

Project File Report (PFR)

Simcoe Wastewater Treatment Plant

Biosolids Management Upgrades Municipal Class Environmental Assessment

Prepared for: Norfolk County

HATCH

Norfolk County
Simcoe Wastewater Treatment Plant - Biosolids Management Upgrades - Municipal Class Environmental Assessment

Project File Report (PFR)

2026-04-08	2	Final	S. Fraser	O. Koc	O. Koc
2026-03-16	1	Final	S. Fraser	O. Koc/ M. Armstrong	O. Koc
2025-12-15	0	Final	C. Brennen	O. Koc/ M. Armstrong	O. Koc
Date	**Rev.**	**Status**	**Prepared By**	**Checked By**	**Approved By**
HATCH					

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

Executive Summary

Background

The Simcoe Wastewater Treatment Plant (WWTP), along with the Waterford, Port Dover, Port Rowan and Delhi WWTPs, provide wastewater treatment services to the residents of Norfolk County (County). The County's 2016 Integrated Sustainable Master Plan (ISMP) and 2007 Biosolids Management Plan (BMP) highlighted the need for upgrades to the Simcoe WWTP, with the goal to create a centralized biosolids treatment facility for the County. In 2024, the County initiated the process to review and evaluate biosolids management upgrade options for the Simcoe WWTP using a 2051 planning horizon and comparing traditional treatment technologies with new emerging technologies such as Thermal Hydrolysis Process (THP).

The County completed the Schedule B Municipal Class Environmental Assessment (EA) Study to evaluate the potential upgrades to the Simcoe WWTP, ensuring proposed solutions align with the County's needs and that proper consultation with all stakeholders has been conducted. This Project File Report (PFR) documents Phases 1 and 2 of the Class EA. The PFR will be available for public review for a period of 30 days. Any comments received will be addressed prior to the project proceeding.

Problem/Opportunity Statement

The problem/opportunity statement prepared for Phase 1 of the Simcoe WWTP Biosolids Management Upgrades Municipal Class EA has been defined as follows:

> *"Norfolk County must develop a long-term biosolids management solution to effectively handle materials generated at all wastewater treatment plants. The solution should accommodate future growth, evaluate emerging technologies, maximize value, be fiscally responsible, and minimize environmental impacts."*

Municipal Class Environmental Assessment

Under the provisions of the Ontario *Environmental Assessment Act*, 1990 (EAA) and Ontario Regulation 334, certain types of provincial and municipal undertakings can meet the requirements of the Act through the use of an approved environmental planning process referred to as a Class EA.

The Class EA process provides a standardized decision-making framework by which a Group or "Class" of undertakings can be planned and implemented in compliance with the Act without the need to complete an Individual Environmental Assessment. Upon completion of the process, the undertaking is considered approved and does not require formal submission to the Ministry of Environment, Conservation and Parks (MECP).

The Municipal Class EA guidance document prepared by the Municipal Engineers Association (MEA) (originally issued in October 2000 and amended in 2024) outlines the approved five phase process for the planning and design of municipal infrastructure.

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

- Phase 1 includes the problem identification.
- Phase 2 includes the identification of the preferred solution.
- Phase 3 includes the identification of the preferred design concept.
- Phase 4 includes the documentation of the EA process.
- Phase 5 includes the detailed design and construction of the project.

Consultation and engagement were integrated at key milestones throughout the project. Both virtual and in-person sessions were held with impacted stakeholders and Indigenous communities to ensure meaningful participation. This input was critical to identifying potential issues early in the process, allowing them to be addressed proactively before advancing to final recommendations.

Development and Evaluation of Alternative Solutions

The preliminary screening phase evaluated all the proposed Alternative Solutions to identify the solutions that align with the project's objectives and deserve further consideration. Identified solutions must meet all established screening criteria to advance in the Class EA study. The short-listed alternative solutions include

- Alternative Solution 3 – Centralized Anaerobic Digestion.
- Alternative Solution 4 – Centralized Thermal Hydrolysis Process.

Each Alternative Solution was evaluated to ensure it effectively addresses the issues identified in the Problem/Opportunity Statement. The evaluation criteria included environmental, social, economic, technical, and planning considerations to identify the most preferred solution. Solutions that did not improve the existing situation were excluded. The County's long-term growth was considered, emphasizing the need for the new biosolids management facility to accommodate future needs. The impact on natural heritage features was assessed for each solution, aiming to minimize environmental impacts. Input from the public and stakeholders was considered crucial for evaluating the feasibility and acceptability of each Alternative Solution. Solutions that did not meet these criteria were not advanced to the next phase of the Class EA Study.

Preferred Alternative Solution

The evaluation process identifies Alternative Solution 4 as the preferred Alternative Solution. Compared to Alternative Solution 3, Alternative Solution 4, a centralized thermal hydrolysis process, offers several key advantages. These include the production of Class A biosolids, greater operational flexibility, a smaller required footprint, and lower life cycle and upfront capital costs. The design will fit within the existing property boundaries and, when evaluated against the proposed Alternative Solutions, will provide the best overall balance of environmental protection, community benefit, cost efficiency, and long-term planning.

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

Public, Indigenous, and Agency Consultation

The public and agency consultation process of this Class EA involved several key steps to ensure transparency and gather input from stakeholders. A Notice of Commencement was issued to inform the public, relevant agencies, and Indigenous communities about the project and its scope. Additionally, one Public Information Centre (PIC) was held to receive feedback and incorporate comments into the Project's design. Rightsholders and stakeholders were also invited to review and comment on the project at various stages.

Throughout the process, information was shared through County project websites and public notices to keep stakeholders informed and engaged. Consultation activities identified concerns, gathered local knowledge, and incorporated public and agency feedback into project planning. This feedback has been documented and included in this report, which outlines how concerns were considered and mitigated in the final project design. Stakeholder input influenced the preferred design by highlighting the importance of minimizing impacts on the local community, particularly by reducing disruptions to the existing Lake Erie and Northern (L.E. & N.) Railway Trail and limiting increased truck traffic associated with construction activities.

The completion of the PFR is finalized with the issuance of a Notice of Completion inviting Indigenous communities, agencies and the public to review and provide input on the document within the 30 calendar-day review period. The Notice will identify the location(s) where the PFR can be reviewed.

Proposed Mitigation of Potential Impacts

The proposed project construction of the preferred Alternative Solution is within the existing Simcoe WWTP property boundary. Mitigation measures are outlined within the PFR to address potential impacts that may result from the project development.

Species at risk were found at the southwest of the existing facility during bird breeding surveys. Communication with the MECP will be required to ensure all requirements under the Endangered Species Act and Species at Risk Act are addressed prior to any construction activities.

Effectively managing increased truck traffic, both during construction and as a result of converting the Simcoe WWTP into a centralized biosolids treatment facility for the County, is essential to the success of the proposed alternative. A new access road to the facility is being proposed, to divert the truck traffic away from the nearby elementary school to improve safety for the general public and the plant operators. The access road feasibility is currently under review, pending the Class EA completion.

During construction, erosion and sediment control plans will be implemented, along with excess soil management plans, to ensure no contamination of the surrounding water sources and on-site reused soils.

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

Throughout the project, the County commits to clear and consistent communication with stakeholders and the public, providing updates on construction schedules, potential disruptions, and ongoing mitigation efforts. This approach aims to enhance transparency, address community concerns, and facilitate a successful implementation.

Conclusions and Recommendations

The County's Class EA study for the Simcoe WWTP Biosolids Management Upgrades Project identified Alternative Solution 4 – Centralized Thermal Hydrolysis Process as the preferred recommended solution. Alternative Solution 4 was identified as the preferred alternative over others because environmental, social, economic, technical, and planning considerations. Alternative Solution 4 will achieve a reduction in current CO_2 emissions, supports an increase in incoming sludge truck operation, has a lower capital cost (compared to other alternatives), follows Canadian Food Inspection Agency (CFIA) regulation, and has the smallest footprint of the short-listed alternatives. The Thermal Hydrolysis Process solution addresses the County's current problems and aligns with the County Biosolids Management Plan and Integrated Sustainable Master Plan.

While each of the alternative solutions was assessed based on potential impacts, recommended mitigation measures were offered to address these concerns. Construction activities during the implementation stage of the Project could result in impacts resulting from increased traffic, noise, dust and disturbance to the natural environment. The mitigation measures, detailed within this PFR, provide a framework to reduce these potential impacts and minimize their effect on the local community and natural environment. It is recommended that the County pursue Alternative Solution 4 – Centralized Thermal Hydrolysis Process as the preferred biosolids management upgrades solution for the Project and proceed with the design suggested in this report. The PFR is completed when the Notice of Completion is issued, inviting Indigenous Communities, agencies, and the public to review and provide feedback on the document within a 30-day review period.

Construction of the biosolids management upgrades at the Simcoe WWTP is anticipated to begin in 2027. This timeline is contingent upon County Council's approval of the capital budget, as well as successfully securing all of the permits and approvals detailed in Section 9.

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

List of Abbreviations

Definition	Abbreviation
AA	Archaeological Assessment
AE	Adult bird entering, occupying, or leaving a nest site (visible or not) or whose behavior suggests the presence of an occupied nest
AODA	Accessibility for Ontarians with Disabilities Act
ASI	Archaeological Services Inc.
BMP	Biosolids Master Plan
CAS	Conventional Activated Sludge
CF	Adult carrying food for young
CFIA	Canadian Food Inspection Agency
CO_2	Carbon Dioxide
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
County	Norfolk County
dBA	A-weighted Decibels
EA	Environmental Assessment
EAA	Environmental Assessment Act
ECA	Environmental Compliance Approval
END	Endangered
ESA	Electrical Safety Authority/Endangered Species Act
ESR	Environmental Study Report
FY	Recently fledged young bird or downy young – who's young leave the nest soon after hatching, incapable of sustained flight
GHG	Greenhouse Gas
GIS	Geographic Information System
H	Species observed in suitable nesting habitat during its breeding season
HCCC	Haudenosaunee Confederacy Chiefs Council
HDI	Haudenosaunee Development Institute
HL	Hazard Land
Individual EA	Individual Environmental Assessment
ISMP	Integrated Sustainable Master Plan
MCEA	Municipal Class Environmental Assessment
MCFN	Mississaugas of the Credit First Nation
MEA	Municipal Engineers Association
MECP	Ministry of Environment, Conservation and Parks
MNO #9	Métis Nation of Ontario Region 9
NASM	Non-Agricultural Source Material(s)

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

Definition	Abbreviation
NHIC	Natural Heritage Information Centre
NY	Nest with young
OB	Observed
OBBA	Ontario Breeding Bird Atlas
OHSA	Occupational Health and Safety Act
OMAFRA	Ontario Ministry of Agriculture and Rural Affairs
OP	Official Plan
OS	Open Space
PFR	Project File Report
PIC	Public Information Centre
PO	Possible breeding evidence
PSW	Provincially Significant Wetland
RDT	Rotary Drum Thickener
S	Singing male bird or adult bird producing other sounds associated with breeding (e.g., calls or drumming) in suitable nesting habitat during the species' breeding season
SARA	Species at Risk Act
SNGR	Six Nations of the Grand River
T	Presumed Territory based on the presence of an adult bird, in the same suitable nesting habitat patch on at least two visits, 1 week or more apart, during the species' breeding season
THP	Thermal Hydrolysis Process
TSSA	Technical Standards and Safety Authority
WAS	Waste Activated Sludge
WWTP	Wastewater Treatment Plant

