening process (considered feasible alternative solutions) were further developed to allow for evaluation against a comprehensive set of detailed evaluation criteria, including but was not limited to, technical, natural environment, socio-cultural and economic considerations.
3) Selection and Recommendation of the Preferred Alternative Solution – The outcome of the detailed evaluation was the selection of the preliminary preferred solution. The preliminary preferred solutions for Phases 2 and 3 were presented to the public during the PICs and were subject to review by the public and review agencies before any final recommendations are made.

A general schematic of the evaluation methodology is outlined in Figure 8-1 and described in more detail in subsequent sections.

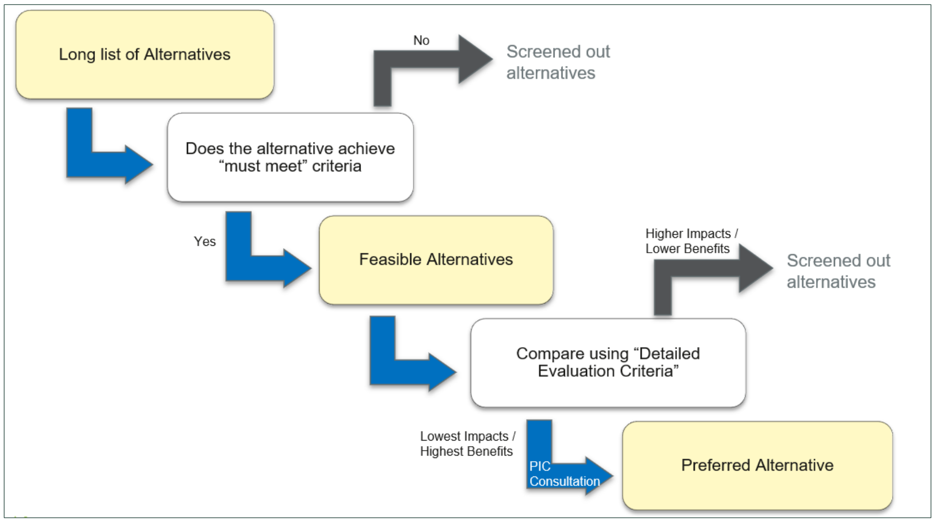

Figure 8-1: Overview of the Evaluation Approach

8.3 Preliminary Screening

As prescribed in the Municipal Class EA process, long lists of alternative wastewater servicing solutions and design concepts were developed at Phases 2 and 3 of the Class EA process, respectively. These included the Status Quo, reflecting the current conditions of the Sioux Lookout WWTP. At Phase 2, these alternatives represented broad solutions to the Problem/Opportunity Statement. At Phase 3, alternative design concepts and technologies were considered for different wastewater treatment unit processes consistent with the Problem/Opportunity Statement and the preferred Phase 2 solution.

For the preliminary screening, each long-listed alternative wastewater servicing solution and design concept was assessed against a set of preliminary screening criteria with the purpose of narrowing down the list to only those that are considered "feasible". Alternatives which did not meet the preliminary screening criteria were eliminated from further analysis. This preliminary screening step also helped to avoid the need to carry forward unrealistic or incompatible alternatives through the next steps of the evaluation process.

Preliminary screening was accomplished by applying the "must-meet" criteria, as shown in Table 8-1. Must-meet criteria were established to capture key objectives for the Sioux Lookout WWTP Expansion Project Class EA. The "must-meet" criteria were considered on a "yes/no" or "pass/fail" basis. Alternative solutions were required to pass all "must-meet" criteria to be shortlisted and carried forward through the next step in the evaluation process.

Table 8-1: Preliminary "Must-Meet" Screening Criteria

Must-Meet Criteria	Description
Compliance	• Does the alternative solution address the lack of wastewater treatment capacity due to future population growth in the Municipality, and address the constraints of the existing Sioux Lookout WWTP and outfall? • Can the alternative solution meet the anticipated treatment requirements? • Does the alternative solution support growth and development in the Municipality, in line with the Municipality's planning objectives, and does not limit growth in the Municipality?
Technical Feasibility	• Does the alternative solution maximize the use of the existing infrastructure and available land area at the existing site of the Sioux Lookout WWTP? • Is the alternative solution compatible with existing treatment processes and operational practices, such that its implementation will not significantly impact the existing operations?
Financial Feasibility	• Is the alternative solution economically mindful in terms of capital and operating costs, relative to the other alternative solutions being considered in the study?

8.4 Phase 2 Detailed Evaluation

Each Phase 2 shortlisted alternative wastewater servicing solution was further investigated and evaluated against a set of evaluation criteria. Four (4) primary evaluation categories, representing the most relevant short-term and long-term considerations for this project, were considered as listed below:

- Socio-Cultural Considerations,
- Natural Environment Considerations,
- Technical Considerations, and
- Economic Considerations.

8.4.1 Overall Scoring Approach

A scoring approach was developed to assist in measuring the ability of each Phase 2 alternative to meet the criteria. Specific indicators for each individual evaluation sub-criterion are described in Table 8-2 below.

8.4.2 Selection of Preferred Wastewater Servicing Solution

The shortlisted alternative wastewater servicing solutions were assessed, relative to each other, and evaluated against all criteria shown in Table 8-2, with scores assigned for each of the four (4) evaluation categories based on the following scoring approach:

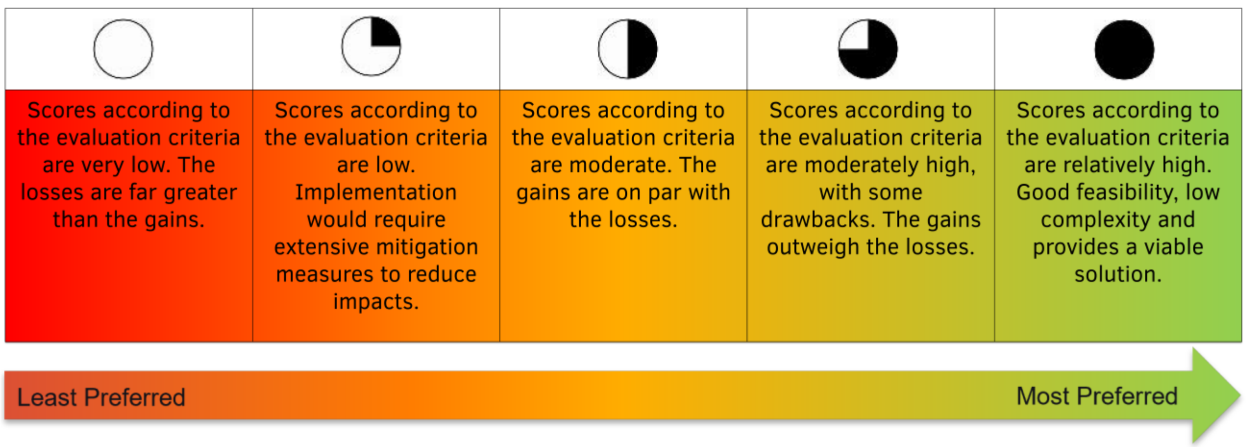

Figure 8-2: Phase 2 - Scoring Approach

An overall score for each shortlisted alternative solution was produced, with the highest scoring being selected as the preferred alternative.

Table 8-2: Phase 2 Evaluation Criteria, Rationale, and Indicators

Criteria	Objective/Rationale	Indicators What information is used in the evaluation?
Socio-Cultural Criteria		
Construction Impacts	Minimize short-term impacts on adjacent residents, road users and local uses resulting from noise, dust, vibration, sewage service and traffic disruption during construction of infrastructure	• Potential noise and dust production from construction equipment. • Potential vibration effects on sensitive receptors (adjacent neighbours and area users) during excavation and construction. • Potential for traffic impacts during construction.
Operational Impacts	Minimize long-term operational impacts on adjacent residents and local users from new infrastructure and activities related to operation of facilities	• Minimize odour production during facility operation/maintenance. • Minimize noise production during facility operation/maintenance. • Minimize traffic impacts during facility operation/maintenance. • Visual effects on sensitive receptors (adjacent neighbours and land users).
Natural Environment Criteria		
Aquatic Environment	Minimize impacts on the aquatic environment during construction and operation	• Potential for impacts on the aquatic environment during construction activities. • Potential for impacts on the aquatic environment during facility operation/maintenance.
Terrestrial Environment	Minimize impacts on the terrestrial environment during construction	• The quantity of trees that will potentially require removal to facilitate construction. • The quantity of land which may be disturbed during construction.

Criteria	Objective/Rationale	Indicators What information is used in the evaluation?
Air Emissions	Minimize impacts of air emissions and the amount of greenhouse gas generation during construction and operation	• Potential for air emissions and greenhouse gas generation during construction. • Potential for increased or reduced air emissions and greenhouse gas generation during facility operation/maintenance.
Soil Quality	Minimize impacts on the soil environment	• Potential for impacts on the soil environment during construction and operations.
Sustainability	Maximizing sustainability	• Potential to maximise reuse of existing infrastructure.
Technical Criteria		
Operational Complexity	Improve operational efficiencies and minimize operational and monitoring requirements	• Requirement for additional or fewer resources and equipment. • Need and extent of required modifications to existing equipment/processes. • Frequency of additional checks and maintenance requirements.
Ease of Implementation	Maximize integration with existing system, treatment processes, and other infrastructure components	• Need for additional infrastructure, or modifications, expansions and upgrades of existing facilities, equipment, and processes. • Opportunity to decommission or provide alternate use for existing facilities. • Compatibility with and impact on existing infrastructure. • Integration or impact to existing utilities.
Constructability	Maximize ease of construction and facilitate integration with existing system(s)	• Complexity, ease of phasing construction. • Ability to maintain wastewater servicing during construction. • Ability to maintain existing utilities in service during construction. • Change in the sewer collection network is minimal or not required.
Future Flow Requirements	Ensure solution will be able to meet future wastewater flow requirements	• Ability to treat future flow conditions, including average and peak flows.

Criteria	Objective/Rationale	Indicators What information is used in the evaluation?
Land Requirements	Minimize need for additional land acquisition	• Land acquisition is not needed, or the need for it is minimal.
Economic Criteria		
Asset Management	Make best use of existing assets	• Does the alternative maximize reuse and make best use of existing Municipal assets?
Capital Cost	Minimizes capital cost	• Financial feasibility of the alternative solutions. • Relative financial advantages of the alternatives, in terms of equipment, infrastructure, land acquisitions, etc.
Operation and Maintenance (O&M) Cost	O&M cost considerations over the 20-year period	• Relative financial benefits in terms of operating costs in the long term for operations, maintenance, staff, haulage, etc.

8.5 Phase 3 Detailed Evaluation

In Phase 3 of the Class EA process, design concepts were developed for the preferred wastewater treatment servicing alternative selected in Phase 2. A detailed comparative evaluation was completed using a weighting and ranking system to compare the alternative design concepts. This resulted in a systematic, rational, and reproducible comparison of alternative treatment alternatives and a straightforward identification of the preferred design concept.

8.5.1 Decision-Making Model

Since the selection of the preferred design concept will need to strike a balance between cost and non-cost factors, the proposed methodology for the detailed comparative evaluation step was four-fold:

1) A decision model was constructed including consideration of all factors or criteria not related to cost. Each of these factors/criteria was expressed in a positive way. If an alternative rated well against that factor, it effectively measured a relative benefit offered by that alternative compared to others. In other words, decision modeling was used to rate the “Benefits” offered by each alternative.
2) In parallel, conceptual level capital and O&M costs were generated for each alternative, which in turn was used to develop Life Cycle Costs.
3) The Benefits Score obtained for each alternative was divided by the Life Cycle Costs to produce a “Benefit-to-Cost Ratio”. It was recommended that the alternative that scored the highest “benefit-to-cost” ratio be the preferred design concept.
4) Lastly, sensitivity analyses were performed on both the decision model and the cost estimates. This effectively verified that any decisions made using this process were robust and defensible.

8.5.2 Scoring Approach and Detailed Evaluation Criteria

For each unit process, applicable treatment technologies were evaluated against a set of criteria that represent all aspects/factors of importance, as a means to identify the preferred design concept. The evaluation methodology was used as a basis to compare the benefits of each treatment technology, relative to each other, and their ability to perform under each evaluation criterion.

The criteria that were used during the detailed evaluation of treatment technologies are subdivided in two categories: primary and secondary criteria. The primary criteria capture global issues that need to be addressed and were further broken down into the secondary criteria. The primary and secondary criteria were assigned weight factors based on their degrees of importance, with the primary criteria scores being determined by their weight factors and the weighted scores of the secondary criteria. Factors were assigned such that the higher the significance of the criterion, the higher the weighting.

Each treatment technology was assessed for each of the evaluation criteria in the model and assigned a total score out of 100. Each score represents how well the specific treatment alternative meets the criterion, such that the higher the ability to meet the criterion, the higher the score assigned (i.e., score of 100 for best performing option, score of 0 to worst performing option).

The primary criteria, secondary criteria, and weight factors are presented in Table 8-3.

Table 8-3: Phase 3 Evaluation Criteria and Weights

Primary Criteria (Weight)	Sub-Criteria	Relative Weight
Socio-Cultural Considerations (15)	Minimize footprint and site impacts /architectural aesthetics (plant appearance)	10
	Minimize truck traffic (during construction & operation)	10
	Minimize noise (during operation)	15
	Minimize odour (during operation)	40
	Minimize impacts on neighbouring properties	25
	Maximum Sub-total Score – Socio-Cultural =	**100**
Natural Environment Considerations (20)	Minimize air/solids emissions	15
	Minimize impacts on species at risk	10
	Source water protection	25
	Minimize impacts on and of climate change (greenhouse gas emissions & carbon footprint), promotes sustainability	25
	Flexibility of treatment processes to adapt and respond to varying climatic conditions	25
	Maximum Sub-total Score – Natural Environment =	**100**
Technical Considerations (35)	Ability to reliably meet effluent quality criteria	15
	Flexibility to respond to variable raw wastewater quality	15

Primary Criteria (Weight)	Sub-Criteria	Relative Weight
	Compatibility with existing infrastructure, existing site boundary	15
	Compatibility with hydraulic grade line requirements	10
	Constructability and construction schedule	15
	Proven technology with strong track record; pilot testing, start-up needs, ease of approvals with MECP	10
	Pre-treatment requirements	10
	Ability to maximize ultimate site capacity	10
	Maximum Sub-total Score – Technical =	**100**
Operational Considerations (30)	Flexibility for expansion beyond buildout capacity	10
	Process complexity	15
	Process robustness (likelihood of process upsets) and redundancy	20
	Biosolids volume handling	5
	Operation and maintenance requirements (need for additional resources/equipment, frequency of additional checks and maintenance requirements)	40
	Training requirements	10
	Maximum Sub-total Score – Operational =	**100**

8.5.3 Economic Analysis

For each shortlisted alternative design concept, Class D (-30%, +50%) capital and O&M cost estimates were developed. These cost estimates were developed through the recent experience of CIMA+ as well as budgetary quotes provided by vendors for key equipment. A contingency allowance has been added to each cost estimate to account for its level of accuracy.