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

Table of Contents

Executive Summary ..... **ii**

List of Abbreviations ..... **vi**

1. Background **1**

1.1 Objectives of the Class EA Study 2
1.2 Objectives of the Project File Report 2
1.3 Problem/Opportunity Statement 2

2. Municipal Class Environmental Assessment Process **4**

2.1 Principles of Environmental Planning 4
2.2 Overview of the MCEA Process 5
2.3 Schedule B Classification and Planning Phases 6
2.3.1 Phase 1: Problem or Opportunity Identification 6
2.3.2 Phase 2: Alternative Solutions Identification and Evaluation 6
2.3.3 Project File Report 7
2.3.4 Notice of Completion 7
2.3.5 Section 16 Order 7

3. Study Area Overview **10**

3.1 Study Area Location and Context 10
3.2 Existing Infrastructure and Facilities 11
3.3 Land Use and Recreational Features 13
3.4 Natural Environment Overview 16
3.5 Archaeological and Cultural Heritage Resources 16
3.6 Groundwater and Surface Water Protection 16
3.7 Geotechnical/Hydrogeological Considerations 17
3.8 Climate Change Considerations 17
3.9 Existing Roadway 19

4. Evaluation Methodology **20**

4.1 Identification of Constraints and Opportunities 20

5. Alternative Solutions **22**

5.1 Long List of Alternatives 22
5.2 Preliminary Screening of Alternatives 22
5.2.1 Screening Criteria and Rationale 22
5.2.2 Short-Listed Alternatives 23
5.3 Evaluation of Short-Listed Alternatives 28
5.3.1 Comparison of Alternatives 28
5.3.2 Life Cycle Cost Estimates 29
5.3.3 Evaluation Matrix 30
5.3.4 Selection of the Preferred Solution 30

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

6. Details of the Preferred Solution 33

6.1 Description of Preferred Solution 33
6.2 Implementation Schedule 35

7. Public, Indigenous, and Agency Consultation Process 36

7.1 Consultation and Engagement Strategy 36
7.2 Indigenous Engagement 36
7.2.1 MCFN 37
7.2.2 SNGR 37
7.2.3 HCCC/HDI 37
7.3 Engagement Tracking Log 37
7.4 Public Consultation 38
7.4.1 Notice of Commencement 38
7.4.2 Public Information Centre Notification 38
7.4.3 Public Information Centre 38
7.4.4 Summary of Public Comments 38
7.4.5 Notice of Completion 39
7.4.6 Review Period Comments 39

8. Mitigation of Potential Impacts and Monitoring 40

8.1 Environmental Considerations and Mitigation Measures 40
8.1.1 Natural Environment 40
8.1.2 Cultural and Archaeological Resources 40
8.1.3 Noise, Odour, Dust, and Vibration 40
8.1.4 Traffic and Access 41
8.1.5 Visual and Landscape Impacts 41
8.1.6 Community Engagement 42
8.1.7 Erosion and Sediment Control 42
8.1.8 Disposal of Excess Material/Soil Management 42
8.1.9 Traffic Management During Construction 42
8.1.10 GHG Emissions Control/Efficient Design 43
8.1.11 Lake Erie and Northern Railway Trail 43
8.2 Monitoring 43

9. Approval and Permits 44

10. References 45

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

List of Tables

Table 3.1: 2051 Projected Annual GHG Emissions for Short Listed Alternatives 18
Table 3.2: Parameters used for BEAM Calculator 19
Table 5.1: Long List of Alternative Solutions 22
Table 5.2: Technical Feasibility Comparison 29
Table 5.3: Cost Comparison of Alternative Solutions 30
Table 5.4: Evaluation of Alternatives 31
Table 7.1: Summary of PIC Public Feedback 38
Table 9.1: Simcoe WWTP Biosolids Management Upgrades – Permits and Approvals 44

List of Figures

Figure 2-1: Municipal Class EA Planning and Design Process Flow Chart 9
Figure 3-1: Study Area 10
Figure 3-2: Simcoe WWTP Site Plan with Proposed Expansion 12
Figure 3-3: Existing Infrastructure 13
Figure 3-4: Community Features Near Simcoe WWTP 14
Figure 3-5: Zoning Designations and Current Occupation of Service in Study Area 15
Figure 5-1: Alternative Solution 3 Process Flow Schematic 25
Figure 5-2: Alternative Solution 3 Preliminary Site Layout 26
Figure 5-3: Alternative Solution 4 Process Flow Schematic 27
Figure 5-4: Alternative Solution 4 Preliminary Site Layout 28
Figure 6-1: Alternative Solution 4 Site Layout and Proposed Access Road 34

List of Appendices

Appendix A Natural Heritage Report

Appendix B Stage 1 Archaeological Assessment

Appendix C Geotechnical and Hydrogeologic Investigations

Appendix D Project Contact List

Appendix E Long Point Region Conservation Authority – Engagement Meeting Minutes

Appendix F Mississaugas of the Credit First Nation – Engagement Meeting Minutes

Appendix G Engagement Tracking Log

Appendix H Notices

Appendix I Public Information Centre Poster Boards

Appendix J Feedback Forms

Appendix K Haudenosaunee Development Institute – Engagement Meeting Minutes

Appendix L Stage 2 Archaeological Assessment

Appendix M Stage I AA Access Road

Appendix N MECP Response Letter

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

1. Background

In 2016, the County issued its Integrated Sustainable Master Plan (ISMP[1]) to address municipal infrastructure needs across the County for the 25-year planning horizon. The ISMP presented a Biosolids Management Solution for the Simcoe Wastewater Treatment Plant (WWTP), building on the recommendations of the 2007 Biosolids Management Options Report. While the assessment showed that Simcoe WWTP would not require major upgrades based on capacity, it was identified as the central facility for biosolids treatment and storage for the County.

The proposed solution included aerobic digestion and thickening of biosolids at Simcoe WWTP, with re-purposing of the existing anaerobic digesters for biosolids storage, which required upgrades to meet operational, compliance and regulatory requirements. This storage would accommodate biosolids from Simcoe and in the future, excess biosolids from Port Rowan and Port Dover WWTPs.

In 2019, the Biosolids Management Solution was re-evaluated for a design year (2041 and 2051) because of forecasted population increases. This review considered the Delhi WWTP as an additional source of biosolids and recommended a technology shift to anaerobic digestion at Simcoe WWTP.

During the evaluation of biosolids management options for Simcoe WWTP, significant concerns were identified regarding the existing anaerobic digesters, particularly their compliance with Technical Standards and Safety Authority (TSSA) regulations. These issues presented operational and safety risks that required immediate attention. As part of the ISMP, a key recommendation was to transition from anaerobic to aerobic digestion through the construction of new aerobic digesters. This approach offers several distinct advantages, including regulatory compliance, cost-effectiveness, and improved sustainability.

Starting in 2024, Norfolk County initiated a new re-evaluation of biosolids management solutions for three key reasons:

- A county-wide review of biosolids management was deemed necessary. A broader scope enables more integrated planning, consistent environmental and social outcomes, and cost-effective technical solutions.
- Updated growth projections extended the planning horizon to 2051, including the addition of Waterford WWTP sludge to the design basis. Future growth impacts technical scalability, long-term cost projections, and environmental footprint, requiring forward-looking planning.

[1] (Norfolk County, 2016)

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

- Emerging technologies, such as Thermal Hydrolysis Process (THP), became more feasible and warranted consideration. Advanced processes improve environmental performance, reduce social impacts (e.g., odour), and offer potential economic and technical efficiencies.

1.1 Objectives of the Class EA Study

The main objectives of the Class Environmental Assessment (EA) study are to evaluate potential upgrades to the Simcoe WWTP to meet the biosolids management and storage requirements for the projected growth across the County. The preferred design concept should be technically viable, environmentally responsible, and economically feasible (considering both capital and operating costs). It should align with the County's priorities as outlined in the 2007 Biosolids Master Plan (BMP) and the 2016 ISMP.

Other Class EA objectives include facilitating comprehensive consultation with affected and interested parties to allow sharing of ideas, education, testing of creative solutions, developing alternatives, and documenting the planning and decision-making process in this Project File Report (PFR).

1.2 Objectives of the Project File Report

The PFR describes the planning and decision-making process followed during the Class EA Study for the potential upgrades to the Simcoe WWTP. The PFR describes the

- Various alternative solutions and design concepts (with differing impacts to environmental, social, economic, technical, and planning aspects) considered for the biosolids management upgrades.
- The evaluation methodology and criteria used to assess these alternatives.
- Anticipated potential impacts and mitigation measures.
- The rationale for selecting the preferred solution and implementation plans.

The Class EA process also allows members of the public, Indigenous communities, interest groups, and approval agencies to review the PFR during a 30-day review period. This period provides individuals with the opportunity to raise any outstanding concerns regarding the project with the County.

1.3 Problem/Opportunity Statement

Norfolk County is experiencing significant challenges in biosolids management, driven by aging infrastructure at the Simcoe and Port Dover WWTPs. These facilities are approaching end-of-life and no longer meet performance or regulatory standards. Issues such as Electrical Safety Authority (ESA) Code violations and poor digester performance further complicate operational reliability. Although the 2016 ISMP identified critical upgrades, they remain unaddressed. Compounding these concerns are space constraints at other WWTPs, updated growth projections to 2051, and evolving requirements under Ontario's Nutrient Management Act, necessitating a long-term, integrated strategy.

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

In response to these challenges, Norfolk County has a strategic opportunity to modernize its biosolids management approach. Phase 1 of the Class EA Study supports upgrading the Simcoe WWTP to meet future regulatory and operational needs. Advancements in wastewater treatment technologies now enable the production of Class A biosolids that comply with Canadian Food Inspections Agency (CFIA) fertilizer standards, offering environmental and economic benefits. A centralized approach could enhance operational efficiency, support fiscal sustainability, and align with long-term growth and planning objectives.

As part of the Class EA, Phase 1 resulted in the development of the following problem/opportunity statement:

> *"Norfolk County must develop a long-term biosolids management solution to effectively handle materials generated at all wastewater treatment plants. The solution should accommodate future growth, evaluate emerging technologies, maximize value, be fiscally responsible, and minimize environmental impacts."*

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

2. Municipal Class Environmental Assessment Process

The Environmental Assessment Act (EAA) is a legislative framework established to ensure that significant environmental effects of projects are considered before they proceed. Enacted in 1975 and regularly updated, the EAA mandates that major public and private sector projects undergo a thorough assessment process to identify, predict, and mitigate potential environmental impacts. The Act emphasizes public consultation and transparency, requiring project proponents to engage with stakeholders and consider their input throughout the assessment process. This ensures that environmental, social, and economic factors are integrated into the decision-making process, promoting sustainable development and safeguarding environmental quality.

The EAA outlines a comprehensive assessment procedure, which includes the preparation of an EA report, review and approval by the Ministry of Environment, Conservation and Parks (MECP), and opportunities for public input and appeals. The assessment can vary in complexity, from streamlined assessments for smaller projects to more detailed and rigorous evaluations for larger, more impactful ones. The Act also allows for the designation of individual projects for special consideration and establishes mechanisms for compliance and enforcement. The EAA serves as a critical tool for environmental governance in Ontario, ensuring that the potential impacts of projects are responsibly managed and mitigated.

The MECP's guide on climate change considerations in EAs helps project proponents evaluate both how their projects may contribute to climate change and how climate change could impact their projects over time. It emphasizes assessing greenhouse gas (GHG) emissions, incorporating climate projections, and planning for resilience and adaptation. The guide also outlines documentation requirements and provides sector-specific examples to facilitate meaningful integration of climate considerations into project planning.

2.1 Principles of Environmental Planning

The EAA prescribes a set of five key principles for successful environmental assessment planning, including

- **Early and Ongoing Consultation:** Engage affected parties early and continuously throughout the planning process to foster cooperation. This may include approval agencies, the public, Indigenous communities, property owners, interest groups, and municipalities. The proponent should involve those potentially impacted and interested as soon as possible to enhance the understanding of environmental issues before selecting the preferred solution. The County conducted early engagement and ongoing consultation throughout the Study, information related to the consultation process is included in Section 7.
- **Consideration of Alternatives:** Evaluate a reasonable range of alternatives, including functionally different "alternatives to" and "alternative methods" for implementing the solution. The "Do nothing" alternative must also be considered as a benchmark for

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

comparison. Information on the evaluation of alternatives can be found in Sections 4, 5, and 6.

- **Assessment of Environmental Effects:** Identify and consider the impact of each alternative on all aspects of the environment, including natural, social, cultural, technical, and economic factors. An evaluation of environmental effects and mitigation measures is detailed in Section 8.
- **Systematic Evaluation and Decision-Making:** Evaluate the advantages and disadvantages of alternatives to determine their net environmental effects. The planning process should include distinct evaluation points, focusing on a preferred alternative. The decision-making process should be phased, recognizing the dynamic nature of environmental decision-making and adapting to changing conditions and new information. Section 4 provides the evaluation methodology.
- **Clear Documentation:** Provide clear and complete documentation of the planning process to ensure "traceability" in decision-making. Documentation should detail the approach and adherence to the principles of environmental assessment planning throughout the process. Once the EA process is complete, a Project File Report will be prepared. This report will include all studies, activities, and evaluations completed during the EA. It will be shared publicly for a 30-day comment period, after which feedback will be reviewed and incorporated into the final recommendations before submission to the MECP.

2.2 Overview of the MCEA Process

A streamlined EA under the EAA is the Municipal Class EA (MCEA) process, which recognizes that there are varying levels of impact requiring a greater or lesser amount of assessment, depending on the nature of the work, the estimated cost and the potential impacts on the environment (which includes natural, social, economic, cultural and technical components). There are four “schedules” of undertakings defined in the MCEA to account for this variation. These schedules include:

- **Exempt Projects**: These projects, previously classified as Schedule A and A+, involve minor municipal works with minimal environmental impact. They are exempt from the requirements of the EAA.
- **Eligible for Screening Exempt**: Some projects may qualify for exemption from the EAA following a detailed screening process. Proponents must accurately complete this process to confirm eligibility or proceed under the applicable Schedule B or C requirements.
- **Schedule B**: Schedule B projects may cause some environmental effects and require public and agency consultation during the first two phases of the assessment process. A PFR must be prepared and made available for review, and if no concerns remain, the

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

project may proceed; these typically involve improvements or minor expansions to existing facilities.

- **Schedule C**: Schedule C projects typically involve constructing new facilities or major expansions and require a full planning and documentation process under the MCEA, including an Environmental Study Report (ESR) for public and agency review. If no concerns are raised during the review, the proponent may proceed with implementation once regulatory requirements are met.

This Project falls within the scope of a Schedule B project since it involves establishing a biosolids management facility at a sewage treatment plant where the biosolids were not generated, as per Municipal Class Environmental Assessment, February 2024, Appendix 1: Project Tables, Table B: Municipal Water and Wastewater Projects, Item 33c.

2.3 Schedule B Classification and Planning Phases

Projects classified under Schedule B must complete the initial two stages of the assessment process. This includes mandatory engagement with both the directly impacted public and relevant regulatory agencies to ensure awareness of the project and to gather and address any concerns. A Project File Report must be compiled and made accessible for public review. If no unresolved issues remain following this process, the project may move forward to implementation, pending completion of regulatory requirements. Typically, Schedule B projects involve upgrades or modest expansions to existing infrastructure, or the development of smaller-scale new initiatives. The Schedule B Class EA process is described below, and a flow chart is provided in Figure 2-1.

2.3.1 Phase 1: Problem or Opportunity Identification

In the initial phase, the need for a long-term biosolids management solution for Norfolk County's wastewater treatment plants is identified and formally documented. This phase includes a thorough assessment of current capacity limitations and projected future demands on the treatment infrastructure. To ensure a well-rounded understanding of the challenges and opportunities, input from the public and key stakeholders is actively gathered and integrated into the development of the problem and opportunity statement.

2.3.2 Phase 2: Alternative Solutions Identification and Evaluation

During Phase 2, a range of alternative solutions to address the identified problem and opportunity is developed. Each alternative is evaluated based on environmental, technical, social, and economic criteria. A Do-Nothing Option was also considered at this phase as a baseline comparison for other alternatives. This phase includes extensive consultation with stakeholders and rightsholders, including public agencies, Indigenous communities, and the general public. The goal of this phase is to identify a shortlist of feasible alternatives for further detailed analysis.

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

2.3.3 Project File Report

The formal planning process for Schedule B projects concludes at the end of Phase 2. At this stage, proponents are required to compile a Project File Report that documents all activities and decisions made during Phases 1 and 2. The Project File Report should include

- A summary of the project background and any previous studies.
- An explanation of the issue or opportunity that prompted the project.
- An environmental inventory or description of the project area.
- A review of alternative solutions considered and the rationale for selecting the preferred option.
- Any technical studies or reports related to environmental factors.
- A record of public and Indigenous engagement, including how feedback was addressed.
- Copies of public notices, letters, and bulletins.

2.3.4 Notice of Completion

Once the PFR is finalized and made publicly available, the proponent must issue a Notice of Completion. This notice marks the end of the formal planning process and initiates a minimum 30-day public comment period, during which stakeholders and rightsholders can review the documentation and provide feedback.

The Notice of Completion serves as an invitation for final input before the project proceeds to implementation, assuming all regulatory requirements have been satisfied, and no outstanding concerns remain.

2.3.5 Section 16 Order

Under the EAA, the Minister of the MECP has the authority to initiate a Section 16 Order. This Order may require the proponent of a project undergoing the Class EA process to

- Submit an application for approval of the project before they proceed. This is generally referred to as an Individual Environmental Assessment (individual EA).
- Meet further conditions in addition to the conditions in the Class EA. This could include conditions for
  - Further study.
  - Monitoring.
  - Consultation.

Reasons for requesting a Section 16 Order include unresolved concerns that a project proceeding under a Class EA may adversely impact constitutionally protected Aboriginal and Treaty rights. Such an Order may help prevent, mitigate, or remedy those potential impacts.

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

If a Section 16 Order request is made, the project proponent must wait for the Minister's decision and, if an Order is issued, may only proceed by complying with its conditions. To initiate a Section 16 Order request for a project, the request must be made before the 30-day public comment period ends. This period begins following the Notice of Completion and the public review of the PFR. A request may be made on the grounds that an Order could prevent, mitigate, or remedy potential adverse impacts on constitutionally protected Aboriginal and Treaty rights.

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

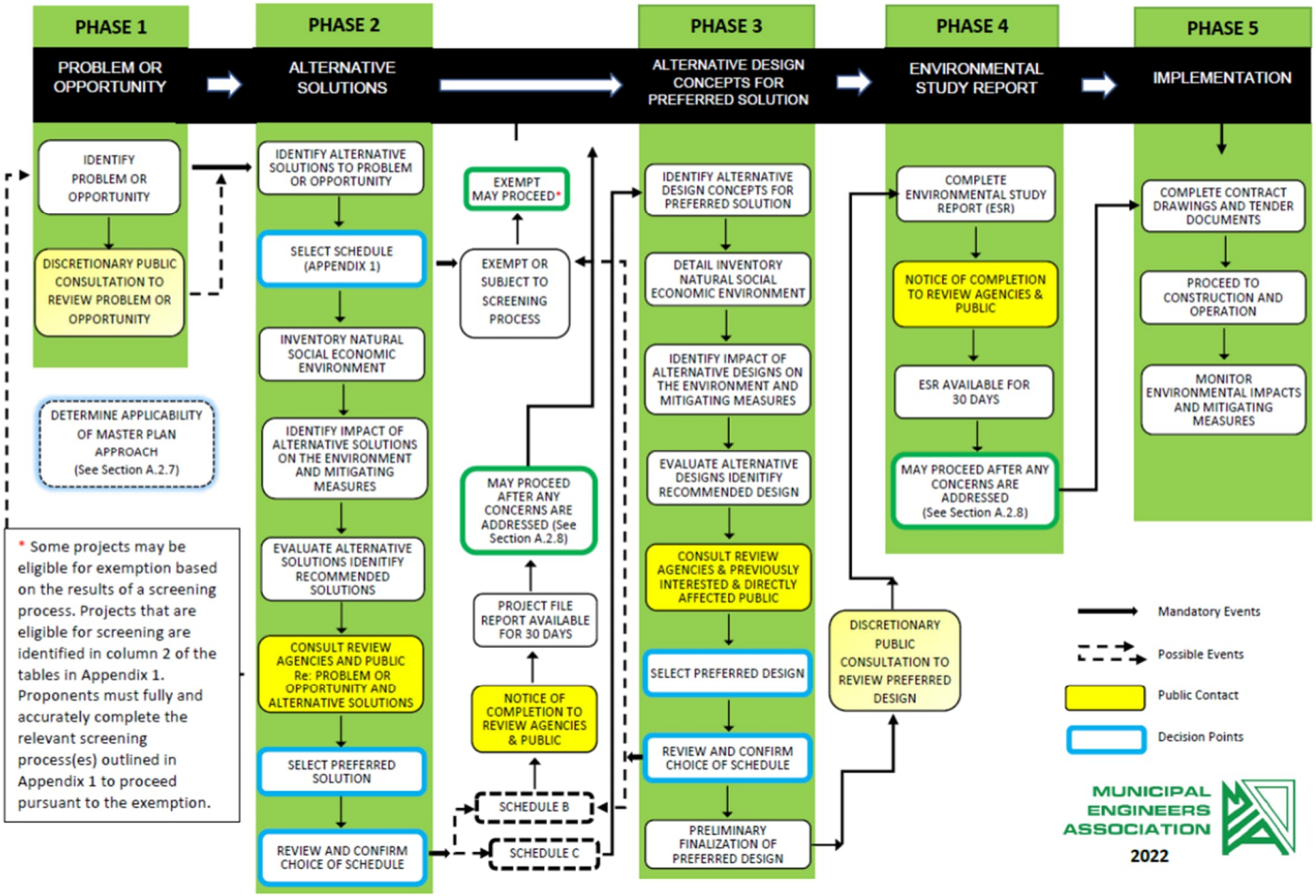


Figure 2-1: Municipal Class EA Planning and Design Process Flow Chart

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

3. Study Area Overview

3.1 Study Area Location and Context

The Simcoe WWTP is located at 16 Oakwood Avenue in Simcoe, Ontario, and is primarily surrounded by residential development. Key nearby features include St. Joseph's School, future residential areas, and Oakwood Cemetery to the east; a light commercial area to the west; and the Brook Conservation Area and the Lake Erie and Northern (L.E. & N.) Railway Trail to the south. The study area extends to the municipal property boundary of the WWTP, as shown in Figure 3-1, and is designated as Major Public Infrastructure in the County's Official Plan[2] (OP).