The analysis of each design concept will be based on twenty-year net present values (NPV) developed using the estimated capital and O&M costs. This will account for the overall cost of each design concept throughout the study period.

8.5.4 Selection of Preferred Design Concept

Shortlisted wastewater treatment design concepts were assessed relative to each other and evaluated against all criteria shown in Table 8-3. Each treatment alternative was scored on a 0-100 basis, with higher scores assigned to better performing alternatives.

The treatment alternative that scores the highest is considered the alternative which provides the most "Benefits" to this project. To identify the recommended preferred design concept, an assessment of the value associated with each design concept was completed. The overall benefit score for each was divided by the estimated life cycle cost of each design concept, resulting in a "benefit-to-cost" ratio. The alternative with the highest "benefit-to-cost" ratio would offer the greatest value and thus, was selected as the preferred design concept.

Finally, the evaluation approach was subjected to a sensitivity analysis to examine how a change of criteria weights affected the scoring results. This analysis assessed the impacts of changes to the evaluation criteria weighting and established whether the alternative with the original highest "benefit-to-cost" ratio remained the preferred design concept once criteria weighting factors were changed.

9. Class EA Phase 2 – Alternative Solutions

In accordance with Phase 2 of the Municipal Class EA process, the Class EA Study identified alternative wastewater treatment strategies to address the Problem and Opportunity Statement and the need to provide additional wastewater treatment capacity to service projected growth in the Municipality of Sioux Lookout.

The following long-list of alternative servicing strategies were identified:

- Alternative 1 – Do Nothing
- Alternative 2 – Limit Community Growth
- Alternative 3 – Expand the Existing WWTP
- Alternative 4a – Build a New WWTP on the Existing Site
- Alternative 4b – Build a Second WWTP on Another Site
- Alternative 5 – Send Wastewater (i.e. Export) to Other Systems for Treatment
- Alternative 6 – Decentralized Wastewater Systems for New Developments

9.1 Pre-Screening of Long-Listed Alternatives

Pre-screening of the long-list of alternatives resulted in the elimination of some alternatives that did not meet the problem and opportunity statement or were not feasible. The alternatives are detailed below:

9.1.1 Alternative 1 – Do Nothing

The existing Sioux Lookout WWTP is approaching its Rated Capacity of 2,840 m^3/d. If measures are not taken to address the capacity limitations, the WWTP will fail to meet the wastewater treatment demands from the predicted population growth and developments in the Municipality by the year 2035. The Do Nothing alternative is not a viable option as it does not address the constraints identified in the Problem or Opportunity Statement. **As such, this alternative was not considered further.**

9.1.2 Alternative 2 – Limit Community Growth

Limiting the community growth is inconsistent with the Municipality's objectives and planning initiatives. It is also impractical to implement this in the Municipality's thriving economic and social situation. The Municipality is in a central and interconnected location and will continue to grow and develop in the coming years. This alternative also does not provide a true solution to fulfill the current needs of the Municipality. **Hence, this alternative was not considered further.**

9.1.3 Alternative 3 – Expand the Existing WWTP

This alternative entails expansion of the existing Sioux Lookout WWTP to increase its rated treatment capacity to meet future wastewater flows and loadings to the WWTP. Reusing the existing WWTP and its infrastructure, with upgrades and expansions to unit treatment processes addresses the constraints identified in the Problem and Opportunity Statement and supports growth in the Municipality. **This option was carried forward to detailed evaluation.**

9.1.4 Alternative 4a – Build a New WWTP on the Existing Site

This alternative includes the construction of a new WWTP designed to treat all future wastewater flows, replacing the existing WWTP. The new WWTP would be constructed on the same property as the existing plant, after which the existing WWTP would be decommissioned. There is sufficient area available within the plant boundary for a new WWTP, and additional land acquisition is unlikely. A new WWTP addresses treatment capacity limitations identified in the Problem and Opportunity Statement and supports growth in the Municipality. **This option was carried forward to detailed evaluation.**

9.1.5 Alternative 4b – Build a Second WWTP on Another Site

This alternative includes the retention of the existing Sioux Lookout WWTP to treat wastewater flows up to its Rated Capacity, and the construction of a new second WWTP to treat future flows beyond the Rated Capacity of the existing plant. The new WWTP would be constructed at a second site and would treat flows conveyed from new developments and population growth in the Municipality. A second WWTP addresses treatment capacity limitations identified in the Problem and Opportunity Statement and supports growth in the Municipality. **This option was carried forward to detailed evaluation.**

9.1.6 Alternative 5 – Send Wastewater (i.e. Export) to Other Systems for Treatment

The nearest WWTP plant is the Dryden WWTP, located 100 km from Sioux Lookout by road. The next WWTP plant, in order of proximity to Sioux Lookout, is in the city of Kenora which is 239 km away by road. In addition to the significant distances, the available treatment capacities of these wastewater treatment plants would need to be considered. This alternative creates a reliance on another municipality for an essential service in the Municipality. The quantity of wastewater to be hauled each day will require significant manpower and trucks, resulting in high costs for haulage. **Due to its**

impracticality and unjustifiable financial requirements for the Municipality, this option was not considered further.

9.1.7 Alternative 6 – Decentralized Wastewater Systems for New Developments

Decentralized treatment is essentially treatment provided to the wastewater that is in close proximity to the source of wastewater generation, such as within homes or small communities. Individual treatment units provide much of or all treatment, and there is typically more than one treatment unit serving the population in a specific area. However, decentralized systems will likely limit growth, since each new development will need to consider the construction and operation of new decentralized treatment systems. This alternative also does not address existing constraints at the Sioux Lookout WWTP, as identified in the Problem and Opportunity Statement.

The design and implementation of decentralized systems are heavily dependent on the development type and the available land area, and have potential for more frequent odour and maintenance issues. **Overall, since this alternative has the potential to limit growth in the Municipality, it was not considered further.**

9.1.8 Summary of Pre-Screening of Long-Listed Alternatives

A summary of the pre-screening of the long-listed alternatives is shown below in Table 9-1:

Table 9-1: Summary of Pre-Screening of the Long-Listed Alternatives

No.	Alternative Servicing Strategy	Pre-Screening Assessment	Shortlisted
1	Do Nothing	• Does not address existing or anticipated plant limitations, nor the poor condition of the existing outfall. • WWTP will fail to service predicted population growth and developments.	No
2	Limit Growth	• Limiting the community growth is inconsistent with the Municipality's objectives and planning initiatives. • Does not address existing plant limitations, nor the poor condition of the existing outfall.	No

No.	Alternative Servicing Strategy	Pre-Screening Assessment	Shortlisted
3	Expand the Existing WWTP	• The capacity of the existing WWTP can be upgraded through a plant expansion, to accommodate increased wastewater flows and address existing plant limitations.	Yes
4a	Build a New WWTP on the Existing Site	• A new WWTP plant with increased capacity can accommodate increased wastewater flows. • Existing plant limitations would no longer apply following decommissioning.	Yes
4b	Build a Second WWTP on Another Site	• A second WWTP can treat future wastewater flows anticipated from population growth and developments. • Existing plant limitations could be addressed with minimal upgrades.	Yes
5	Send Wastewater (i.e. Export) to Other Systems for Treatment	• The nearest WWTP is approximately 100 km away, making this option impractical to implement. • Financially unjustifiable (transportation, haulage costs, manpower etc.).	No
6	Decentralized Wastewater Systems for New Developments	• Likely limits growth which is inconsistent with the Municipality's objectives and planning initiatives. • Does not address existing plant limitations, nor the poor condition of the existing outfall.	No

9.2 Evaluation of Shortlisted Alternatives

Each of the shortlisted alternatives were evaluated on the basis of four (4) evaluation categories (Social, Technical, Natural Environment, and Economic). This was carried out to evaluate the impacts and benefits of each alternative, as well as to compare the results obtained to determine the optimum alternative.

The evaluation of the shortlisted alternatives is detailed in the following sub-sections.

9.2.1 Alternative 3 – Expand the Existing WWTP

The current Rated Capacity of 2,840 m³/d at the Sioux Lookout WWTP is insufficient to accommodate future growth and projected wastewater flows in the Municipality. Expansion of the existing WWTP to meet the future wastewater treatment requirements is possible within the existing site area, as shown in Figure 9-1. An expansion of the plant to treat a future ADF of 3,400 m³/d would be needed, based on a service population projection of 6,790 people for the year 2046. This is an increase of approximately 20% from the plant's current Rated Capacity. Optimization of existing processes can also be carried out where possible.

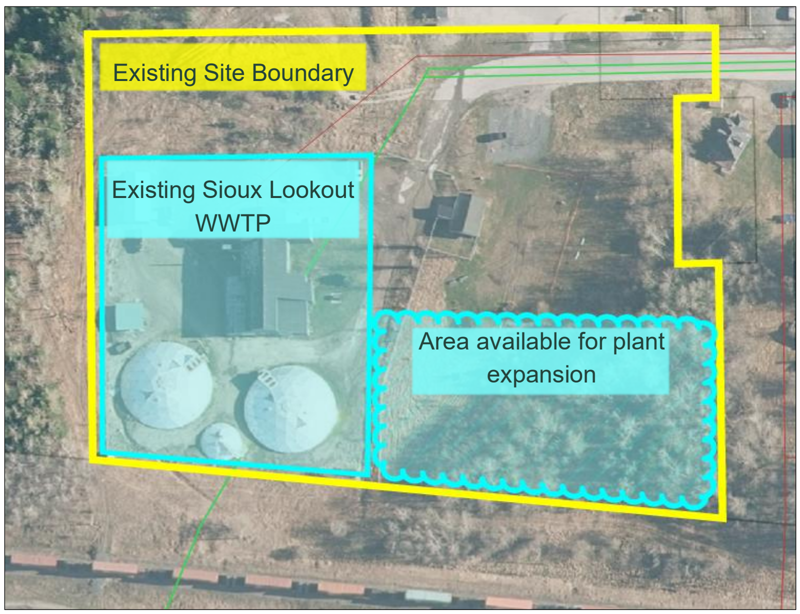

Figure 9-1: Location Overview for Alternative 3 – Expand the Existing WWTP

The evaluation of Alternative 3 in terms of the four (4) evaluation categories is shown in Table 9-2.

Table 9-2: Evaluation of Alternative 3 – Expand the Existing WWTP

Evaluation Category	Rating Considerations
Social	• Noise, dust/mud, air quality, and traffic impacts are anticipated only during the construction period. No change in noise, dust/mud, air quality and traffic are anticipated during operation. • No anticipated change in odour impacts. Currently, there are no known odour issues at the WWTP.

Evaluation Category	Rating Considerations
Natural Environment	• Impacts are anticipated on the aquatic environment during construction for the replacement of the outfall pipe. However, impacts on the aquatic environment during operation are anticipated to be similar to existing plant operation. • A few trees may be removed for WWTP expansion depending on the technology selection and construction requirements. • This alternative demonstrates the lowest anticipated greenhouse gas generation as compared to other shortlisted alternatives. • Construction may have minor impacts to the soil environment. No change in soil quality impacts anticipated during operations. • Maximizes reuse of existing infrastructure for sustainability.
Technical	• Retrofit of the existing facility may be challenging for design and construction, considering that continuous operation of the existing WWTP must be maintained. • No change in the sewer collection network is required. • The WWTP expansion will be sized to meet future flow conditions and will address existing constraints to improve treatment of peak flows. • Minor impact on ease of operation and maintenance can be expected with new equipment/infrastructure from the expansion.
Economic	• Capital cost considerations: New equipment is required, and new infrastructure may be required. • Additional land acquisition is not required. • Maximizes utilization of existing infrastructure and land area. • Additional O&M costs are expected to be scaled with the additional wastewater flow.

9.2.2 Alternative 4a – Build a New WWTP on the Existing Site

A new, larger WWTP with an increased treatment capacity could be constructed on the same site as the existing WWTP, with the existing WWTP subsequently decommissioned. Similar to Alternative 3 above, the new WWTP will need to be designed to treat an ADF of 3,400 m^3/d. There is sufficient land area for the construction of a new WWTP within the existing site property boundary, as depicted in Figure 9-2.

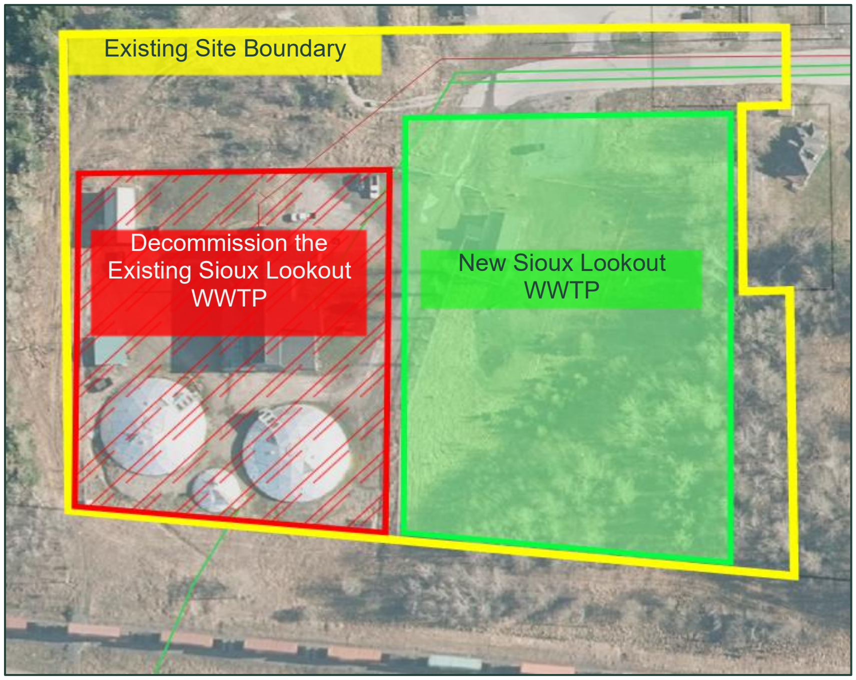

Figure 9-2: Location Overview for Alternative 4a – Build a New WWTP on the Existing Site

The evaluation of Alternative 4a in terms of the four (4) evaluation categories is shown in Table 9-3.

Table 9-3: Evaluation of Alternative 4a - Build a New WWTP on the Existing Site

Evaluation Category	Rating Considerations
Social	• A longer construction period is required as compared to WWTP expansion, likely resulting in prolonged noise, dust/mud, air quality and traffic impacts that require mitigation. No change in noise, dust/mud, air quality and traffic anticipated during operation. • The new WWTP design will require mitigation measures (covers and odourous air treatment) to reduce potential impacts of odours on nearby residents. No change in odour impacts is anticipated during operation.
Natural Environment	• Impacts are anticipated on the aquatic environment during construction for the replacement of the outfall pipe. However, impacts on the aquatic environment during operation are anticipated to be similar to existing plant operation. • Additional trees will likely require removal compared with a WWTP expansion. • Higher greenhouse gas generation is anticipated as compared to a WWTP expansion due to additional tankage construction. • Construction may have moderate impacts to the soil environment. No change in soil quality impacts is anticipated during operations.