The site is zoned Open Space (OS), where wastewater treatment facilities are permitted. A proposed access road is expected to cross both OS and Hazard Land (HL) zones, where streets are permitted. The area also includes an abandoned rail corridor, which the OP protects for Other Future Linear Uses (OFR). Currently, this corridor accommodates several underground and overhead utility lines and forms part of a recreational trail network. The OP also identified the potential need for a collector-level roadway connecting future residential development east of the Simcoe WWTP to Victoria Street. The proposed additional use of the corridor for a roadway is supported by both the OP and Zoning; however, the roadway design must remain minimal in nature and complementary to the existing trail and surrounding natural features to reduce disruption and maintain the area's recreational and ecological character.

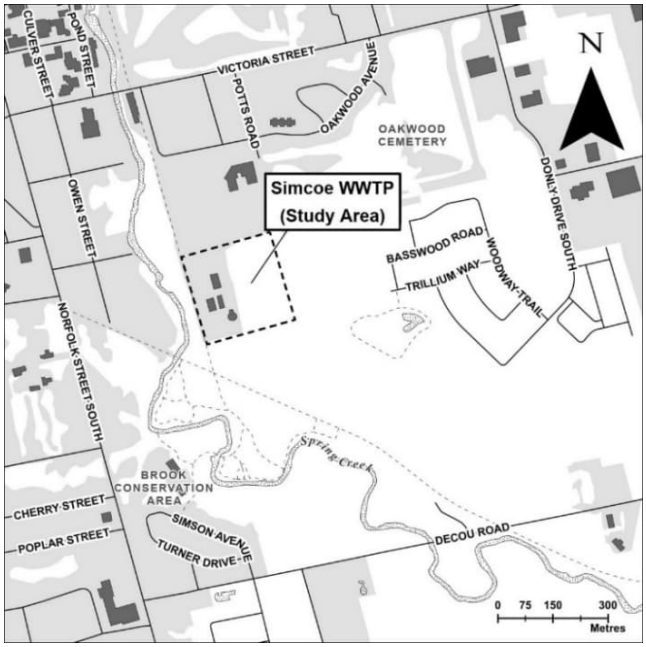


Figure 3-1: Study Area

[2] Norfolk County Official Plan

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

3.2 Existing Infrastructure and Facilities

The Simcoe WWTP is a conventional activated sludge (CAS) system with tertiary treatment for phosphorus removal, and has an Environmental Compliance Approval (ECA) rated capacity of 15,400 m^3/d. After preliminary treatment (screening and grit removal), the wastewater is further treated between two secondary treatment plants, each equipped with primary clarifiers, bioreactors and secondary clarifiers, with capacities as follows: Plant 1 was constructed in 1953 with a rated capacity of 2,671 m^3/d; and Plant 2 was constructed in 1979 with a rated capacity of 12,729 m^3/d. Both treatment plants discharge effluent to a common tertiary filtration facility and chlorination facilities prior to discharge to the Lynn River.

The Simcoe WWTP has three cylindrical concrete anaerobic digesters: one primary digester and two secondary digesters. These digesters were built as part of the original plant construction. Combined raw sludge and waste activated sludge (WAS) are co-thickened in the primary clarifiers. This combined sludge is directed to a primary anaerobic digester, with an effective volume of 2,507 m^3, and digested biosolids are stored in two secondary digesters with total storage volume of 2,437 m^3. Figure 3-2 shows an aerial map of the Simcoe WWTP. The facility is currently experiencing ESA Code and regulatory compliance issues with respect to digester performance and biosolids quality, which is a major challenge to operations. Figure 3-3 features the existing infrastructure in the area around Simcoe WWTP.

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

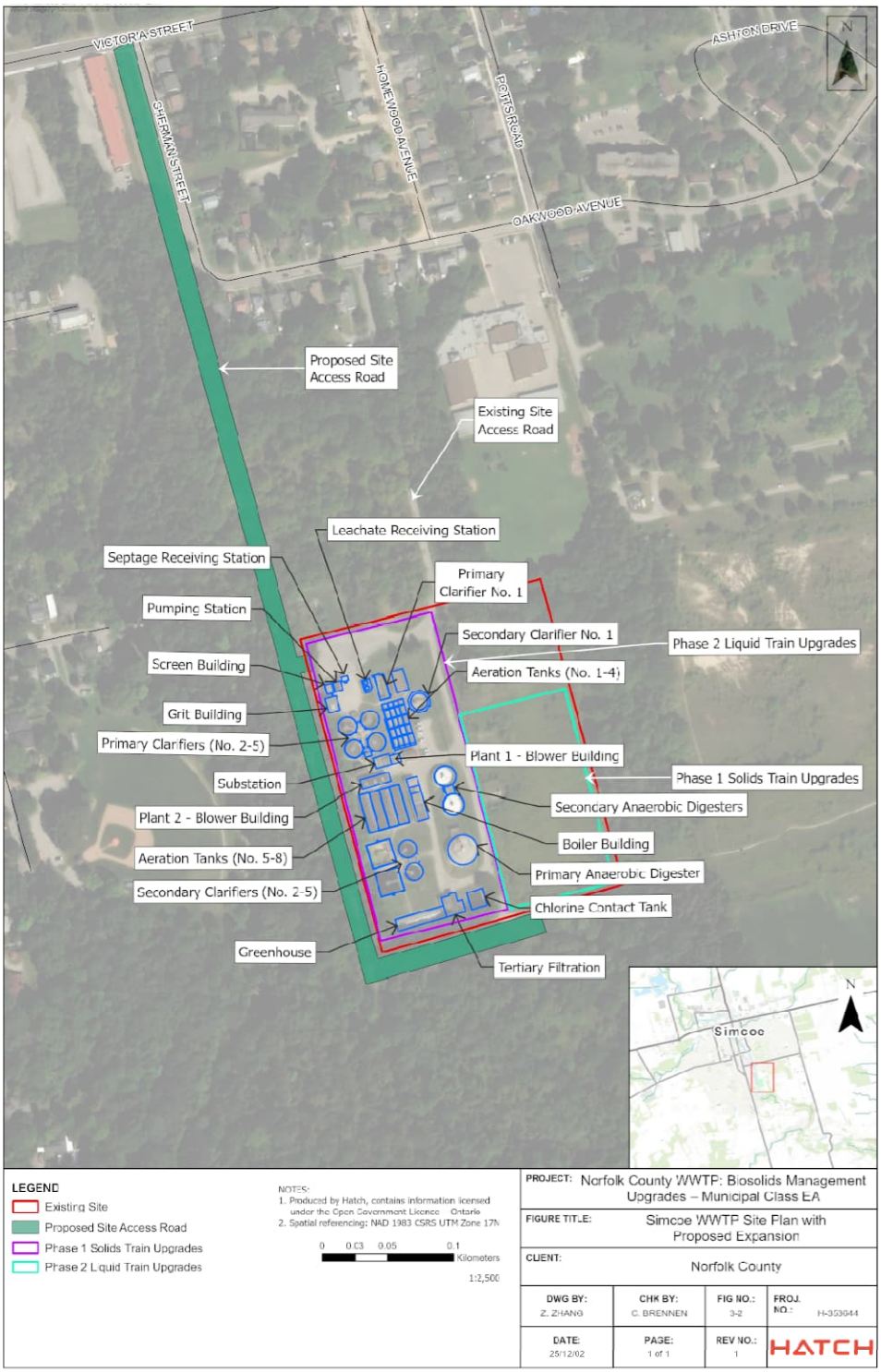


Figure 3-2: Simcoe WWTP Site Plan with Proposed Expansion

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

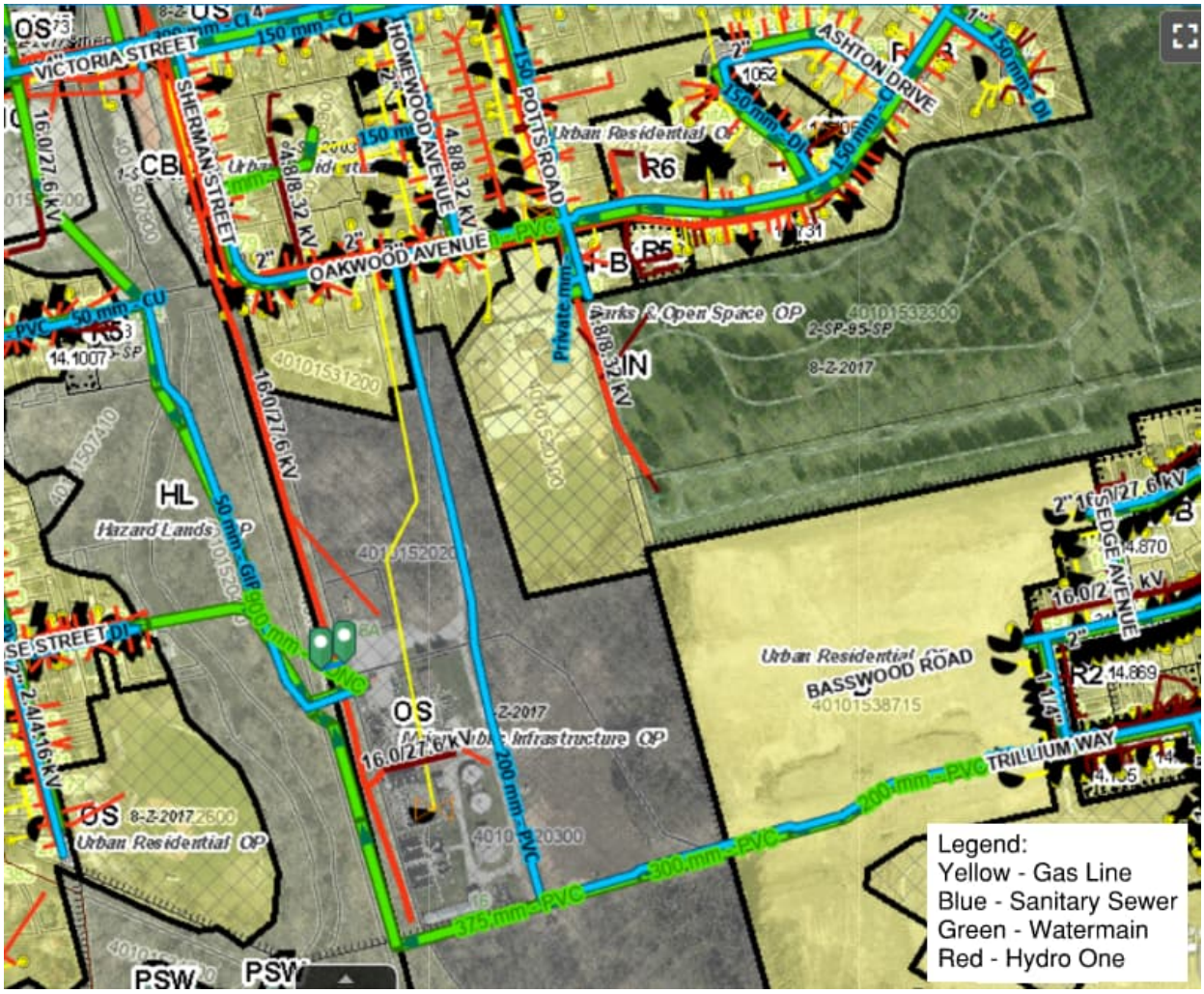


Figure 3-3: Existing Infrastructure

3.3 Land Use and Recreational Features

According to the Norfolk County Zoning By-law[3] and the County Geographic Information System (GIS) Mapping System[4], the Simcoe WWTP is located within an area designated as "Open Space." Facilities such as wastewater treatment plants are permitted in all zoning categories.