Evaluation Category	Rating Considerations
Technical	• The construction of a new greenfield WWTP is less complex than retrofit of existing facility and can be completed offline with tie-in during commissioning. • Site constraints may provide limited area for construction activities of the new WWTP. • No change in the sewer collection network is required. • It is unlikely that additional land acquisition will be required for the new WWTP. • The new WWTP will be sized to meet future flow conditions, including peak flows. • Minor impact on ease of operation and maintenance can be expected with new equipment/infrastructure.
Economic	• Capital cost considerations: Decommissioning of the existing WWTP will have minimal reuse of existing structures and equipment. Significant new equipment and infrastructure are required for the new WWTP. • Additional land acquisition is not required. • Additional O&M costs are expected to be scaled with the additional wastewater flow.

9.2.3 Alternative 4b – Build a Second WWTP on Another Site

Under this alternative, the existing Sioux Lookout WWTP would continue to operate and treat flows up to its Rated Capacity. Future wastewater flows from new developments would be directed to the new second WWTP for treatment. The new WWTP would be constructed in a secondary location within the boundary of the Municipality. The developed areas of the Municipality currently cover a large area, as shown in Figure 9-3.

Figure 9-3: Aerial Image of the Developed Lands in Municipality of Sioux Lookout

Important considerations in the location selection for the new second plant include:

- The new WWTP will require a new outfall to a receiving body such as Pelican Lake. The water treatment facility for the community of Sioux Lookout is located approximately 1 km south-east of the existing WWTP, on the shoreline of Pelican Lake. The discharge location of a new second WWTP would need to consider limitations including the intake protection zone of the water treatment facility.

- Odour generation from the new WWTP may be of public concern. Thus, lands in the vicinity of sensitive receptors such as schools, hospitals, mass residential units, tourism sectors, etc. were not considered.

After examination of zoning documents for the Town of Sioux Lookout, one suitable location for the second plant is the private property parcel located between the CN tracks and Pelican Lake, as shown in Figure 9-4. The total land area at this second plot is about 32.5 ha. For the purposes of this evaluation, it was assumed that the outfall alignment used by the existing WWTP could be used for the new WWTP, with a new dedicated outfall constructed for the new WWTP. Feasibility of purchasing the private property, shoreline building regulations and the CN tracks to the north of the site increase construction complexity for a new WWTP at this site. These boundaries may also limit the land area available for construction.

Figure 9-4: Potential Location for the Second WWTP at Sioux Lookout

The evaluation of Alternative 4b in terms of the four (4) evaluation categories is shown in Table 9-4.

Table 9-4: Evaluation of Alternative 4b - Build a Second WWTP on Another Site

Evaluation Category	Rating Considerations
Social	• A longer construction period is required as compared to a WWTP expansion, likely resulting in prolonged noise, dust/mud, air quality and traffic impacts that require mitigation. • The new location for the WWTP could potentially increase noise, dust/mud, air quality and traffic during operation for residents nearby to the new WWTP. • The new WWTP design will require mitigation measures (covers and odourous air treatment) to reduce potential impacts of odours on nearby residents.
Natural Environment	• Impacts are anticipated on the aquatic environment during construction for an additional outfall pipe as well as replacement of the existing outfall. During operation, additional wastewater effluent plume into Pelican Lake is anticipated, which may have additional implications for aquatic environment. • There is potential for greater terrestrial impacts on a second WWTP greenfield site. • Higher greenhouse gas generation is anticipated as compared with a WWTP expansion due to additional tankage construction. • Construction may have moderate impacts to the soil environment. No change in soil quality impacts are anticipated during operations.
Technical	• Construction of a new greenfield WWTP is less complex than retrofit of the existing facility and can be completed offline with tie-in during commissioning. • A new WWTP will require realignment of the collection system. • Additional outfall to Pelican Lake is required. • Additional land acquisition is required. • New WWTP will be sized to meet future flow conditions. Existing WWTP will require upgrades to address existing constraints, including replacement of the existing outfall which is in poor condition. • Operational and maintenance requirements will increase when operating two WWTPs.
Economic	• Capital Cost Considerations: Significant new equipment and infrastructure are required for the new WWTP, as well as for the realignment of the wastewater collection system to the new WWTP. • Land acquisition will be required for the new WWTP, increasing capital costs. • Significantly increased O&M requirements are anticipated for two WWTPs, including increased equipment and infrastructure maintenance and additional operations staff.

9.3 Assessment of Alternative Solutions

The shortlisted alternatives were evaluated in a detailed manner with a weightage of 25% each for Technical, Social, Economic, and Environmental considerations. The evaluation matrix is provided in **Appendix F**.

The scoring for each shortlisted alternative is presented in Table 9-5.

Table 9-5: Evaluation of Shortlisted Phase 2 Alternatives - Scoring Details

Evaluation Category	Alternative 3: Expand Existing WWTP	Alternative 4a: New WWTP on Existing Site	Alternative 4b: Second WWTP on Another Site
Social	●	◕	◔
Environment	◕	◑	◔
Technical	◕	◕	◔
Economic	◕	◑	◔
Option Ranking	**1**	2	3

Based on Table 9-5, the preferred alternative solution is Alternative 3, which is to expand the existing Sioux Lookout WWTP to treat a design ADF of 3,400 m^3/d.

9.4 Preliminary Preferred Alternative

Following the detailed evaluation process considering the Social, Natural Environment, Technical, and Economic factors, Alternative 3 – Expanding the Existing WWTP, was selected as the preliminary preferred solution. The evaluation highlighted that this alternative provides an avenue to fully utilize the existing assets and infrastructure at the existing Sioux Lookout WWTP. Additionally, there is no requirement for further land acquisition since there is sufficient area at the existing site to facilitate a plant expansion. The expansion of the plant will enable the WWTP to treat the future wastewater flows projected for the Town of Sioux Lookout.

The implementation of this alternative has relatively low anticipated complexity when compared to the other shortlisted alternatives. Expansion of the existing WWTP maximizes the use of existing land and infrastructure, and no change in the sewer collection network will be required.

This alternative is anticipated to have minimal impacts on the surrounding natural environment, minimal noise, odour, air quality and traffic impacts, and the lowest anticipated greenhouse gas emissions of the shortlisted alternatives. It was also the alternative with the lowest anticipated economic impact in terms of capital and O&M cost considerations.

Due to its substantial benefits, minimal anticipated impacts, and the ability of this alternative to address the Problem and Opportunity Statement, Alternative 3 was the preferred alternative.

10. Class EA Phase 3 – Alternative Design Concepts

10.1 Identification of Wastewater Treatment Alternative Design Concepts

10.1.1 Review of Processes for Evaluation

To evaluate alternative design concepts, individual wastewater treatment unit processes were assessed. Treatment capacities of the existing unit processes were estimated, and the ability of each to meet the design flows was assessed. Upstream treatment requirements and potential impacts on downstream processes and overall plant design were also assessed for unit processes within each alternative design concept. The unit processes considered included the following:

Preliminary Treatment

Based on the capacity assessment, the influent bar screen and vortex grit tanks have sufficient capacity to meet the design flows. As a result, alternative preliminary treatment alternatives have not been considered in this evaluation. However, some downstream treatment technologies may require improved preliminary treatment. Therefore, any upgrade requirements to this unit process will be captured in the evaluation of technologies for secondary treatment.

Primary Treatment

Primary treatment was not considered for the upgrades at the Sioux Lookout WWTP since the benefits of primary treatment are not effective at a facility of this size and constituent loading.

Secondary Treatment

The existing two CTUs at the facility provide extended aeration treatment and secondary clarification of the wastewater. Based on the capacity assessment, the extended aeration tanks do not have sufficient capacity to treat the design flows and loadings. The secondary clarifiers are estimated to have sufficient capacity to treat the design conditions. Alternatives which increase the secondary treatment capacity of the facility were considered for evaluation.

Tertiary Treatment

Tertiary treatment was not considered for the upgrades at the Sioux Lookout WWTP since meeting the ACS proposed effluent limits (Section 6.3.3) will likely not require tertiary-level treatment.

Disinfection

Based on its design, the existing UV disinfection system has sufficient capacity to treat the design flows. Therefore, upgrades to the disinfection process have not been considered in this evaluation.

Sludge Stabilization

Based on the capacity assessment, the existing aerobic digesters located in the CTUs do not provide sufficient treatment to stabilize the waste activated sludge produced. Alternatives for sludge stabilization upgrades have been considered for evaluation.

Solids Dewatering

Based on the capacity assessment and discussions with operations on the poor condition of the existing belt filter press, solids dewatering will require upgrades to meet projected future plant design requirements. Upgrades to the solids dewatering system are preferred to be implemented in the existing dewatering building, which currently houses the belt filter press and auxiliary equipment.

Final Effluent Outfall

The increased treatment demand according to future flow projections will necessitate an upsizing of the existing outfall. Additionally, as detailed in Section 5.2.4, the condition of the existing outfall pipe at the Sioux Lookout WWTP is poor. As such, replacing the outfall and upsizing it was seen to be the most suitable option for the plant, based on the initial evaluation.

10.1.2 Long-List of Alternatives

A long-list of potential alternatives for each evaluated process area are summarized in Table 10-1.

Table 10-1: Long-List of Alternatives

Process Area	Alternatives Considered
Liquid Treatment Train	• Expand existing CTU aeration zones into aerobic digesters • Third Extended Aeration CTU • New Conventional Activated Sludge Plant to supplement existing CTUs • Process Intensification using Integrated Fixed-film Activated Sludge (IFAS)

Process Area	Alternatives Considered
	• New Aerobic Granular Sludge Plant to supplement existing CTUs
Solids Treatment Train	• Lime Stabilization • Aerobic Digestion • Anaerobic Digestion • Autothermal Thermophilic Aerobic Digestion
Final Effluent Outfall	• Do Nothing • Replace and Upsize Existing Outfall • New Outfall Pipe – Parallel to Existing Outfall • New Outfall Pipe – West of Existing Outfall

10.1.3 Alternative Screening

Preliminary screening criteria that were identified in previous sections were utilized for screening the long-list of technologies. The results have been summarized in Table 10-2, Table 10-3, and Table 10-4 for the liquid, solids, and outfall alternatives, respectively.

Table 10-2: Long-List Screening Results – Liquid Treatment Train

Liquid Train Technology	Compliance Feasibility	Technical Feasibility	Financial Feasibility	Pass / Fail	Comments
Expand existing CTU aeration zones into aerobic digesters	No	Yes	Yes	Fail	Increasing the extended aeration volume of each CTU through repurposing the existing digester volume increases the treatment capacity of each CTU. The estimated increase in capacity was not sufficient for the design conditions, so this alternative was not shortlisted for further evaluation. This option may be considered for upgrade phasing opportunities, as appropriate.
Third Extended Aeration CTU	Yes	Yes	Yes	**Pass**	The plant has provision for a future third CTU making this option compatible with the existing site layout. A third CTU is in line with and would have minimal impact on current operational practices.
New Conventional Activated Sludge Plant to supplement existing CTUs	Yes	No	No	Fail	A conventional activated sludge plant has a relatively large footprint compared with the existing CTUs. New operational practices would need to be developed to operate two different treatment technologies in parallel. The site works required for implementation would also carry significant financial costs.

Liquid Train Technology	Compliance Feasibility	Technical Feasibility	Financial Feasibility	Pass / Fail	Comments
Process Intensification using IFAS	Yes	Yes	Yes	**Pass**	An IFAS process may be implemented to provide increased treatment capacity within the existing tankage. IFAS in the form of fixed or free-floating media would provide a surface for fixed growth bacteria, increasing the biological treatment capacity of the process. Due to its relatively low complexity, this would represent a minor change in operational practices. Additional financial savings may also be realized through decreased operational (energy) costs depending on the IFAS technology selected. This technology requires further evaluation.
New Aerobic Granular Sludge (AGS) Plant to supplement existing CTUs	Yes	No	No	Fail	Although it occupies a smaller footprint than conventional activated sludge, AGS would also require new operational practices to operate in parallel with the existing CTUs. AGS is a more operationally complex technology and is anticipated to carry relatively higher capital costs for implementation.

Table 10-3: Long-List Screening Results – Solids Treatment Train

Solids Train Technology	Compliance Feasibility	Technical Feasibility	Financial Feasibility	Pass / Fail	Comments
Lime Stabilization	Yes	No	No	Fail	Technology requires large footprint and can produce significant odours and dust. The process results in large sludge volumes and would require a large new dedicated facility.
Aerobic Digestion	Yes	Yes	Yes	**Pass**	Aerobic digestion is well suited for small, extended air WWTPs due to its relatively low capital and operating costs at this scale. The plant currently operates aerobic digesters, so this technology is in line with existing operational practices.
Anaerobic Digestion	Yes	No	No	Fail	Anaerobic digestion carries high capital costs and has relatively high operational complexity. The process is typically implemented at larger treatment plants which are better able to take full advantage of its benefits. Anaerobic digestion is not compatible with existing operational practices at the plant.

Solids Train Technology	Compliance Feasibility	Technical Feasibility	Financial Feasibility	Pass / Fail	Comments
Autothermal Thermophilic Aerobic Digestion (ATAD)	Yes	No	No	Fail	ATAD offers improved pathogen and volume reduction compared with aerobic digestion. However, it is a significantly more operationally complex technology and carries higher capital and O&M costs for implementation. ATAD is not compatible with existing operational practices at the plant.

Table 10-4: Long-List Screening Results – Final Effluent Outfall

Final Effluent Outfall Alternative	Compliance Feasibility	Technical Feasibility	Financial Feasibility	Pass / Fail	Comments
Do Nothing	No	No	Yes	Fail	This alternative does not address the existing capacity and condition constraints of the Sioux Lookout WWTP outfall.
Replace and Upsize Existing Outfall	Yes	No	Yes	Fail	The implementation of this alternative is technically unfeasible, due to requirements for the bypass system across the CN rail tracks when upsizing the outfall in the current outfall location to maintain continuous service.

Final Effluent Outfall Alternative	Compliance Feasibility	Technical Feasibility	Financial Feasibility	Pass / Fail	Comments
New Outfall – Parallel to Existing Outfall	Yes	Yes	Yes	**Pass**	A new outfall will be upsized and capable of meeting future flow requirements. Although this alternative will require a larger extent of easements and approvals, it meets the planning objectives of the Municipality and is technically feasible and is relatively of low complexity. This alternative requires further evaluation.
New Outfall – West of Existing Outfall	Yes	Yes	Yes	**Pass**	This alternative also involves a new outfall that will be upsized and capable of accommodating future flow requirements. Outfall construction in a new easement will allow for largely uninterrupted operations through the existing outfall until construction of the new outfall is completed. Although this alternative is technically feasible, it requires further evaluation.

10.1.4 Summary of Shortlisted Alternatives

The list of suitable technologies has been summarized in Table 10-5:

Table 10-5 Shortlisted Alternatives

Process Area	Alternatives Shortlisted
Liquid Treatment Train	• Third Extended Aeration CTU • Process Intensification using IFAS
Solids Treatment Train	• Aerobic Digestion
Outfall	• New Outfall - Parallel to Existing Outfall • New Outfall - West of Existing Outfall

10.2 Concept-Level Development of Shortlisted Alternatives

10.2.1 Common Components

For this evaluation, certain components have been identified as common, irrespective of the alternatives for the liquid and solids train, including:

- Process Blowers,
- Chemical Phosphorus Removal, and
- RAS and WAS Pumping.

10.2.1.1 Process Blowers

The existing Hoffman process blowers at the Sioux Lookout WWTP are approximately 30 years old. The manufacturer of the blower confirmed that the model is obsolete and is no longer manufactured or supported. Based on this feedback, there is significant risk for future maintenance of the existing blowers.

The capacities of the existing blowers could not be confirmed due to a lack of available information from the manufacturer. Based on the limited available information, the estimated capacity appeared to be insufficient for the future air demands of the plant. The actual capacities of blowers have also been observed to decrease with age.

Due to the risks outlined above, new process aeration blowers are recommended for the Sioux Lookout WWTP. These will be sized through detailed design to best fit the preferred wastewater treatment train alternatives. The new blowers are anticipated to be more efficient than the existing blowers. The specific blower technology will be confirmed during detailed design of the plant expansion.

10.2.1.2 Chemical Phosphorus Removal

Phosphorous removal from wastewater is an integral step to meet the effluent limits for discharge. This is typically completed by chemical precipitation, accomplished by dosing coagulants such as aluminium salts (alum) or iron salts (ferric or ferrous) upstream of the clarifiers to induce precipitation of the soluble phosphorous in the clarifiers.

The existing Sioux Lookout WWTP ECA includes final effluent compliance limits and objectives for total phosphorus. However, the plant does not currently have a chemical coagulant dosing system installed at the site. To help ensure the plant is able to continue to meet its final effluent phosphorus compliance requirements, a chemical phosphorus removal system is recommended to be installed through these upgrades. This will include chemical storage, dosing pumps, and related piping, electrical, and controls systems, which will be sized and sited during detailed design of the plant expansion.

10.2.1.3 RAS and WAS Pumping

The existing CTUs employ an air lift pump system for sludge removal from the secondary clarifiers. RAS and WAS flow splitting is done manually using a diverter valve, directing RAS to the head of the extended aeration tanks and WAS to the Stage 1 aerobic digesters in each CTU. This method of control makes it difficult for operations to effectively manage return and wasting rates and operating conditions.

Due to the insufficient capacity in the existing aerobic digesters, and based on the shortlisted solids treatment train alternative, the existing air lift system will require upgrading to meet the future needs of the facility. Dedicated RAS and WAS pumping for each CTU will be required through the plant expansion, and will be developed through detailed design.

10.2.1.4 Solids Dewatering

The existing belt filter press used for solids dewatering at the Sioux Lookout WWTP is 30 years old and at the end of its service life. The Sioux Lookout WWTP will require new dewatering equipment for the future solids treatment train in line with current operational practices. The type of dewatering technology and its sizing will be confirmed through detailed design of the solids treatment train.

10.2.2 Liquid Treatment Train

10.2.2.1 Third Extended Aeration CTU

The CTU design is a well-established configuration in wastewater treatment and is popular for its relatively small footprint due to the shared walls between the aeration tanks and clarifiers. It is also typically well suited for small WWTPs with limited available construction area.

A third CTU at the Sioux Lookout WWTP would be constructed identically and operate similarly with the two existing CTUs. The structure would include an outer concentric extended aeration tank surrounding a secondary clarifier.

Figure 10-1: CTU (Courtesy of AUC Group)

Figure 10-2: Existing CTUs at the Sioux Lookout WWTP

The existing distribution chamber located in the control building was constructed with a future third CTU in mind. As shown in Figure 10-3, the distribution chamber has a third outlet consisting of a sluice gate and outlet pipe which is capped downstream for future use. Similarly, there is an existing air line to a third CTU from the process blowers which is capped for future use. New effluent and sludge piping will be required for the third CTU.

Figure 10-3: Existing Distribution Chamber

The third CTU would operate in parallel with the existing CTUs, evenly splitting influent flow between each CTU. The process flow diagram for a third CTU is shown in Figure 10-4.

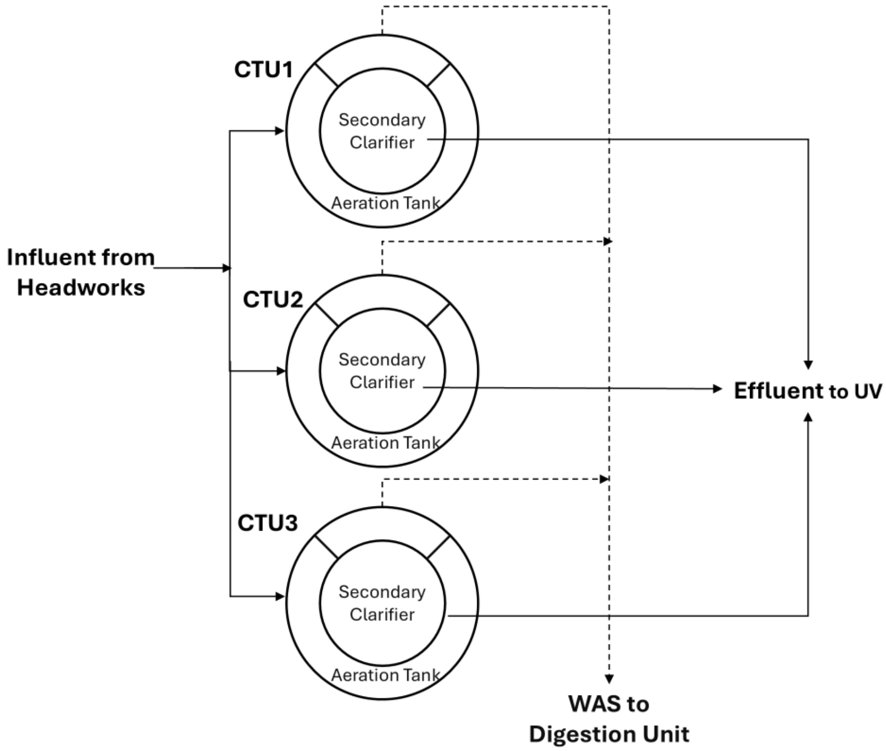

Figure 10-4: Process Flow Diagram for a Third CTU

The conceptual site layout for the third CTU is shown in Figure 10-5. Similar to the existing two CTUs, the third CTU would have an annular extended aeration tank with an outer diameter of 23.7 m and an inner diameter of 15.2 m. The central clarifier would have a diameter of 14.6 m and a side water depth of 3.46 m.

Other aspects to be considered with the implementation of a third CTU include new electrical and control signal connections through new duct banks. The new CTU will also require process equipment and components including a diffuser grid, clarifier drive and mechanism, RAS/WAS pumping, monitoring instrumentation, and associated piping and valves.

A third CTU would provide additional capacity beyond what is required for this plant expansion, adding increased resiliency to the facility. The main disadvantages of implementing a third CTU is the relatively large footprint and new construction requirements. The proposed location for implementation is also within the deciduous tree line, which may cause relatively larger land disturbance and tree removal.

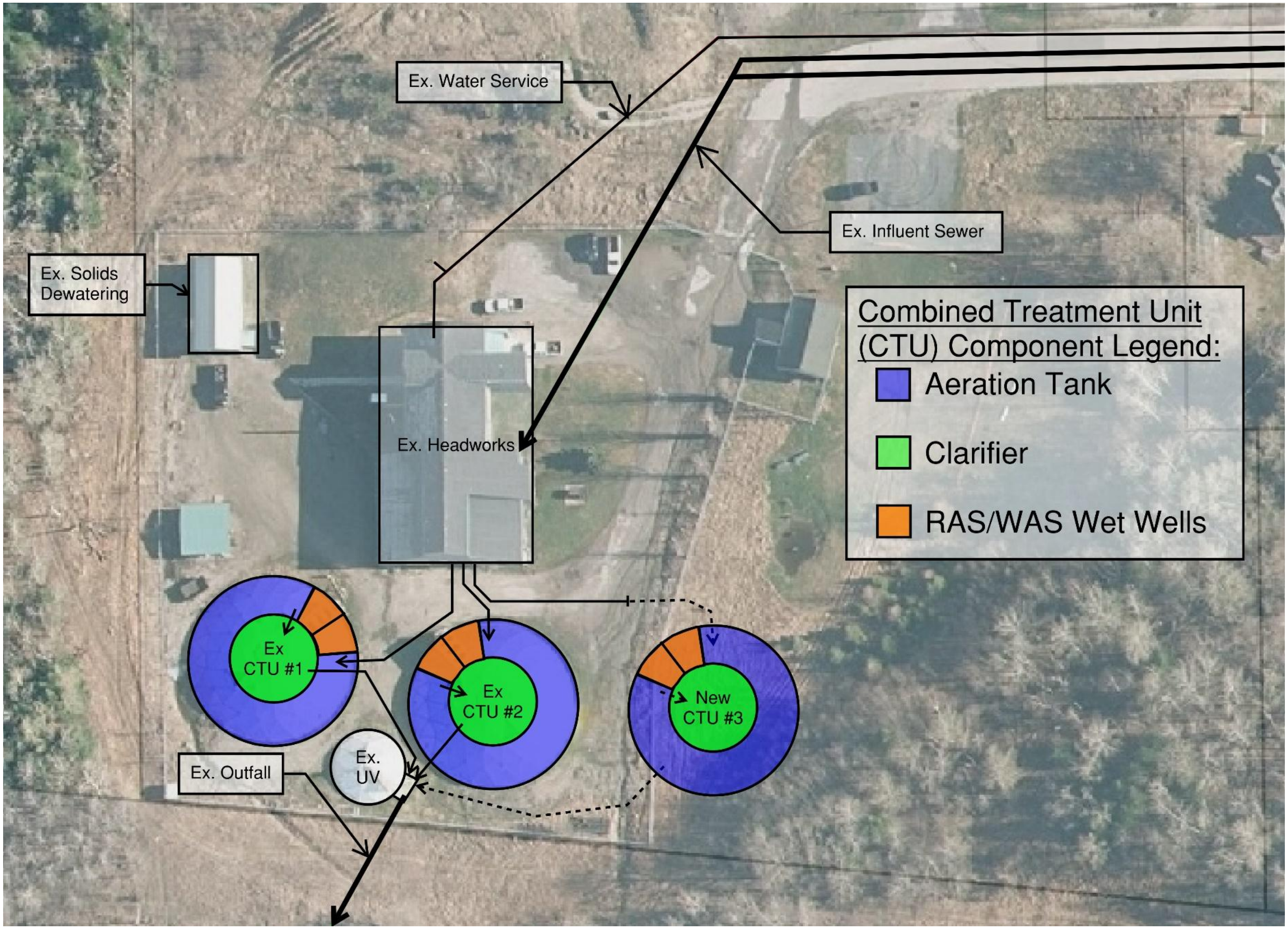

Figure 10-5: Third CTU Concept Layout

10.2.2.2 Process Intensification – Integrated Fixed-film Activated Sludge (IFAS)

The IFAS process was initially introduced in the 1990's in order to facilitate upgrades of existing activated sludge plants in a more cost efficient manner. IFAS is characterised by either free floating or fixed media that are installed into an activated sludge process. The large surface area of the media promotes biofilm growth. The use of aeration to enhance treatment efficiency is also typical in IFAS systems. Figure 10-6 depicts a process flow diagram for an IFAS process.

Several IFAS technologies exist which may be suitable for the Sioux Lookout WWTP and would provide the additional capacity required for plant expansion. Table 10-6 describes three IFAS technologies under consideration for this retrofit, with some key technology descriptors.

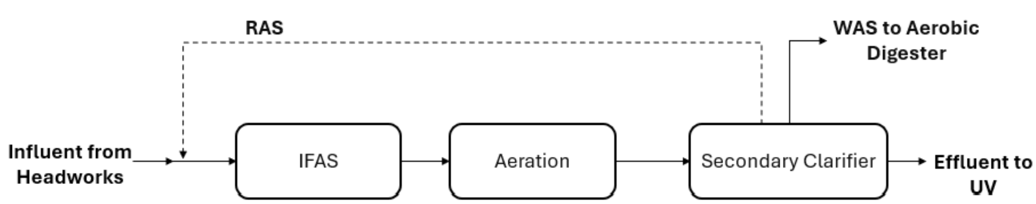

Figure 10-6: Process Flow Diagram for IFAS Process

Table 10-6: IFAS Technologies

Technology	Key Descriptors
Membrane Aerated Biofilm Reactor (MABR)	• A biological treatment that utilizes fixed-growth biofilm on hollow fibre membranes. • The membranes are gas-permeable and are secured in modules that are fully immersed in the bioreactor. • Produces dense biofilm growth on the membrane that has the added advantage of being resistant to washout during high peak flows. • Air is blown through the gas-permeable membranes, providing highly efficient oxygen transfer directly to the biofilm layer. • Periodic air scouring is required to regulate biofilm thickness.

Technology	Key Descriptors
	• Increases BOD and TAN removal rates, increasing treatment capacity. • Three WWTPs in Ontario currently employ MABR processes.
Moving Bed Biofilm Reactor (MBBR)	• A biological treatment that employs fixed-growth biofilm on free-floating plastic media in the aeration tank. • More resilient to washout than typical suspended growth processes. • No air scouring is required as biofilm thickness is controlled passively; when media come into contact with each other to dislodge biofilm. • Increases BOD and TAN removal rates, increasing treatment capacity. • Flow velocity and mixing efficiency are important, and high velocities or poor mixing can be detrimental to treatment efficiency. • Several WWTPs in Ontario currently employ the MBBR technology.
Fixed Media	• A biological treatment technology that employs a biofilm grown on a media which is fixed at a point but still capable of movement within the aeration tank. • An example of the fixed media IFAS is the WavTex™ which is composed of multiple layers of sheet media that are fixed on a steel frame. • The flexible screens are designed to be non-clogging, and provide a stable environment for biofilm with resistance to washout. • Increases BOD and TAN removal rates, increasing treatment capacity. • The WavTex™ modules also require low maintenance and have low complexity and do not require media retention screen. • Periodic coarse bubble scouring to manage biofilm thickness.

Technology	Key Descriptors
	• One known installation in Ontario for WavTex is at the Peterborough WWTP.
Mobile Organic Biofilm (MOB)	• A biological treatment that employs fixed-growth biofilm on free-floating organic carrier media in the aeration tank • Lignocellulosic plant material is used as carrier media. Media is introduced into aeration tank as briquettes, which disintegrate into cellulosic particles to promote biofilm growth. • Media also acts as a ballast, improving sludge settleability in the secondary clarifiers. • Media is recirculated through the RAS lines and is screened from the waste activated sludge, but must be replenished periodically to account for loss. • Increases BOD and TAN removal rates, increasing treatment capacity. • Biofilm thickness is controlled passively, so no air scouring is required. • Relatively new technology in North America, with limited installation base.