To the east of the facility, there is an additional Open Space Zone in addition to a Development Zone, where there is a proposed future residential development. There are Hazard Land Zones located to the west and the south of the facility, in addition to Provincially Significant Wetland (PSW) Zones. The north includes a Neighbourhood Institutional Zone, as well as various Residential Zones (R1-B, R2, R5, and R6). The Simcoe WWTP and

[3] (Norfolk County, 2014)
[4] (Map Norfolk Community Web Map, 2025)

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

surrounding areas zoning designations can be seen below in Figure 3-5 and the current occupation of service in study area is provided in Figure 3-4.

Community features located near the Simcoe WWTP include a cemetery, St Joseph's Elementary School, Simcoe Memorial Park, Brook Conservation Area, and a future residential development. Additionally, there are various water sources near the facility, including the Lynn River and significant watersheds. Figure 3-4 highlights the community features near Simcoe WWTP.



Figure 3-4: Community Features Near Simcoe WWTP

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

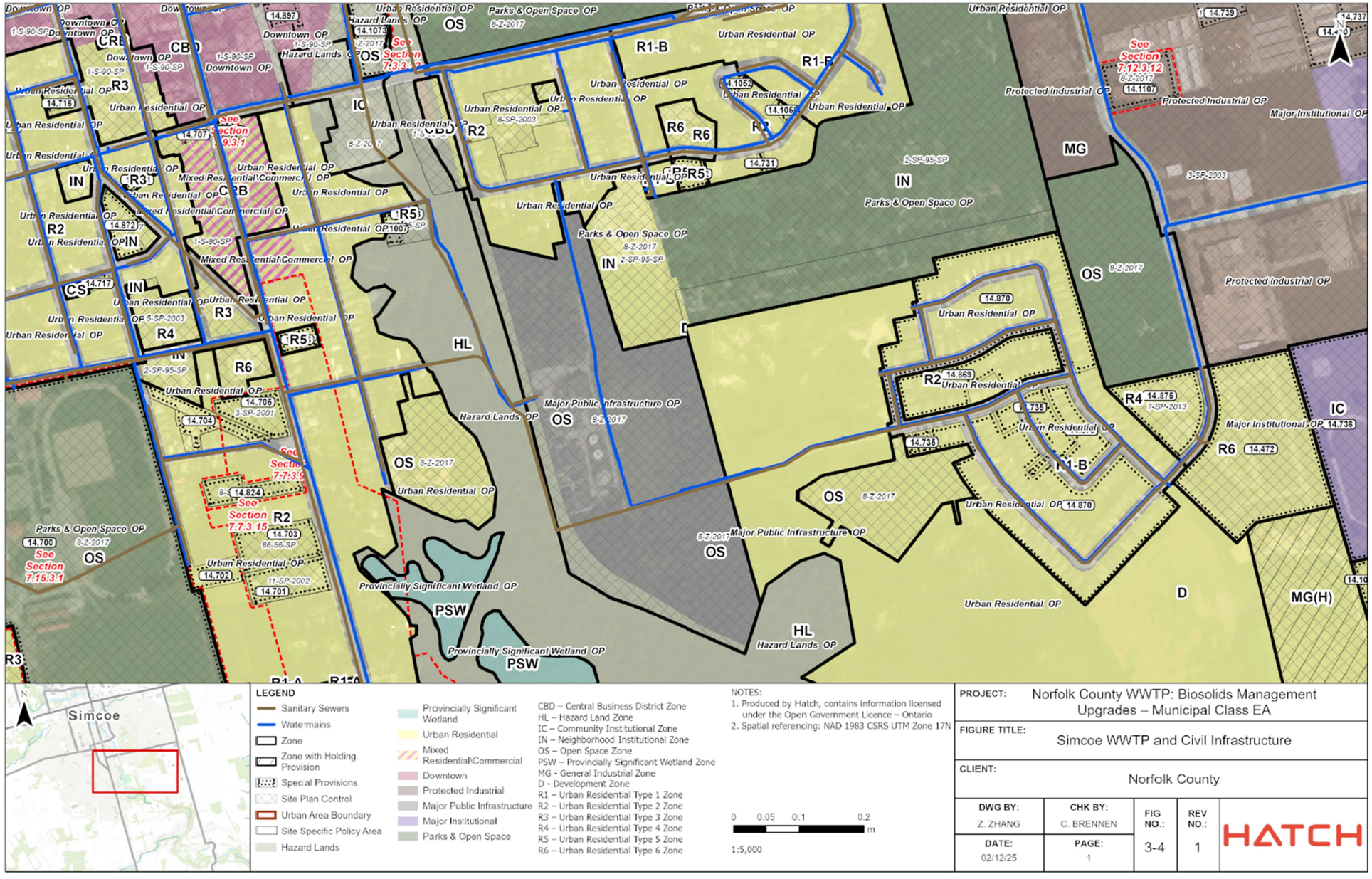


Figure 3-5: Zoning Designations and Current Occupation of Service in Study Area

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

3.4 Natural Environment Overview

As noted in the Natural Heritage Report in Appendix A, there were 35 species of birds and 2 mammal species observed during the two surveys conducted on site. Species at Risk were seen near the south-west corner of the existing site, including red-headed woodpeckers, which are endangered, and chimney swifts, which are threatened. Preliminary vegetation assessments characterized the property as primarily cultural meadow habitat with deciduous-dominant mixed woodlands adjacent.

3.5 Archaeological and Cultural Heritage Resources

A Stage 1 Archaeological Assessment (AA) was completed for the proposed biosolids management upgrades area within the Simcoe WWTP property boundaries during 2025, which recommended Stage 2 test pit surveys be conducted for parts of the study area. The Stage 1 AA project area was located adjacent to the east of the existing facilities at the Simcoe WWTP. It measured approximately 150 metres by 90 metres and covered an area of approximately 1.35 hectares. The Stage 1 AA Report is included in Appendix B.

Archaeological Services Inc. (ASI) was contracted by Hatch, on behalf of the County, to conduct a Stage 2 AA following the recommendations of their Stage 1 report. The Stage 2 work has been completed, noting that no archaeological resources were encountered and no further archaeological assessment is recommended. The Stage 2 AA Report is included in Appendix L.

Additionally, a Stage 1 AA was conducted for the new access road area between Victoria Street and Trillium Way, which requires Stage 2 test pit surveys be conducted at five metre intervals for a portion of the study area. The Stage 1 AA Report for the access road is included in Appendix M.

3.6 Groundwater and Surface Water Protection

As per the MECP Source Protection Information Atlas[5], there are no drinking water well source protections in place for the Simcoe WWTP. However, there are various water sources near the Simcoe WWTP and provincially significant wetland zones. Simcoe WWTP's proximity to the Lynn River poses additional concerns, especially related to phosphorus loadings.

There have been challenges meeting the current total phosphorous objectives in recent years. In a 2023 report by Blue Sky titled "Final Report – Addressing ECA Special Condition Related to Receiver Monitoring and Phosphorus – Simcoe WWTP", it was concluded that the biggest impacts on effluent TP concentrations were due to the use of single-point ferrous addition (vs. dual point), periods of poor mixed liquor settleability, and operational issues (e.g., plugging of ferrous dosing lines). No observed impacts were associated with hauled waste (septage, leachate), nor were internal recycle streams identified as an issue. However, the proposed biosolids management strategy will impact internal recycle stream volumes and loadings. The County has completed a Facility Optimization Study to assess the capacity and

[5] (Ministry of the Environment, Conservation and Parks, 2025)

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

upgrade needs of the liquid treatment train. This analysis will be continued and will incorporate the impacts of the preferred biosolids management strategy.

Stormwater management plans will be created throughout the design to ensure no negative impacts on the surrounding areas. Additionally, provisions will be implemented during and before construction to ensure no contamination of the water sources. The existing groundwater discharge plan noted in the 2017 Terraprobe Hydrogeological Report (Appendix C) will be reviewed against the current regulatory requirements and revised as necessary. Pre-construction baseline water quality monitoring is critical since surface waters could be temporarily affected by construction or sludge handling.

3.7 Geotechnical/Hydrogeological Considerations

Geotechnical and hydrogeological assessments were completed in 2017 and 2018, respectively, and are included in Appendix C. These reports will need to be verified for accuracy prior to any construction activities taking place to determine soil and dewatering requirements for the site. As per EASR requirements, a water taking report will be prepared by a qualified person(s) and water taking activities will be registered in the EASR. If permanent drainage is determined to be required for structure footings, a long-term Permit to Take Water (PTTW) will be obtained. In addition, updates to these reports will inform the excess soil management and erosion and sediment control requirements for the project.

3.8 Climate Change Considerations

The potential impacts on climate change of the project alternatives were assessed by evaluation of the expected direct greenhouse gas (GHG) emissions. This review included a GHG emission analysis on the short-listed alternatives to compare and help minimize potential impacts of the proposed facilities, as described below and shown in Table 3.1. Alternative Solution 4 results in 48 tCO2e/yr higher offset of CO2e emission than Alternative Solution 3.

The GHG emissions from the THP module of Lystek process were estimated to be 177 CO2e/year. A significant fraction of these emissions was estimated to be from addition of KOH solution in the THP process.

The emissions from polymer manufacturing for Lystek process were estimated to be higher than the Alternative Solution 3 due to higher polymer dosage requirement and higher mass of dry solids processed in pre-thickening.

Transportation emissions for the biosolids were estimated to be higher for the Alternative Solution 3. This is due to the higher amount of hauled sludge at lower solid content.

For land application, Biosolids Emissions Assessment Model (BEAM), developed for the Canadian Council of Ministers of the Environment was used. Table 3.2 shows the input parameters used in the BEAM v2.2 calculator.

In addition to the GHG fertilizer credits for nitrogen, phosphorus and carbon sequestrations, the BEAM tool also estimates fugitive emission of N2O and CH4 during sludge storage prior

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

to land application. For both Alternative Solutions 3 and 4, the sludge storage tanks are covered with off-gas passed to the odor removal facility. Therefore, fugitive emissions of N2O and CH4 from storage were not included in the present analysis.

The GHG emissions from Alternative Solution 4 were lower than the Alternative Solution 3. The higher nitrogen, phosphorus and potassium fertilizer credits appears to be the main reason for lower GHG footprint for the Lystek process. The fertilizer credits are highly sensitive to the nitrogen and phosphorus content in biosolids from the two options. It is recommended to verify the N and P contents of the biosolids through experimental means. Moreover, the percent availability of N and P contents in biosolids also will have effect on the estimated offset credits. As described previously, the validity of potassium credits needs to be further confirmed based on the local fertilizer usage practices at Norfolk County.