Typically, IFAS retrofits consist of installing the modules or introducing the media into the aeration basin. Depending on the technology, tank modifications or additional retrofit works such as media sieves or screens may be required. Images of example installations of MABR, MBBR, Fixed Media (WavTex), and MOB (Nuvoda) are shown in Figure 10-7, Figure 10-8, Figure 10-9, and Figure 10-10 respectively.



Figure 10-7: MABR Cassette Example & Retrofit Bioreactor Installation (Courtesy of OxyMem)

Figure 10-8: MBBR Media in Tank & Biofilm Growth on MBBR Media (Courtesy of Snowate)

Figure 10-9: Fixed Media and Installation Example (Courtesy of Entex)

Figure 10-10: MOB Media Installation and Biofilm Growth on Media (Courtesy of Nuvoda)

The preferred IFAS technology would be selected during the detailed design phase and installed within the existing tankage of the CTUs during construction. The existing aerobic digester volumes in each CTU would be repurposed into additional aeration volume. Depending on the IFAS technology, the media would be installed in this repurposed aerobic digester volume or would be free-floating in the mixed liquor.

The conceptual site layout for the IFAS retrofit is shown in Figure 10-11. Notably, this retrofit does not require the construction of new tankage at the site. This upgrade will require the retrofit of the existing aerobic digester sections of each CTU including the realignment of influent piping, removal of concrete walls, and installation of structural supports, media sieves, media screening, and aeration piping, depending on the preferred IFAS process. RAS/WAS self-priming pumping is recommended with this option to improve sludge return and wasting monitoring and control.

Additionally, the IFAS retrofit will likely require a headworks screen upgrade to protect the IFAS media from large influent solids. The specific screen size will be selected during the detailed design phase based on the requirements of the preferred IFAS technology.

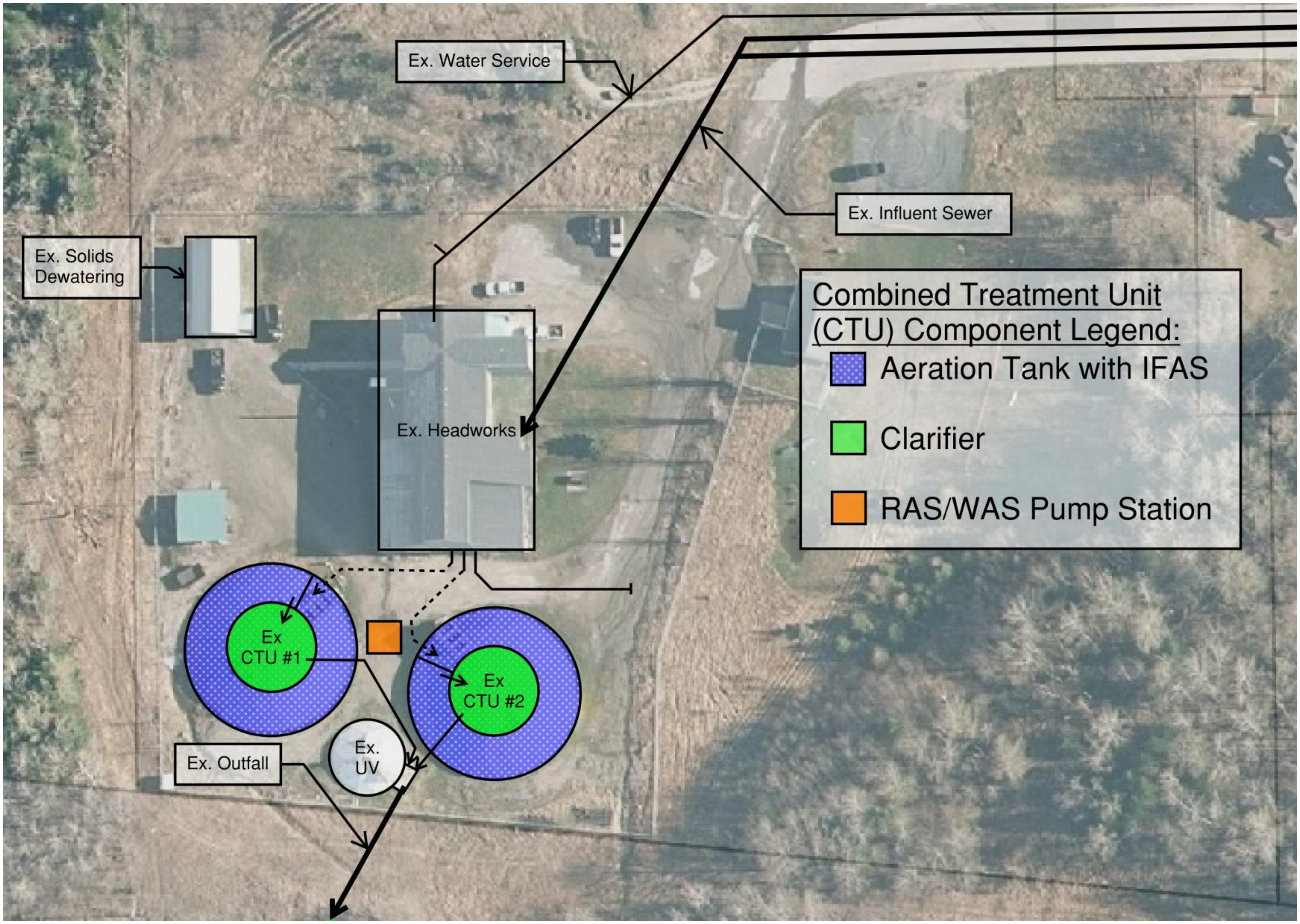

Figure 10-11: IFAS Retrofit Concept Layout

10.2.3 Solids Treatment Train – Aerobic Digestion

Aerobic digestion is a biological sludge stabilization method reliant on the presence of oxygen. Aerobic bacteria utilize the oxygen to break down organic matter into simpler compounds. The process typically utilizes mechanical mixing in conjunction with air diffusers to achieve uniform mixing and oxygen contact. The process is temperature dependent and requires longer retention times at low temperatures. This is relevant at the Sioux Lookout WWTP due to the low influent wastewater temperatures.

The process flow diagram for aerobic digestion followed by solids dewatering is shown in Figure 10-12. An example of an aerobic digester is provided in Figure 10-13.

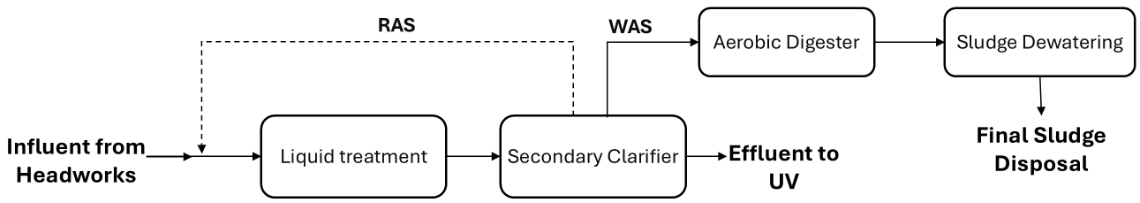

Figure 10-12: Process Flow Diagram for Aerobic Digestion

Figure 10-13: Aerobic Digester (Courtesy of APG Neuros)

A conceptual site layout showing the space requirements of the proposed aerobic digester is shown in Figure 10-14, which was sized based on the maximum month production of WAS. For the Sioux Lookout WWTP, this includes two parallel aerobic digesters each with a volume of 450 m^3.

WAS from each CTU would be pumped directly to the aerobic digesters, which would operate continuously. A decanter system will be incorporated into the digester design to facilitate sludge thickening. Digested sludge would be pumped to the solids dewatering system. The air requirements for the aerobic digesters will be incorporated into the design of the new process air blowers.

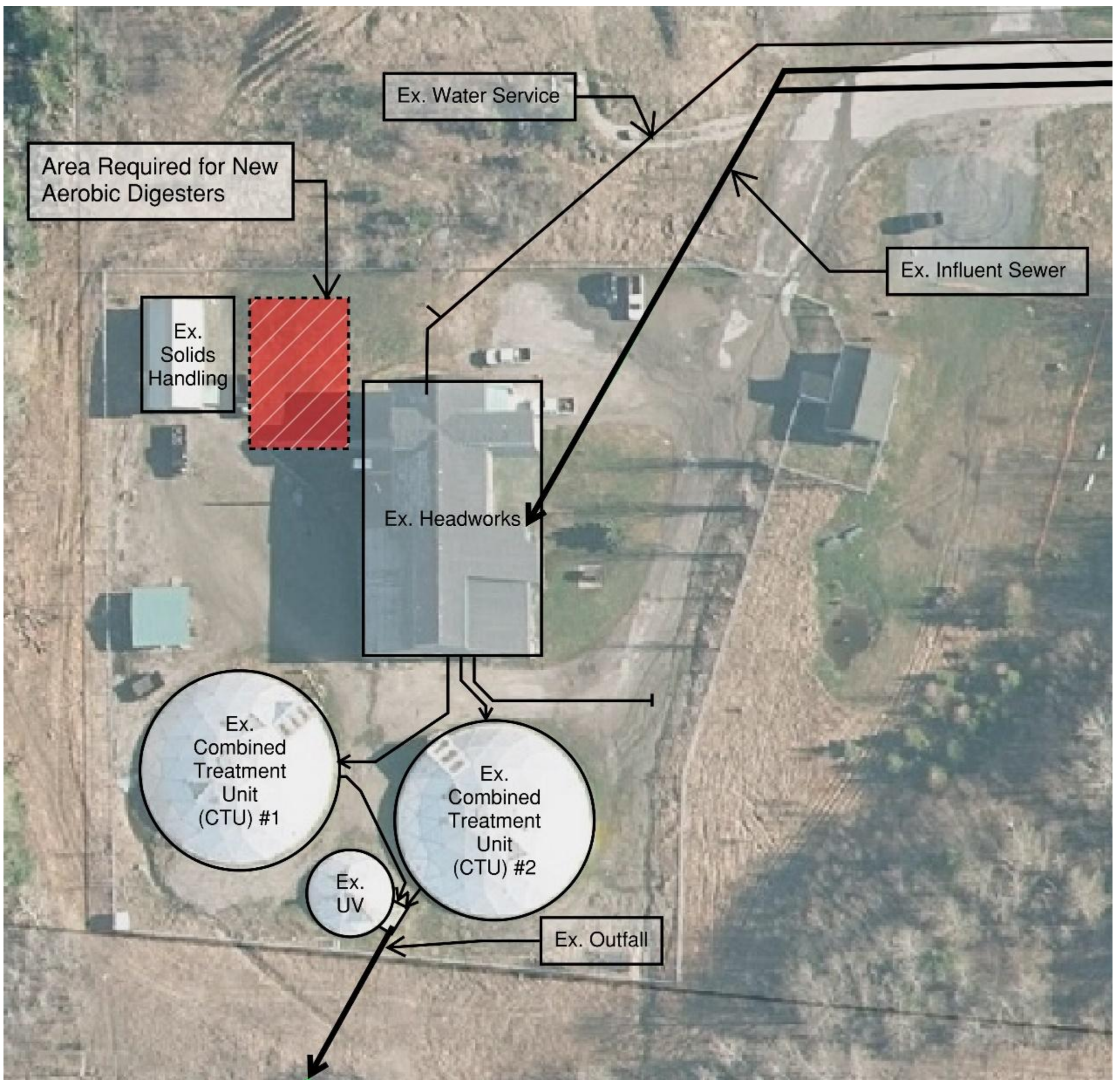

Figure 10-14: Aerobic Digestion Concept Layout

10.2.4 Final Effluent Outfall

Potential layouts for the two shortlisted new outfall alternative routes as well as the existing outfall route are shown in Figure 10-15. The final routing of the new outfall will be determined during detailed design.

Several constraints for the routing of the new outfall alternatives were considered, including:

- A trenchless boring method will be required for either new outfall alternative to traverse the CN tracks. Therefore, a sufficient amount of land area ahead of the crossing is required to stage the pipe. In addition, boring entry and exit pits are proposed to be located on the WWTP site and municipal road right-of-way, respectively, to avoid the CN right-of-way;
- A new easement through the private property along the shoreline of Pelican Lake will be required for either new outfall alternative. Therefore, the private property owner is a key stakeholder for the proposed new outfall;
- The location of new outfall diffusers in Pelican Lake (i.e. discharge location) is proposed close to the existing outfall diffusers in an effort to reduce changes to aquatic environmental impacts from existing conditions; and
- Further archaeological investigations may be required for either new outfall alternative. However, as noted in the Stage 1 archaeological investigation report in **Appendix C**, should trenchless installation and directional drilling be employed for the installation of the new outfall, the MCM should be consulted on the proposed methodology to outline appropriate archaeological mitigation strategies.

The primary differences between the new outfall alternatives are:

- A new outfall parallel to the existing outfall has the potential for less terrestrial and marine environmental impacts due to its proposed routing along the private property driveway, and lesser length of new piping installation in Pelican Lake, and
- A new outfall west of the existing outfall has an overall shorter route and requires less of an easement through the private property (preferred by the private property owner).

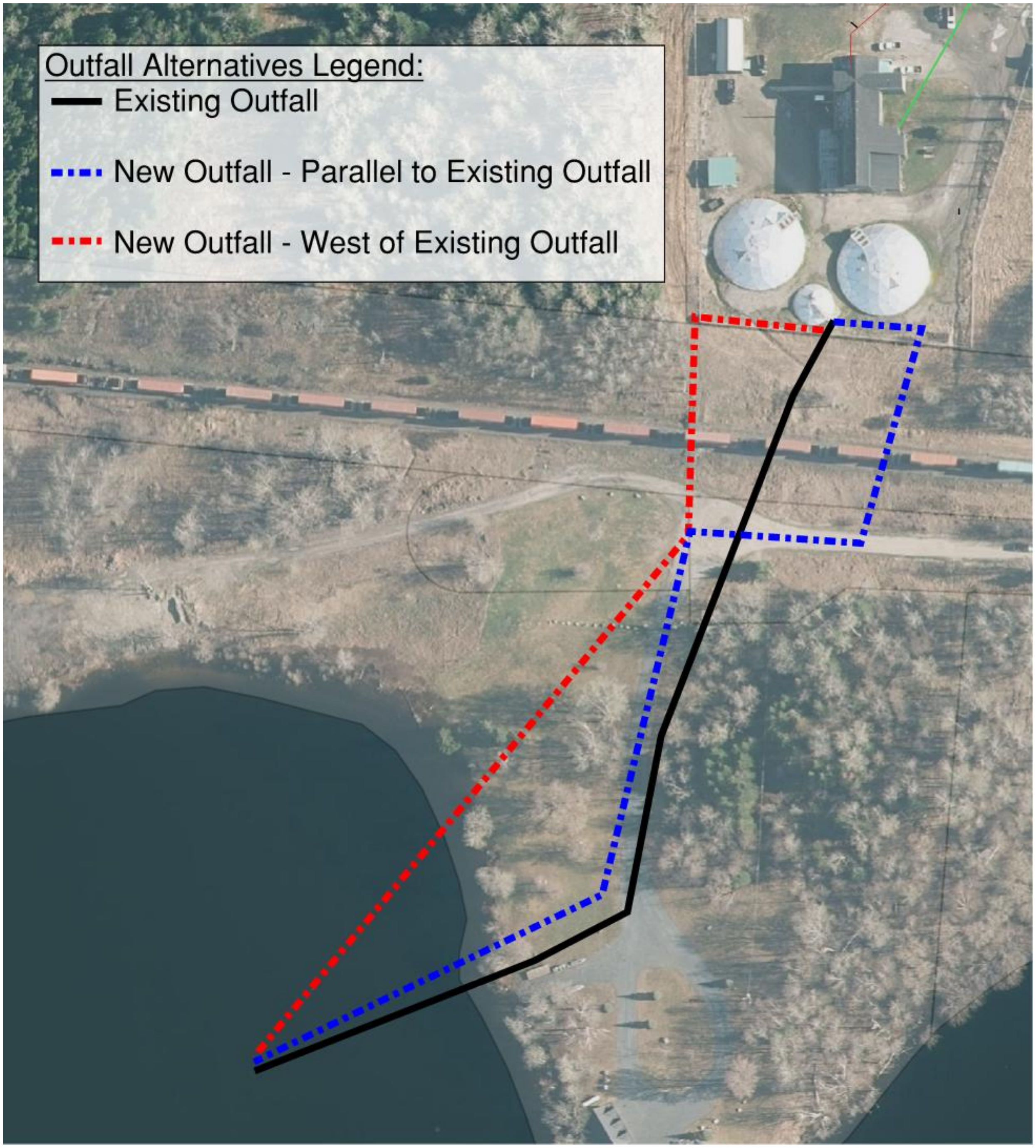

Figure 10-15: Existing Outfall and Shortlisted New Outfall Alternatives

10.3 Evaluation of Shortlisted Alternatives

10.3.1 Liquid Treatment Train

10.3.1.1 Technical Benefit Scoring

The Technical Benefit Scoring results and rankings for the two liquid treatment train alternatives are presented in Table 10-7 below. The detailed evaluation is presented in **Appendix F**.

Table 10-7: Liquid Treatment Train – Technical Benefit Scoring

Primary Criteria	Weight	Third CTU	IFAS Retrofit
Technical	35	26.1	28.5
Operational	30	22.7	23.1
Socio-Cultural	15	10.1	11.9
Natural Environment	20	12.1	14.5
Overall Scores	100	70.9	78.1
Scoring Rank	--	**2**	**1**
Overall Scores – Inverted Bias	100	67.4	76.9
Scoring Rank – Inverted Bias	--	**2**	**1**

The IFAS Retrofit scored the highest on the Technical Benefit Scoring due to its relative ease of implementation and process resiliency. The ranking for both alternatives remains consistent if the criteria weight bias is inverted between Technical & Operational criteria and Social & Natural Environmental criteria.

10.3.1.2 Life-Cycle Cost Analysis

A summary of the life-cycle cost (LCC) analysis and associated rankings is presented in Table 10-8. The cost estimation for the IFAS Retrofit was completed based on estimates for a MABR retrofit. The IFAS Retrofit displayed the lowest life-cycle cost over a 20-year project lifetime.

Table 10-8: Liquid Treatment Train – Life-Cycle Cost Analysis

Parameter	Third CTU	IFAS Retrofit
Capital Cost ($ millions)	$ 13.5 M	$ 10.0 M
Annual O&M Cost ($ millions)	$ 0.095 M	$0.079 M
Life-cycle Cost (20-year NPV) ($ millions)	$ 14.9 M	$ 11.2 M
LCC Ranking	**2**	**1**

10.3.1.3 Decision Model Results

Benefit-to-Cost ratios for both alternative technologies are presented in Table 10-9 according to the results from the technical benefit scoring and life-cycle cost analysis. Based on the results of this evaluation, the IFAS Retrofit is the preliminary preferred alternative for the liquid treatment with the highest Benefit-to-Cost ratio of 7.0.

Based on the results of the analysis, the costing outweighs the technical benefit for both alternatives. The ranking of the preferred option remains consistent with scoring from an inverted bias.

Table 10-9: Liquid Treatment Train – Decision Model

Parameter	Third CTU	IFAS Retrofit
Overall Technical Benefit Scores	70.9	78.1
Life-cycle Cost (20-year NPV) ($ millions)	14.9	11.2
B:C ratio	**4.8**	**7.0**
Ranking	**2**	**1**

10.3.1.4 Liquid Treatment Train Preliminary Preferred Alternative

In summary, the IFAS Retrofit alternative was preferred for the liquid treatment train expansion for the Sioux Lookout WWTP. This alternative occupies the smallest footprint of the shortlisted alternatives, requires the least complex construction, and will improve process resiliency for the plant. Furthermore, it allows for further future expansion within the existing footprint of the plant while maintaining available space at the site for other future uses.

The opinion of probable cost for the IFAS Retrofit alternative is less capital and operationally intensive than the Third CTU alternative. The combination of higher technical score and lower life-cycle cost results in a higher Benefit-to-Cost ratio for the MABR Retrofit alternative.

Overall, the evaluation results reflect that the IFAS Retrofit alternative is less capital intensive and provides the most feasible solution that will meet the current and future wastewater treatment needs for the Municipality of Sioux Lookout.

10.3.2 Solids Treatment Train

10.3.2.1 Technical Benefits

Aerobic digestion was identified as the only feasible long-listed alternative for the solids treatment train at the Sioux Lookout WWTP. All other alternatives were screened out due to incompatibility with the existing facility and operational practices or due to low financial feasibility.

As the only shortlisted option, aerobic digestion is the preferred alternative for the solids treatment train. This alternative is compatible with existing operational practices, provides the required treatment capacity, and fits within the space constraints at the site. The potential for odour generation during operation will need to be considered during the detailed design of the upgrade. Construction of the new tankage will result in a temporary increase in truck traffic, noise, and dust production associated with rock removal and concrete pouring.

10.3.2.2 Life-Cycle Cost Analysis

An overview of the LCC analysis for the aerobic digester is presented in Table 10-10. The life-cycle cost was calculated for a 20-year project lifetime.

Table 10-10: Solid Treatment Train – Life-Cycle Cost Analysis

Parameter	Aerobic Digestion
Capital Cost ($ millions)	$ 5.1 M
Annual O&M Cost ($ millions)	$0.063 M
Life-cycle Cost (20-year NPV) ($ millions)	$ 6.0 M

10.3.3 Final Effluent Outfall

10.3.3.1 Technical Benefit Scoring

The Technical Benefit Scoring results and rankings for the two new outfall alternatives are presented in the Table 10-11 below. The detailed evaluation is presented in **Appendix F**.

Table 10-11: Outfall Alternatives – Technical Benefit Scoring

Primary Criteria	Weight	New Outfall - Parallel to Existing Outfall	New Outfall - West of Existing Outfall
Technical	35	24.5	31.9
Operational	25	17.5	23.8
Socio-Cultural	15	8.4	14.1
Natural Environment	25	22.9	22.0
Overall Scores	100	73.3	91.7
Scoring Rank	--	**2**	**1**
Overall Scores – Inverted Bias	100	74.0	91.3
Scoring Rank – Inverted Bias	--	**2**	**1**

The New Outfall – West of Existing Outfall alternative scored the highest on the Technical Benefit Scoring due to its relatively lesser impacts on the private property owner. The ranking for both alternatives remains consistent if the criteria weight bias is inverted between Technical & Operational criteria and Social & Natural Environmental criteria.

10.3.3.2 Life-Cycle Cost Analysis

A summary of the LCC analysis and associated rankings is presented in Table 10-12. The New Outfall – West of Existing Outfall alternative displayed the lowest life-cycle cost over a 20-year project lifetime.

Table 10-12: Outfall Alternatives – Life-Cycle Cost Analysis

Parameter	New Outfall - Parallel to Existing Outfall	New Outfall - West of Existing Outfall
Capital Cost ($ millions)	$ 2.4 M	$2.2 M

Parameter	New Outfall - Parallel to Existing Outfall	New Outfall - West of Existing Outfall
Annual O&M Cost ($ millions)	$ 0.03 M	$ 0.03 M
Life-cycle Cost (20-year NPV) ($ millions)	$ 2.8 M	$ 2.6 M
LCC Ranking	**2**	**1**

10.3.3.3 Decision Model Results

Benefit-to-Cost ratios for both outfall alternatives technologies are presented in Table 10-13 according to the results from the technical benefit scoring and LCC analysis. Based on the results of this evaluation, the New Outfall - West of Existing Outfall is the preliminary preferred alternative for the new outfall with the highest Benefit-to-Cost ratio.

The ranking of the preferred option remains consistent with scoring from an inverted bias.

Table 10-13: Outfall Alternatives – Decision Model

Parameter	New Outfall - Parallel to Existing Outfall	New Outfall - West of Existing Outfall
Overall Scores	73.3	91.7
Life-cycle Cost (20-year NPV) ($ millions)	2.8	2.6
B:C ratio	**26.2**	**35.3**
Ranking	**2**	**1**

10.3.3.4 New Outfall Preferred Alternative

In summary, the cost-benefit analysis determined that the New Outfall - West of Existing Outfall alternative was preferred for the proposed replacement of the Sioux Lookout WWTP outfall. This alternative has the benefit of less impact on the private property owner during construction and operation and therefore increased likelihood for securing a new easement. The proposed route for the new outfall will be further refined in detailed design.

11. Climate Change Considerations

11.1 Background

Climate change has been particularly impactful over the past three decades and has become known for its rapid and far-reaching effects across the globe. In particular, climate change can cause the following key impacts (United Nations, n.d.):

- Increased temperatures,
- Increased severity of storms,
- Increased droughts,
- Warmer oceans and rise in sea level, and
- Loss of species, etc.

Some examples of environmental aspects that are affected by climate change are depicted in Figure 11-1 below.

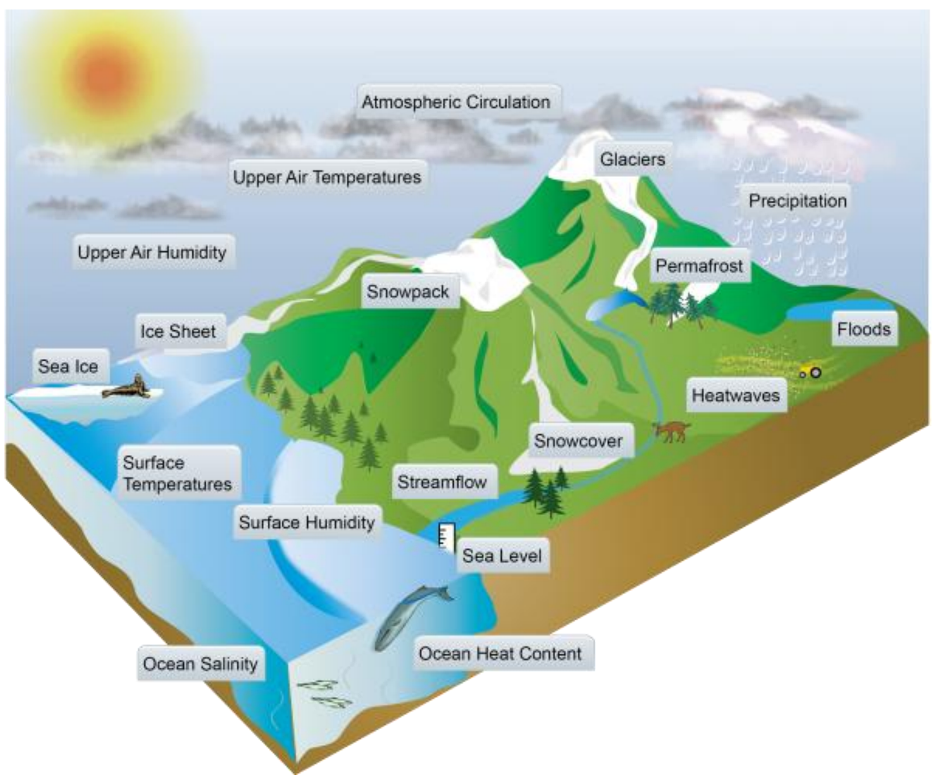

Figure 11-1 Climate Change Indicators (Courtesy of NOAA NCDC)

Much like the rest of the world, Canada has seen a rising trend in increased temperatures over the past three decades. Since 1948, the number of days under extreme heat conditions, also known as days experiencing 'heat waves', have increased for at least 60% of the country. In Ontario alone, based on historical data for the time period of 1948 to 2023, the total number of heatwaves was seen to have increased (ECCC, 2025).

The effects of climate change on temperature and rainfall can be predicted based on a variety of complex data (including greenhouse gas emissions) and modelling and are typically called ‘Climate models’. This is often used to predict and quantify the approaching magnitude of variation in climate.

Climate models utilize Representative Concentration Pathways (RCPs), which indicate the degree of global warming based on projected greenhouse gas (GHG) emissions and associated population growth, economic and development activity, energy intensity etc. The RCPs typically range from a ‘low’ emission scenario which includes active mitigation measures for global warming as RCP 2.6, followed by two ‘intermediate’ scenarios of RCP 4.5 and RCP 6.0, and lastly, a ‘high’ emission scenario of RCP 8.5. The higher the RCP, the higher the degree of global warming (Government of Canada, 2024).

One climate change study by York University investigated the change in temperature and precipitation based on the RCP projections, and is relevant in the context of Ontario’s climate. The study utilized mean baseline data for the period of 1986-2005, and the model results projected the increase in Ontario's average maximum temperature for the year 2070 to be in the range of 1.8 to 6.4 °C, based on the least (RCP 2.6) to the worst case emissions scenario (RCP 8.5), respectively (Climate Change Team at LAMPS, York University, n.d.) (Figure 11-2).