Additionally, the location of the proposed biosolids management upgrades had been largely cleared in previous years, with some remaining grassy lots, trees and shrubbery. In it is current condition, the impacts of the construction in this area would be minimal on the existing carbon sink. The proposed biosolids management upgrades solution has been considered for resilience to heavy rain, flooring, extreme temperatures, and power issues, considering items such as drainage plans, piping insulation and HVAC requirements, and generators. These details will be further considered during the project design phase.

Further reviews will be conducted once the selected design is finalized to ensure that all potential mitigation measures are in place to reduce the overall air quality impacts of the Simcoe WWTP.

Table 3.1: 2051 Projected Annual GHG Emissions for Short Listed Alternatives

2051 GHG Emissions (tonneCO_2e)		
	Alternative Solution 3	**Alternative Solution 4**
THP MODULE		
Electrical consumption	N/A	3
45% KOH solution manufacturing	N/A	174
CONVENTIONAL/LYSTEMIZE DIGESTION		
Fugitive emissions from biogas combustion and flaring	16	16
Digester mixing electrical consumption	12	N/A
THICKENING/DEWATERING		
Polymer manufacturing	9	34
Electrical consumption	0.3	3
TRANSPORTATION		
Biosolids to land application	25	19
Polymer to Simcoe WWTP	0.1	0.3
KOH to Simcoe WWTP	N/A	2

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

2051 GHG Emissions (tonneCO_2e)		
LAND APPLICATION		
Tractor diesel consumption	33	25
Fertilizer offset credit for nitrogen	-144	-218
Fertilizer offset credit for phosphorus	-37	-55
Fertilizer offset credit for potassium	N/A	-61
Fertilizer offset credit for carbon sequestration	-292	-339
TOTAL	**-348**	**-396**

Table 3.2: Parameters used for BEAM Calculator

Land application BEAM parameters		
Biomass Characteristics	**Alternative Solution 3**	**Alternative Solution 4**
Quantity of treated biosolids going to land application (Mg/day-wet)	53	40.5
Solids content of treated biosolids going to land application (%)	6%	9%
Quantity going to land application (Mg/day-dry)	3.18	3.726
Density of treated biosolids (kg/m^3)	1000	1000
Type of biosolids to be land applied	digested	digested
Total nitrogen (%-dry weight)	6%	10%
Total phosphorus (%-dry weight)	2%	2%
Total volatile solids (TVS) (%-dry weight)	61%	61%
Organic carbon (%-dry weight)	34%	34%
CaCO3 equivalence (%-dry weight)	0	0
Average number of days biosolids are stored prior to land application	239	239

3.9 Existing Roadway

The County, as recognized in the OP, identified the potential need for a collector-level roadway connecting future residential development east of the Simcoe WWTP to Victoria Street. If deemed beneficial, this connection could also serve as a new access route to the WWTP, improving safety and reducing traffic impacts near sensitive areas such as St. Joseph's School and Oakwood Cemetery. Given the projected increase in truck traffic by 2051, this new access road is a key criterion in the screening process. Should both residential and public infrastructure developments require the roadway, a cost-sharing approach (based on usage and vehicle type) may be considered to support its design and construction.

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

4. Evaluation Methodology

The project team has established an evaluation framework to guide the development and assessment of biosolids management upgrades alternatives for the Simcoe WWTP. This framework plays a pivotal role in selecting the preferred alternative design concept. The evaluation process is structured following five steps:

- **Step 1:** Identify and Define a Vision for the plant and its context in the Local Community taking into consideration opportunities and constraints (Phase 1).
- **Step 2:** Develop Alternative Solutions Long-List (Phase 2).
- **Step 3:** Complete Screening and Develop Short-listed Solutions (Phase 2).
- **Step 4:** Identify Recommended Preferred Alternative (Phase 2).
- **Step 5:** Confirm Preferred Solution Based on Comments from Public and Review Agencies (Phase 2).

This structured approach ensures a balanced and systematic selection of the most appropriate biosolids management upgrades option for the Simcoe WWTP considering both practical constraints and the long-term impacts of the facility within the community. The evaluation criteria were developed in conjunction with the County, with preliminary criteria used to screen the long-list of alternatives, and more detailed criteria used to compare the short-listed alternatives, as presented in Sections 5.2.1 and 5.3.3, respectively.

4.1 Identification of Constraints and Opportunities

As outlined in Section 3, several key constraints must be considered in the Preferred Alternative Solution:

- **Land Use and Recreational Features**: The facility is surrounded by residential areas, with St. Joseph's School, future housing developments, and Oakwood Cemetery to the east. To the west, there is a small commercial area.
- **Natural Environment**: The Brook Conservation Area and the L.E. & N. Trail are located to the south, providing important recreational and ecological value that must be protected.
- **Groundwater and Surface Water Protection**: The Simcoe WWTP is near various water sources, including the Lynn River and provincially significant wetlands, which require careful protection of groundwater and surface water quality.

In addition to the facility and regulatory requirements noted above and in Section 1.3, the County identified the following opportunities to improve the existing facilities:

- Newer technologies have become more prominent in the wastewater treatment industry and should be evaluated against conventional technologies.

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

- **Quality of Biosolids:** opportunity to convert biosolids to higher value final product such as Class A product that complies with the Ontario Nutrient Management Act and CFIA fertilizer quality designation. Biosolids are nutrient-rich organic materials produced during the treatment of domestic sewage sludge. Once treated to meet regulatory standards, biosolids can be beneficially reused most commonly through land application. There are two classifications of biosolids considered in this project: Class A and Class B:
  - Class B Biosolids have undergone treatment to reduce pathogens but do not eliminate them entirely. They are subject to additional restrictions for public health and environmental safety. Non-Agricultural Source Material (NASM) Plans (Ontario Ministry of Agriculture and Rural Affairs (OMAFRA) protocols) are required prior to land application. All five wastewater facilities currently produce Class B biosolids.
  - Class A Biosolids must have pathogens reduced to virtually all non-detectable levels and comply with very strict standards for odours, metals, and vector attraction reduction. Class A biosolids are safe for residential home use for lawns and gardens and in agricultural applications. Class A Biosolids are considered fertilizers and therefore NASM Plans are not required.

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

5. Alternative Solutions

5.1 Long List of Alternatives

A comprehensive review of the available upgrade options was completed to identify Alternative Solutions that align with the project objectives. The project team identified four Alternative Solutions as presented in Table 5.1.

Table 5.1: Long List of Alternative Solutions

Alternative Solutions	Description
1 – Do Nothing	Maintain the existing Simcoe WWTP with no improvements other than regular maintenance. This alternative is used as a baseline comparison for other alternatives. This solution would not meet regulatory compliance.
2 – 2016 Master Plan (ISMP)	Upgrading the Simcoe WWTP as per the 2016 ISMP solution and noted in Section 1. Aerobic digestion and thickening of Simcoe Biosolids, and repurposing of the Simcoe WWTP anaerobic digesters for storage of biosolids from Simcoe, and excess biosolids from Port Rowan and Port Dover WWTPs in future.
3 – Centralized Anaerobic Digestion	Upgrading the Simcoe WWTP to be a County-wide centralized biosolids treatment facility using anaerobic digestion and biosolids storage with thickening at the Simcoe WWTP.
4 – Centralized Thermal Hydrolysis Process	Upgrading the Simcoe WWTP to be a County-wide centralized biosolids treatment facility using thermal hydrolysis process stabilization and biosolids storage at the Simcoe WWTP.

5.2 Preliminary Screening of Alternatives

5.2.1 Screening Criteria and Rationale

The preliminary screening phase is a crucial step aimed at thoroughly examining all proposed Alternative Solutions. The objective is to identify solutions that align with the project's objectives and merit further consideration during the development of alternative concepts. Therefore, it is expected that the Alternative Solutions need to meet the screening criteria as these criteria are considered mandatory criteria. If an Alternative Solution does not meet all criteria, it cannot be advanced to the next phase of the Class EA Study.

Three key criteria were employed during this screening process:

- **Growth Requirements**: All alternatives must align with a 2051 planning horizon.
- **Centralized Solution for all County Wastewater Treatment Facilities**: According to both the 2007 BMP and the 2016 ISMP, all proposed alternatives must include a centralized, County-wide biosolids management facility.
- By 2051, truck traffic to and from the plant is expected to double, making the current Oakwood Avenue access route unsuitable due to safety concerns and restricted access near St. Joseph's school and Oakwood Cemetery. A proposed access road should be

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

included in all alternatives to improve safety, reduce community disruption, and support long-term operational needs, including future plant expansion.

Alternative Solution 1 (Do Nothing) and Alternative Solution 2 (2016 Master Plan) both failed to comply with the preliminary screening criteria. Alternative Solution 1 did not propose any upgrades to the existing facility, which is currently having compliance issues, and therefore must be upgraded and expanded to meet future demands. Additionally, Alternative Solution 1 fails meet MECP requirements due to compliance issues. Alternative Solution 2 (2016 Master Plan) was designed for a 2041 planning horizon, not 2051, and did not include Delhi and Waterford WWTPs in the design basis, making it insufficient for the County's needs. Therefore, both Alternative Solutions 1 and 2 were screened out as future solutions.

Alternative Solutions 3 and 4 both met the preliminary screening criteria and were carried through as short-listed alternatives for further evaluation.

5.2.2 Short-Listed Alternatives

The two short-listed alternatives were developed in more detail and are described in the following sub-sections. In addition to the details below, both alternatives would require a new access road to the plant, to accommodate increased truck traffic and to improve safety for the operators and public. Only Alternative Solution 4 will include enhanced biogas production to be used for energy recovery.

Preliminary site layouts for the two alternatives are summarized in Sections 5.2.2.1 and 5.2.2.2. During the detailed design phase of the project, the chosen alternative site layout will be reviewed and optimized and therefore may be modified from what has been presented. However, the final site layout will remain within the property boundaries and will not impose on the general public.

5.2.2.1 Alternative Solution 3: Centralized Anaerobic Digestion and Biosolids Storage with Thickening at Simcoe WWTP

Alternative Solution 3 involves the construction of new anaerobic digesters to digest sludge generated in the liquid treatment train of the Simcoe WWTP, co-thickened sludge from Port Rowan, Port Dover and Delhi WWTPs, and WAS from Waterford WWTP. The anaerobically digested sludge would then be thickened and transferred to new biosolids storage tanks prior to disposal. Like Alternative Solution 4, an important constraint of this solution are the existing digesters, which are aged and would require upgrades. A process flow schematic and preliminary site layout have been provided in Figure 5-1 and Figure 5-2, respectively.

The conceptual level design for the 2051 planning horizon consists of the following:

- Co-thickened sludge from Port Rowan, Delhi, and Port Dover WWTPs as well as WAS from Waterford WWTP would be hauled to a new receiving station that would be constructed at the Simcoe WWTP.
- Co-thickened sludge from Simcoe WWTP and the hauled co-thickened sludge and WAS in the receiving station would be directed to the new anaerobic digesters.