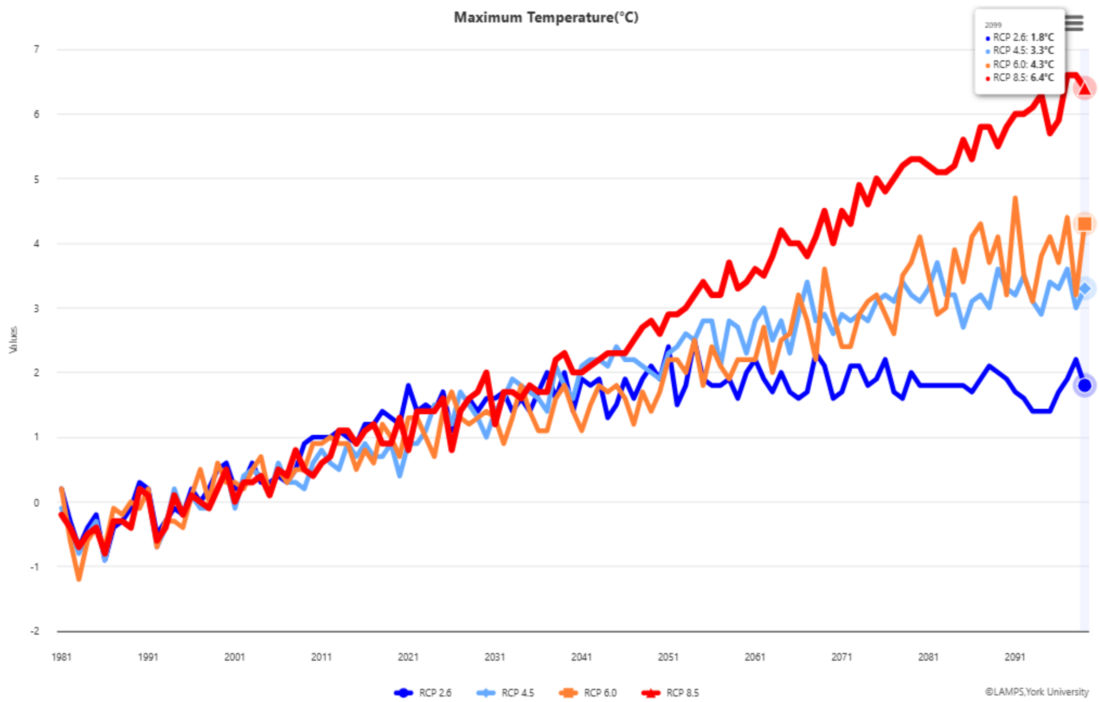

Figure 11-2 Projections for Increasing Maximum Temperatures in Ontario (Courtesy of LAMPS, York University)

Similarly, the model projected the change in Ontario's average precipitation to increase in the range of 50.6 to 136.1mm, based on the least (RCP 2.6) to the worst case emissions scenario (RCP 8.5), respectively (Climate Change Team at LAMPS, York University, n.d.), (Figure 11-3).

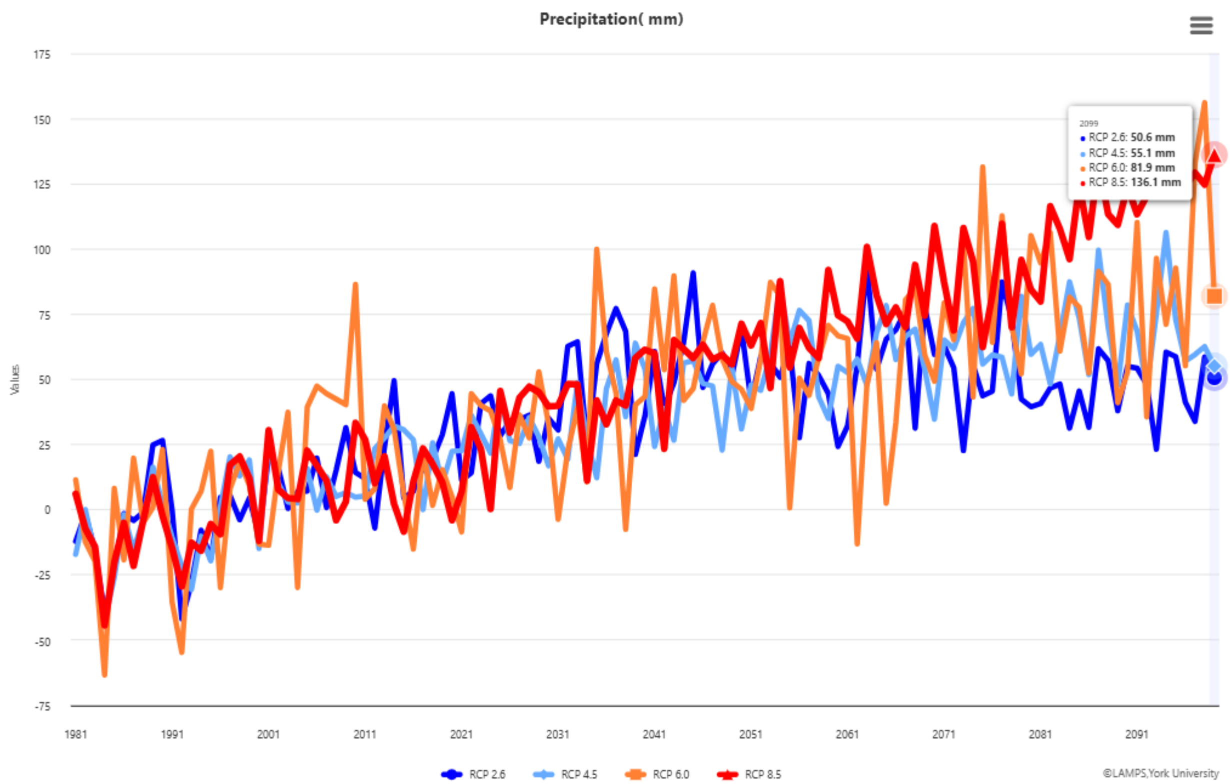

Figure 11-3 Projections for Increasing Precipitation in Ontario (Courtesy of LAMPS, York University)

11.2 Historical Climate Data for Sioux Lookout

Canadian Climate Normals are 30-year averages of weather data such as temperature, wind, precipitation etc., and are used to summarize and track long-term changes in regional climate. For Sioux Lookout, the most recent Canadian Climate Normals are for the period of 1991 to 2020, issued by the Government of Canada. A graph summarising this period of data is depicted in Figure 11-4. Average maximum summer temperatures were seen to range from 15°C to 25°C, and average minimum winter temperatures range from 0°C to -23°C, with the majority of precipitation being received in the months of May and June.

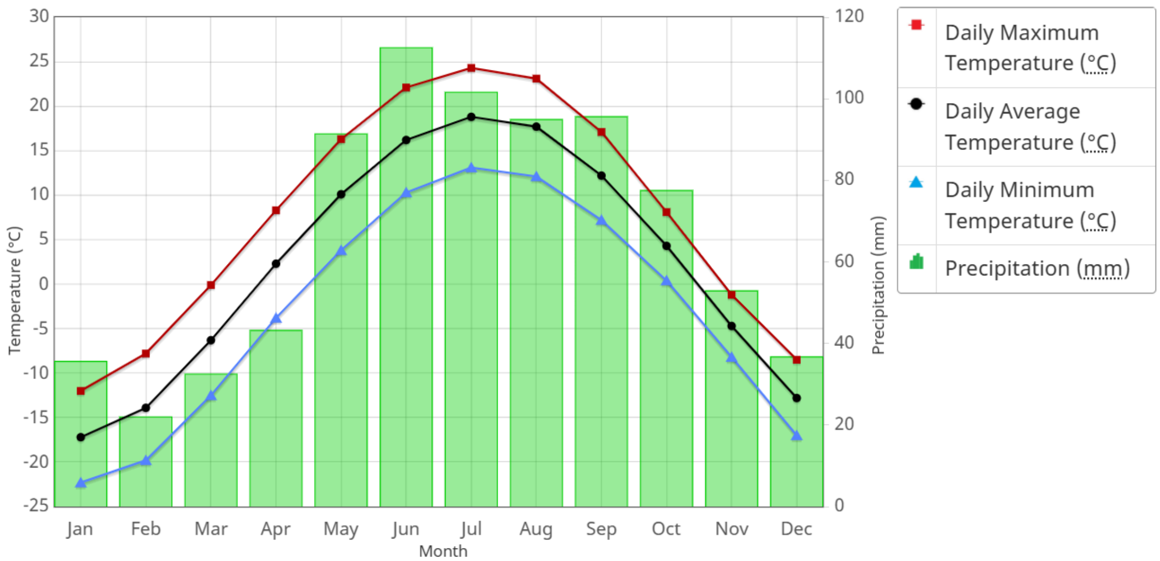

Figure 11-4: Sioux Lookout Climate Normals 1991-2020 (Courtesy of Government of Canada)

Based on historical data, the Climate Change Normals for 1961-1990 and 1991-2020 show considerable differences, as seen in Table 11-1. For instance, the total precipitation for the month of May increased from 56.1 mm in 1961-1990 to 86.8mm in 1991-2020. For temperature, the average temperature across the summer (Jun-Aug) have increased by approximately 1°C.

Table 11-1: Sioux Lookout Climate Normals – Comparison of Data from 1961-1990 and 1991-2020

Month	1961-1990 Daily Average Temperature (°C)	1991-2020 Daily Average Temperature (°C)	1961-1990 Rainfall (mm)	1991-2020 Rainfall (mm)
Jan	-18.9	-17.2	0.3	1.2
Feb	-15.5	-13.9	0.4	1.3
Mar	-7.6	-6.3	5.9	10
Apr	1.9	2.3	24.2	21.2
May	9.8	10.1	56.1	86.8
Jun	15.2	16.2	96.2	112.1

Month	1961-1990 Daily Average Temperature (°C)	1991-2020 Daily Average Temperature (°C)	1961-1990 Rainfall (mm)	1991-2020 Rainfall (mm)
Jul	18.6	18.8	93.5	103.6
Aug	16.8	17.7	87.6	92.5
Sep	10.9	12.2	80.1	94.5
Oct	4.5	4.3	45.2	60.3
Nov	-5.2	-4.7	8.8	15.2
Dec	-15.4	-12.8	1.3	1.5

11.3 Climate Change Context for the Sioux Lookout WWTP

Given the rising global change in established climate trends, climate change is critical for asset and infrastructure planning. This is particularly important for long-term planning, and in order to implement systems and structures that are resilient to and capable of mitigating the adverse and variable impacts of climate change as much as reasonably possible.

For wastewater treatment systems, climate change can have a host of impacts on the collection network and the WWTP. For instance, climate change is known to cause increased precipitation and storms, increased severity of storms, and increased snow melt. This can, in turn, lead to a higher degree of inflow and infiltration, which can cause a higher volume of inflows to enter the collection network and the WWTP. These added volumes often consume system capacity and may cause the wastewater collection system and pumps to exceed their firm capacity during peak flows. Inflow and infiltration may also lead to adverse effects such as flooding of the system, or emergency bypasses to the environment.

Increased rain and snow melt also have the potential impact of diluting the influent wastewater quality, beyond the level to which existing biological treatment units at the Sioux Lookout WWTP can effectively treat the wastewater. This can have consequences such requiring longer duration of treatment, higher intensity of process units such as aeration, higher chemical usage, more energy intensive plant operations, etc.

Additionally, climate change can cause an increase in heat waves and drought conditions, as well as the durations of these phenomena. Fluctuating climate patterns can in turn impact local receivers and watersheds. Hence, the final receiver for the effluent can also experience adverse effects such as low flow conditions, which may impact how much effluent can safely be discharged into the receiver. For the Sioux Lookout WWTP, this is not a critical concern, since the treated effluent discharge is to Pelican Lake, which is a relatively large receiver with stable flows, when compared to smaller creeks.

On the other hand, extreme rain and/or snow melt phenomena is also known to cause flooding in waterways. In the context of Sioux Lookout, the most recent major flooding event of Pelican Lake was noted to be in May 2022. The WWTP was noted to have functioned without any issues during this event, and was able to continue safe discharge of treated effluent into Pelican Lake. Hence, flooding concerns in the environment are not noted to be critical for the Sioux Lookout WWTP, and the WWTP exhibits adequate resiliency in this regard.

11.4 Considerations for Alternatives Evaluation

Due to the effects of climate change, there is a higher likelihood of changes in the volume and quality of influent to the WWTP, which impact the system and equipment capacity and may also reduce the overall treatment efficiency of the Sioux Lookout WWTP. In light of this, this Class EA has integrated climate considerations as vital and necessary factors for the evaluation of all alternatives being considered for the Sioux Lookout WWTP.

As noted in Table 8-3, the impacts on and of climate change (greenhouse gas emissions & carbon footprint) were key criteria that were evaluated when comparing different alternatives relative to each other. The scoring and associated weightage reflects the effect to which each alternative could best addresses these criteria, and ensures that climate change is a factor that drives decision making, and that the preferred alternative aligns with this Class EA’s desired outcome for a more sustainable choice that accounts for climate change and its impacts.

11.4.1 Climate Change Impacts

With regard to the preferred alternative and design concept, the IFAS module is a technology that does not require high intensity of infrastructure, particularly of concrete or energy intensive materials. The technology also offers maximum reuse of existing infrastructure and is often installed in retrofits since it is extremely suitable for re-use in existing tank structures. Additionally, the operational process for IFAS is less energy intensive than other alternatives considered.

Furthermore, the IFAS carriers offer some options for more environmentally sustainable materials, such as biodegradable organics in the case of MOB, or recycled plastic carriers for the MBBR. These options can further improve sustainability and reduce overall environmental impact.

With regard to biodiversity conservation, the area footprint, as well as the construction impacts of implementing the IFAS technology are expected to be minimal. Overall, the building structures for the expansion will be built on the existing Sioux Lookout WWTP site via existing or smaller new external tanks. Supporting structures and piping will also be built on the existing site, except for the outfall pipe that will discharge to Pelican Lake. Impacts on the environment from the outfall construction are mainly anticipated during the construction period, and are expected to be minimal and temporary in nature. The dense forest cover to the west and south of the Sioux Lookout WWTP are not anticipated to be impacted by this alternative.

11.4.1.1 GHG Emissions

Greenhouse gas (GHG) emissions are often described in terms of the Methane (CH_4) and Nitrous oxide (N_2O) emissions resulting from the processes that cause them. These emissions are then quantified by relating their emission factors to the Global Warming Potential, which is a measure of how much heat a greenhouse gas can trap in the atmosphere over a specific time period, relative to that of carbon dioxide (CO_2).

For wastewater treatment processes, a variety of factors such as the scale, type of influent, treatment type, etc. can impact these emissions. For biofilm based processes, further complexity arises for the estimation of GHG emissions due to the type of process, type of microorganisms, the reactor, the treatment configurations, etc. Due to the high complexity and intricate relationship between the variety of factors impacting treatment, it is often difficult to quantify or predict emissions from full-scale systems. This also makes comparison of results from studies challenging.

There is limited information available on GHG emissions from IFAS technologies. Of note, one study by He et. al investigated the impacts of N_2O emissions from the IFAS technology in comparison to a solo sludge system similar to conventional systems and noted that IFAS systems are capable of producing 50%–83% lower N_2O emissions when compared to suspended sludge systems. The study noted that biofilms can perform as a "sink," promoting N_2O reduction through endogenous denitrification (He, Liu, Li, Zhu, & Liu, 2023). The design of the reactor, as well as preceding processes in the treatment train can highly impact overall performance and emissions from the IFAS technology. Overall, owing to the lower area footprint and lower requirements for concrete construction, it can be said that the IFAS has lower anticipated GHG emissions when compared to larger conventional treatments such as traditional CTUs.