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

- Digested sludge (Class B biosolids) from the anaerobic digesters would then be conveyed to the thickening facility. The biosolids thickening process would include a rotary drum thickener (RDT) feed tank, polymer dosing system, flocculation tank, two RDT units (one duty/one standby), a filtrate equalization tank, and polymer make-down system. Filtrate would be returned to the head of the Simcoe WWTP liquid treatment train.
- The thickened biosolids would then be conveyed to the new biosolids storage tanks. From storage, the Class B biosolids would be disposed to Townsend lagoon or via land application.
- The biosolids storage tanks would be designed to allow for periodic decanting of the storage tank contents, with supernatant directed to the head of the liquid treatment train. Due to the potential for odour generation during decanting, odour control facilities would be provided.

5.2.2.2 *Alternative Solution 4: Centralized Thermal Hydrolysis Process Stabilization and Biosolids Storage at Simcoe WWTP*

Alternative Solution 4 involves implementing the THP system, including a polymer system, dewatering system, alkali system, THP reactor, an anaerobic digestion tank, a fertilizer storage tank, and an odour control system. This solution would still require upgrading the existing digesters post implementing the THP process. A process flow schematic and preliminary site layout have been provided in Figure 5-3 and Figure 5-4 respectively.

The conceptual level design for the 2051 planning horizon consists of the following:

- Co-thickened sludge from Port Rowan, Port Dover and Delhi WWTPs, and WAS from Waterford WWTP would be hauled to a blend tank in the new receiving station at the Simcoe WWTP, where it would be combined with co-thickened sludge from Simcoe WWTP.
- The contents of the blend tank would then be conveyed to centrifuges, from where each centrifuge would send the dewatered sludge to the dewatered cake tank. Filtrate would be returned to the head of the Simcoe WWTP liquid treatment train.
- The cake from each dewatered cake tank would then be sent to a dedicated THP module, for a total of two THP modules, where it would be combined with alkali (Potassium Hydroxide) and low-pressure steam and sheared prior to being conveyed to the anaerobic digestion tank.
- From the anaerobic digestion tank, the Class A biosolids would be conveyed to the fertilizer storage tanks prior to disposal via land application.