11.4.2 Climate Change Mitigation

The IFAS technology is known to handle variations in influent flow well. There is reduced risk of 'wash out' or the loss of microorganisms that treat the wastewater in this process, since the microorganisms are stabilized on the IFAS carriers. Hence, the technology is anticipated to be capable of handling peak flows or flow increases from climate change without major impacts to the quality of treatment, and exhibits adequate resiliency to peak flows, or sudden increases in flow volumes.

The IFAS process can also be scaled up easily, to meet flow increases through the addition of floating IFAS media or fixed modules and offers some flexibility to increase output without the need for additional tankage. Hence, it also offers more sustainable phasing alternatives to meet flow increases beyond the planning period.

11.5 Summary

Overall, the preferred alternative considers climate change as a key factor in its decision making and implementation. The preferred treatment technology, the IFAS, has minimal impact on climate change and has a moderate to high ability to mitigate the anticipated impacts from climate change on the Sioux Lookout WWTP. The outfall pipe path also has limited impact on the surrounding and biodiversity. Overall, construction of building structures is relatively smaller in scale and is anticipated to have low to moderate impacts during construction, which are expected to be temporary in nature.

12. Preferred Design Concept

Following a detailed cost-benefit analysis which considered Natural Environment, Socio-Cultural, Technical, and Operational criteria, the preferred design concept is shown in Figure 12-1, and includes:

- IFAS retrofit of the existing liquid treatment system,
- New aerobic digesters to be installed on the existing WWTP site, and
- A new outfall to be installed west of the existing outfall.

The benefits of the preferred design concept include:

- Limited footprint required for plant expansion with the majority of proposed infrastructure upgrades to be installed on the existing WWTP site, limiting environmental, archaeological, and cultural heritage impacts,
- Limited construction complexity with the ability to construct both the aerobic digesters and new outfall offline while existing WWTP infrastructure remains operational, and
- Flexibility to add a third CTU and size the new outfall to allow for future plant expansions, as required.

The opinion of probable cost for preferred design concept totaled $19 M and is detailed in **Appendix G**. The Class 'D' level opinion of probable cost (-20% to +30%) was developed in 2025 $CAD and assumed one construction contract for the liquid treatment upgrades, solids treatment upgrades, and new outfall implementation. The opinion of probable cost shall be further refined in detailed design.

The following sections provide a proposed implementation schedule, permits and approvals, and potential impacts and mitigation measures for the preferred design concept.

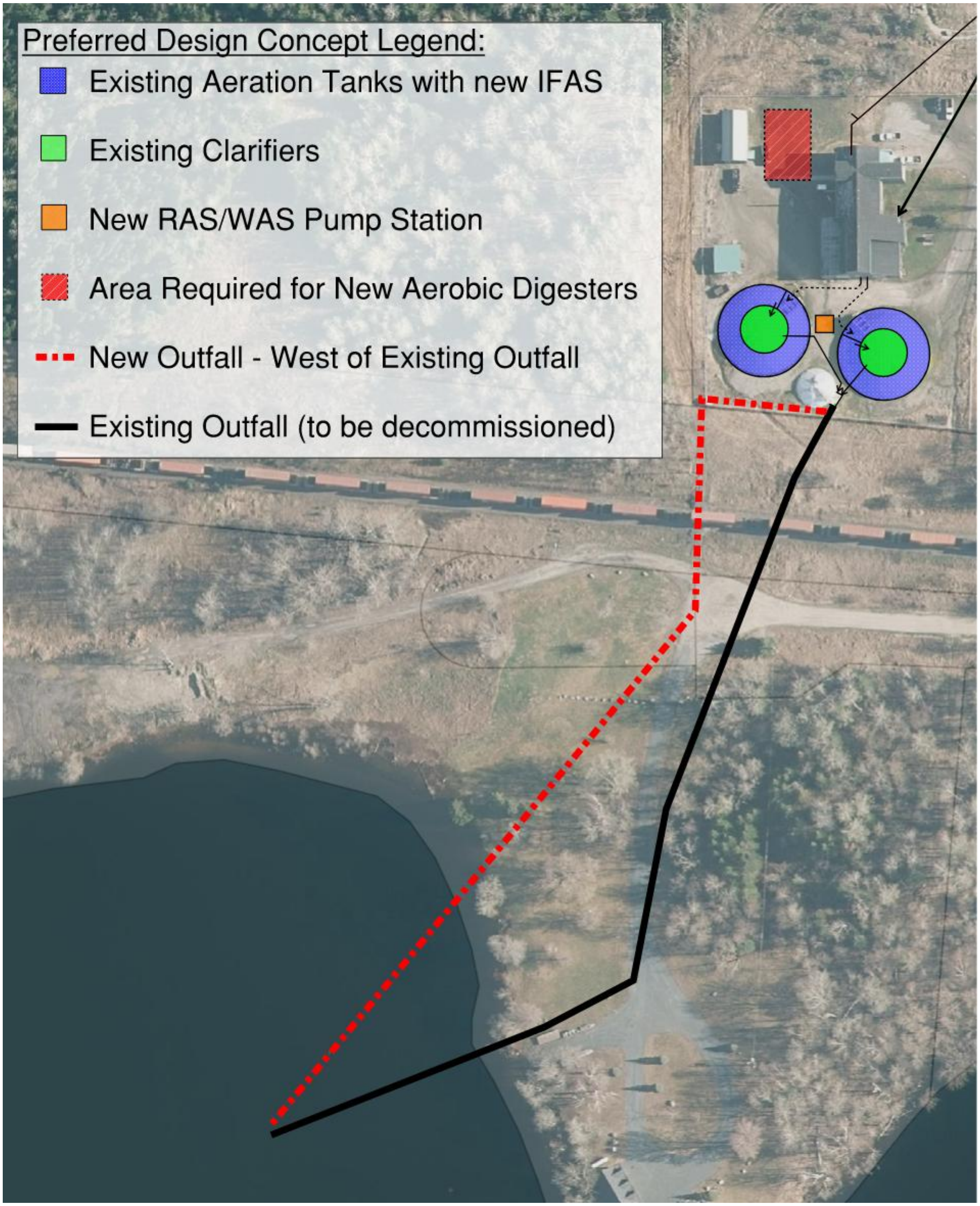

Figure 12-1: Preferred Design Concept

12.1 Implementation Schedule

The Municipality has received Provincial funding through the Municipal Housing Infrastructure Program – Health and Safety Water Stream to implement the preferred design concepts as presented in this report. The design and construction of the Sioux Lookout WWTP expansion is proposed in two contract phases to meet the funding deadlines:

- Contract 1 (Design and Construction – 2026)
    - Dewatering upgrades (without increasing the plant's Rated Capacity) to address the need to replace critical obsolete equipment (i.e. belt filter press).
- Contract 2 (Design – 2026, Construction – 2027-2028)
    - Expansion of plant's Rated Capacity to 3,400 m^3/d, including:
        - Installation of IFAS liquid treatment solution, including screening, chemical phosphorus removal, RAS/WAS pumping, and blower upgrades,
        - New aerobic digestion system, and
        - Replacement of the outfall.

12.2 Permits and Approvals

The following permits and approvals that will be required prior to construction have been identified, which will be confirmed during detailed design:

- Easement for installation of new outfall within private property,
- Canadian Nation Railway Utility Crossing application,
- MECP – ECA Amendment,
- MECP – Permit to Take Water for construction period (as required),
- Ministry of Natural Resources (MNR) Work Permits for work within a waterbody and along shoreline,
- Department of Fisheries Ocean (DFO) permitting,
- Approvals required for the new *Species Conservation Act* (as applicable),
- Transport Canada (Navigable Waters),
- Electrical Safety Authority notification, and
- Local utilities (hydro, gas, etc.).

12.3 Potential Impacts and Mitigating Measures

This section describes the potential impacts anticipated from the construction and operation of the preferred design concept, as well as the recommended mitigating measures to avoid or minimize such impacts.

Implementation of the preferred solutions are not expected to have significant impacts on the existing natural environment during operation; however, as with any construction project, there will be some temporary potential impacts to the public and environment during construction in areas such as noise, dust and vibration during the construction period. Most of the impacts will be of short-term duration and are expected to occur only during construction. Property owners adjacent to the sites where construction activities will take place should be notified in advance and provided with the Municipality's contact information should they encounter any problems during construction.

Construction of new infrastructure should adhere to strict safety guidelines and all applicable codes and standards. All construction work shall be carried out in accordance with the Occupational Health and Safety Act and other local regulations.

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

12.3.1 Receiving Water Quality

An assimilative capacity study was completed as part of this Class EA to assess impacts of this expansion on the quality of the receiving water and recommend effluent limits to the facility (Section 6.3.3). The ACS established effluent limits in consultation with the MECP with special consideration for the seasonal conditions of Pelican Lake. Recommended future effluent limits maintain existing load of effluent parameters.

12.3.2 Natural Heritage Features

No significant impacts to the existing natural heritage features are anticipated as a result of construction of the preferred liquid and solids treatment design concepts as they are confined to the existing Sioux Lookout WWTP site, which has been previously disturbed from the construction of the existing facility. However, construction of the preferred outfall replacement design concept may impact natural heritage features. A number of general mitigation options can be employed to avoid potential impacts, as follows:

- Clearly demarcate and maintain the site boundaries during project activities;
- Implement dust control measures in dry conditions;

- Avoid removal or disturbance to vegetation during the migratory bird nesting period (April – August). If vegetation removal or disturbance during this period cannot be avoided, conduct a pre-clearing nesting survey by a qualified biologist;
- Avoid activities resulting in major noise and vibration levels during the migratory bird nesting period (April – August), whenever possible;
- Avoid the storage of construction materials or equipment adjacent to sensitive natural features (e.g., shoreline) to minimize disturbance to these features and resident wildlife;
- Ensure all equipment is cleaned prior to transportation and use on the site to avoid the spread or introduction of invasive species on the site;
- Develop a soil management plan for the handling, disposal and management of excess soil or materials generated by construction to meet regulatory requirements;
- Develop a dewatering plan for the handling, disposal, and management of discharge to meet regulatory requirements;
- Conduct work outside of sensitive habitat for SAR;
- Fuel spills may potentially occur when refuelling construction equipment. The proposed mitigation measures include the following:
    - Apply proper construction techniques to reduce the risk of spills.
    - Develop and implement a plan for preventing, reporting and cleaning up fuel spills will be developed and ready for implementation and equipment required to clean up a spill will be contractually required to be on-site at all times.
- Minimize tree removal as much as possible, and replace trees as required;
- Re-plant and re-vegetate construction areas with local non-invasive species after construction is complete;
- Develop and implement an erosion and sediment control plan that can mitigate any adverse impact to Pelican Lake and prevent any uncontrolled discharge of turbid or sediment laden water; and,
- Implement sediment/erosion controls adjacent to natural features during project activities, with special attention to protect the shoreline and any SAR that could be present. Sediment and erosion control measures should consider mitigation of erosion of the shoreline on an “as required basis”.

Despite the WWTP site being disturbed, species at risk may be present on site. A detailed survey of the site should be conducted at detailed design for species at risk in the project area. If any threatened or endangered species are found, impact attenuation measures should be implemented to minimize impacts to wildlife.

12.3.3 Cultural Heritage Resources

As discussed in Section 5.4.2, no built heritage resources or cultural heritage landscapes were identified in the Study Area. Therefore, no further heritage studies are recommended.

The Stage 1 Archaeological Assessment of the Study Area determined that the existing Sioux Lookout WWTP site contained no archaeological potential (Figure 5-4). Therefore, no further assessments are required on the WWTP site to implement the preferred liquid and solids treatment train design concepts. However, a Stage 2 and Marine Archaeological Assessment of the proposed new outfall route are required prior to ground disturbance for geotechnical investigations and construction.

If archaeological resources are impacted during the implementation of the preferred solution, the Ministry of Heritage, Sport, Tourism and Cultural Industries must be notified at archaeology@ontario.ca. All activities impacting archaeological resources must cease immediately, and a licensed archaeologist will carry out an archaeological assessment in accordance with the Ontario Heritage Act and the Standards and Guidelines for Consultant Archaeologists.

The Funeral, Burial and Cremation Services Act, 2002, S.O. 2002, c.33 requires that any person discovering human remains must cease all activities immediately and notify the police or coroner. If the coroner does not suspect foul play in the disposition of the remains, in accordance with Ontario Regulation 30/11 the coroner shall notify the Registrar, Ontario Ministry of Public and Business Service Delivery and Procurement, which administers provisions of that Act related to burial sites. In situations where human remains are associated with archaeological resources, the Ministry of Citizenship and Multiculturalism should also be notified (at archaeology@ontario.ca) to ensure that the archaeological site is not subject to unlicensed alterations which would be a contravention of the Ontario Heritage Act.

12.3.4 Social Impacts

12.3.4.1 Public Notification

Public notification during construction is recommended to be facilitated through social media notifications, newspaper ads, construction signage and flyers to residents and businesses. All emergency services (Police, Fire, and Paramedic) should be notified of the project, specifically where construction is to impact access to public roads.

12.3.4.2 Noise, Dust and Vibration during Construction

Noise, dust and vibration during construction projects is unavoidable. Potential sources of noise, dust, and vibration are truck traffic and regular construction activities. These impacts can generally be mitigated following the mitigation measures below:

- All truck traffic, excavation equipment and other activity that potentially generates significant noise levels should be restricted to normal work hours pursuant to local municipal noise bylaws.
- Excavated materials should be used on-site wherever possible in order to minimize truck haulage to off-site disposal areas.
- Dust control measures (such as sweeping, dust control agents and mud mats) should be applied as necessary.
- Dry exposed soil should be kept wet to make it less susceptible to wind erosion and should be covered if left for extended periods of time.
- Pre-construction and post-construction surveys of neighbouring building/properties should be completed to ensure that any impacts associated with construction can be clearly identified.
- Conduct work within the noise bylaw requirements, provide hoarding around construction areas and working equipment, where possible.

12.3.4.3 Odours and Noise During Operation

Construction of the preferred design concepts is not anticipated to cause an increase in plant odours. To mitigate odour and noise issues for the neighbouring residential properties, the most odorous processes (i.e. Headworks) will continue to be housed within buildings.

Where possible, noise will be controlled by locating all equipment and machines indoors in buildings appropriately designed for noise attenuation.

13. References

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A

Appendix A: Consultation Documentation

B

Appendix B: Natural Environment Desktop Screening Report

C

Appendix C: Archaeological Stage 1 Assessment Report, Marine Desktop Assessment Report & Cultural Heritage Screening Report

D

Appendix D: Design Basis Technical Memorandum No. 1

E

Appendix E: Assimilative Capacity Study

F

Appendix F: Alternative Evaluation Matrices

G

Appendix G: Preferred Design Concept – Class 'D' Opinion of Probable Cost

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