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

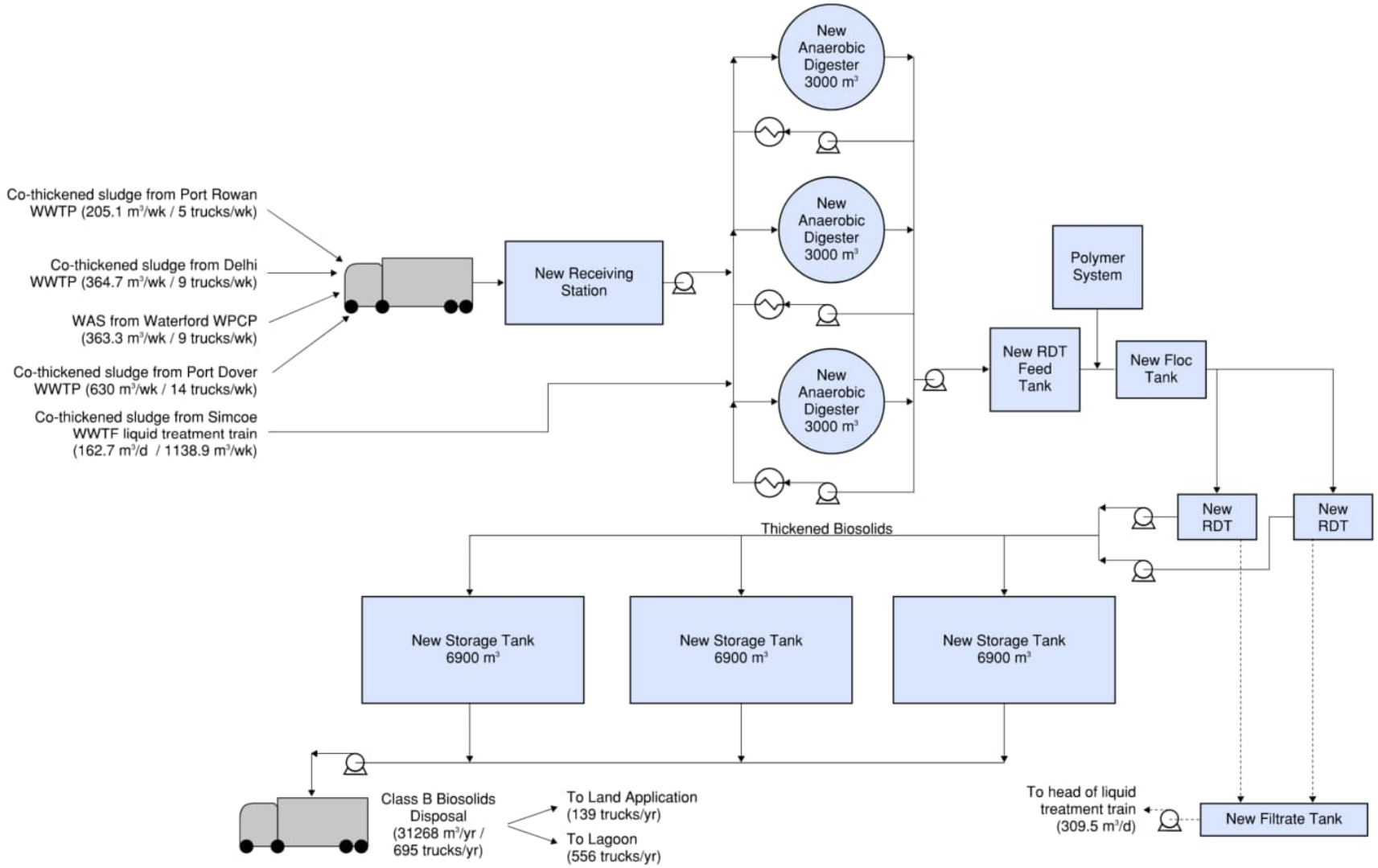


Figure 5-1: Alternative Solution 3 Process Flow Schematic

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

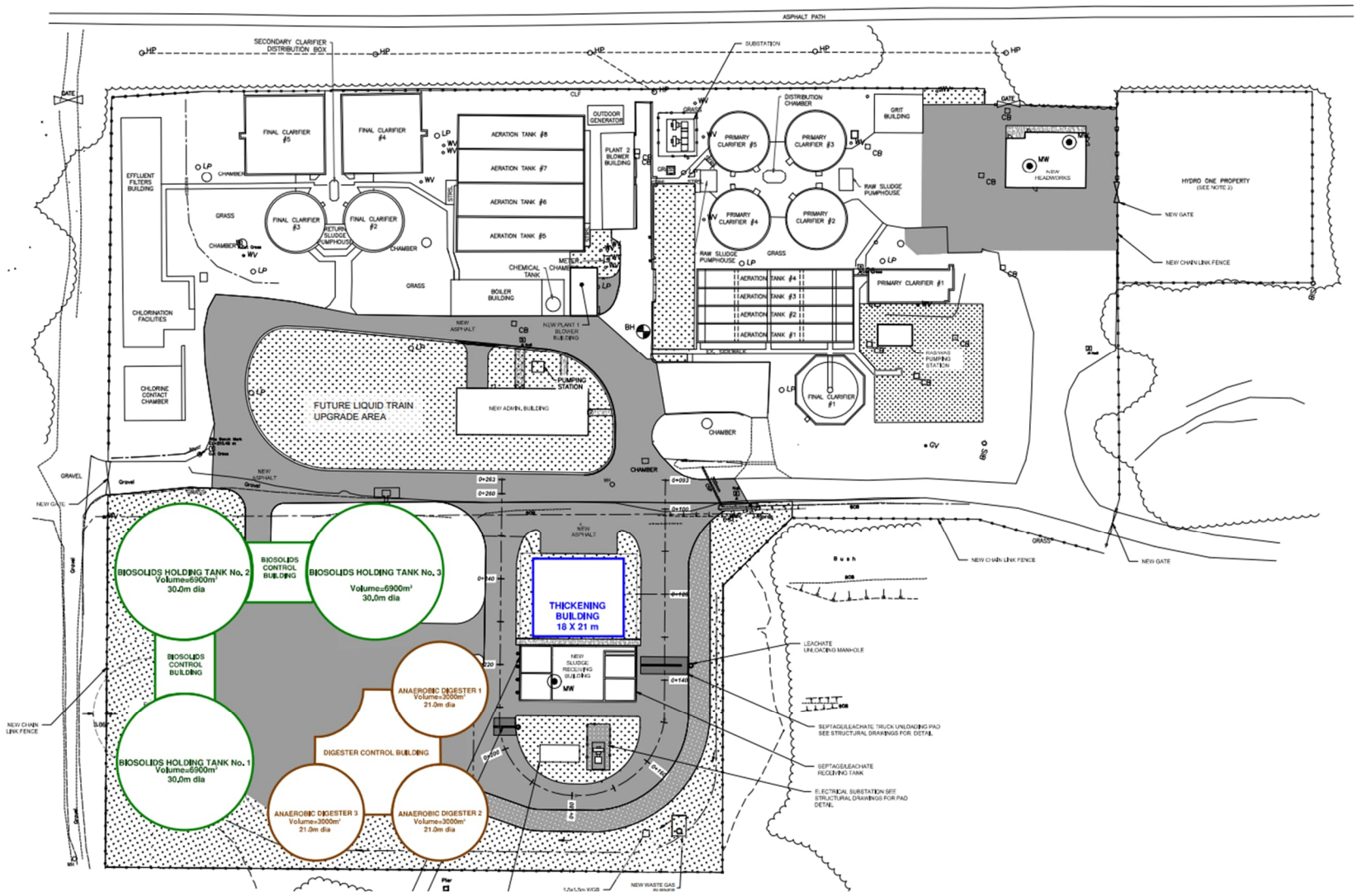


Figure 5-2: Alternative Solution 3 Preliminary Site Layout

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

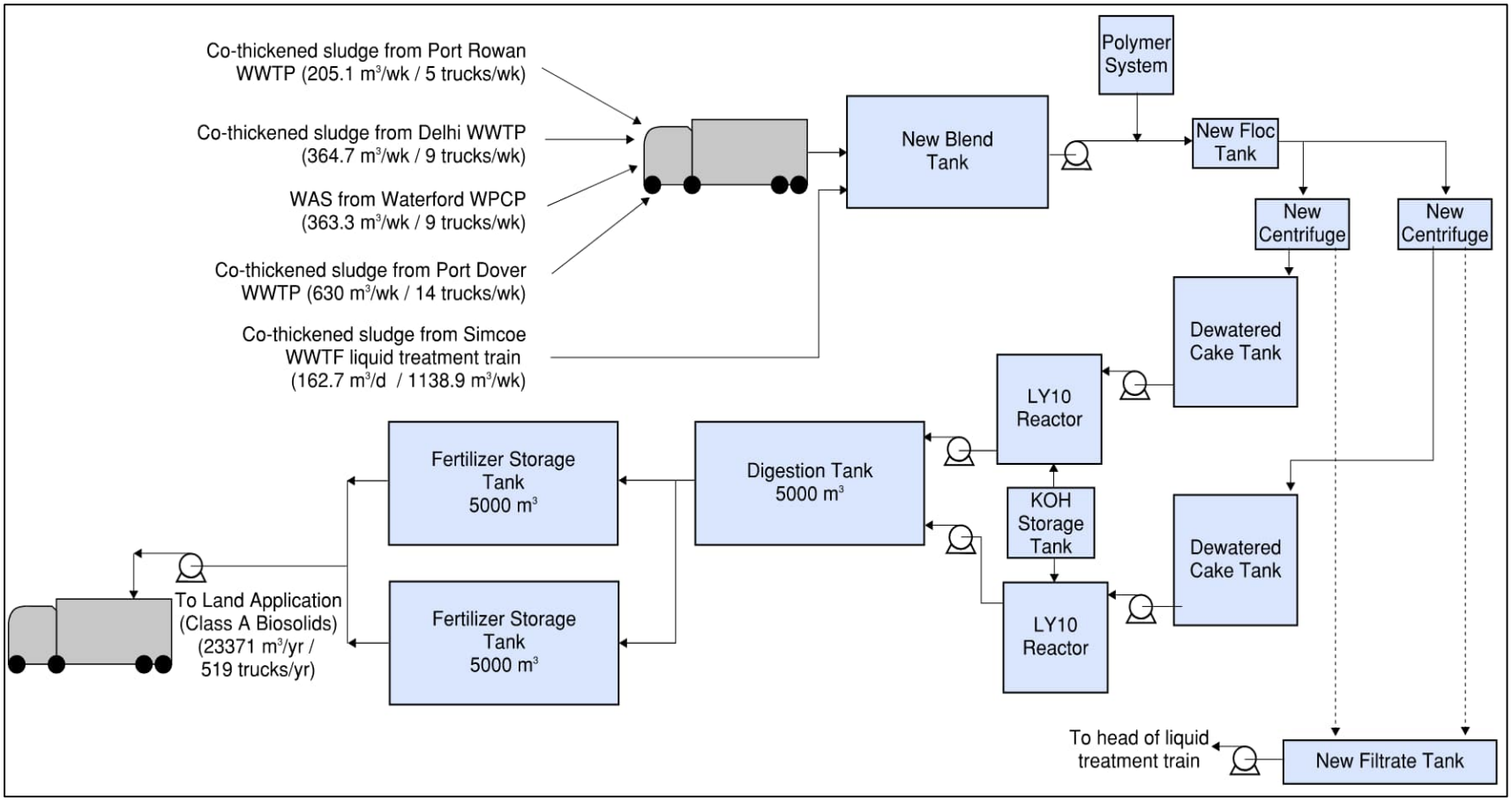


Figure 5-3: Alternative Solution 4 Process Flow Schematic

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

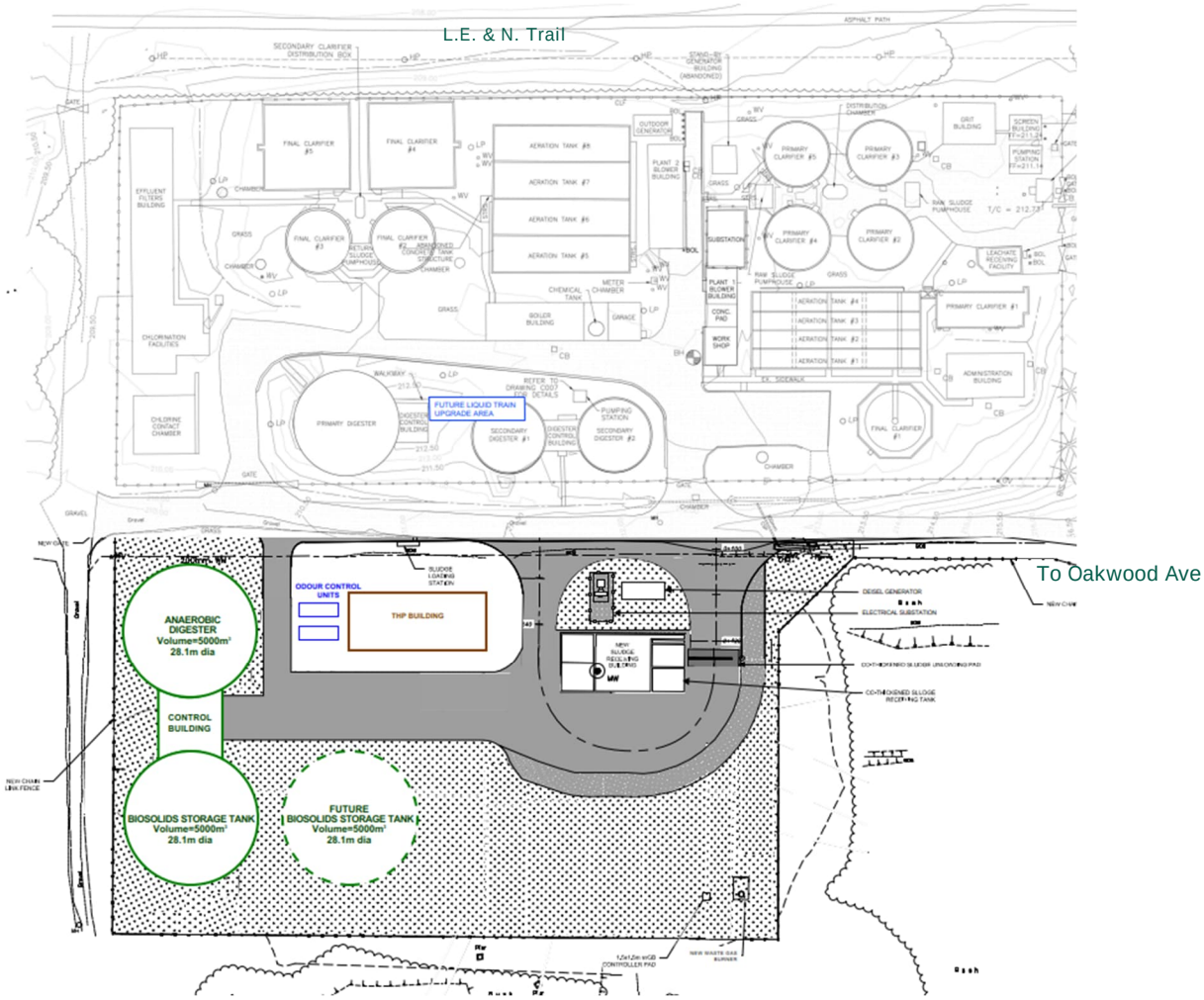


Figure 5-4: Alternative Solution 4 Preliminary Site Layout

5.3 Evaluation of Short-Listed Alternatives

5.3.1 Comparison of Alternatives

A technical feasibility comparison for Alternative Solutions 3 and 4 was completed, focusing on four major topics: quality of biosolids produced, potential for odours, operational flexibility, and storage requirements on site, as presented in Table 5.2.

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

Table 5.2: Technical Feasibility Comparison

Alternative Solution 3 – Centralized Anaerobic Digestion	Alternative Solution 4 – Centralized Thermal Hydrolysis Process
Produces Class B biosolids, with higher pathogen levels – less ideal for reuse near communities.	Advanced treatment delivers Class A biosolids, safest for community and environment.
Odours can be more noticeable, potentially affecting nearby residents.	Significantly reduces pathogens and odours, minimizing nuisance to neighbors.
Limited operating flexibility as all system components need to be sized to ultimate 2051 flows and loadings, which will impact short term performance if growth is delayed.	Higher operating flexibility allows system run time to be adjusted to increase treatment capacity, having no impact on short term performance.
Treatment process produces larger volume of biosolids, requiring more trucks (4/week) for hauling compared to THP process and requires larger storage capacity (e.g., 240 days) – increasing land and footprint needs.	Onsite storage is not regulated – treatment process produces lower volume of biosolids, requiring fewer trucks for hauling and reducing overall storage requirements – smaller footprint, less land use.
Alternative Solution 3 results in slightly higher total GHG emissions than Alternative Solution 4.	Achieves greater overall GHG reductions, with a total of -396 tonneCO_2e compared to -348 tonneCO_2e in Alternative Solution 3.

5.3.2 Life Cycle Cost Estimates

The cost estimate at this stage of the project is classified as a Class D capital cost estimate and is considered reliable to an accuracy range of -35% to +50% at the conceptual design level. Any escalation of the 2024 cost estimate for the future years should be done based on the construction cost estimates.

The capital costs for each alternative consider all major equipment and tankages, site works, yard piping mobilization, demobilization, bonding, and insurance, and include a 35% contingency as requested by the County. The capital costs exclude upgrades to the existing headworks building.

The operational costs include energy, chemical, labour, and annual maintenance costs, as well as sludge disposal costs for the base process requirements for each alternative. No allowances were included for the operation of the liquid treatment train.

The County requested that a 25-year life cycle cost analysis to be provided. As the options were considering the design year of 2051, a 27-year-life cycle cost analysis was calculated to consider all costs incurred until 2051. To cover the increases in operational costs due to equipment degradation over time, a 5% increase in annual operational costs was included in

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

the life cycle cost calculation. The life cycle cost has been presented in terms of net present value.

Conceptual cost estimates for the Biosolids Management Upgrades Alternative Solutions 3 and 4 were prepared based on the conceptual layouts developed and with considerations to building footprint, major process requirement, site preparation and construction, and are presented below in Table 5.3.[6]

Table 5.3: Cost Comparison of Alternative Solutions

Indicator/Alternative	Alternative Solution 3	Alternative Solution 4
Capital Cost	$100,330,000*	$56,264,000*
Annual Operation and Maintenance Cost	$530,000**	$915,000
27-year Life Cycle Cost (to 2051)	$121,305,000	$92,455,000

* Proposed Access Road worth $7M-$9M is not included in the capital cost.

** Annual Operation and Maintenance Costs including core process elements for each alternative for comparison purposes.

5.3.3 Evaluation Matrix

A comprehensive assessment of the biosolids management alternatives described above is summarized in Table 5.4. Alternatives were examined with consideration of key factors and assessed based on their perceived impacts.

5.3.4 Selection of the Preferred Solution

Alternative Solution 4 – Centralized Thermal Hydrolysis Process has been identified as the preliminary preferred alternative design, offering the best overall balance of environmental protection, community benefit, cost efficiency, and long-term planning. Key advantages include:

- Produces high quality biosolids (Class A), with minimal land application restrictions in Ontario.
- Regulatory compliance assurance, since it is CFIA approved and does not require a NASM.
- Small footprint allows for room for future expansion within current property boundaries.
- High operational flexibility ensures that short-term performance will not be impacted while operating under current conditions.
- Lower 27-year life cycle cost, with modular nature of system allowing County to reduce upfront capital costs.

[6] Cost estimates presented in Table 5.3 are from 2024.

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

Table 5.4: Evaluation of Alternatives

Evaluation Criteria	Alternative Solution 3 – Centralized Anaerobic Digestion and Biosolids Storage with Thickening at Simcoe WWTP	Rating	Alternative Solution 4 – Centralized Thermal Hydrolysis Process Stabilization and Biosolids Storage at Simcoe WWTP	Rating
Environmental	• Reduction in current CO_2 emissions • Produces lower quality Class B biosolids – E. coli levels must be < 2,000,000 CFU/g • A Non-Agricultural Source Material (NASM) Plan is required for an agricultural operation/ application • Storage at Townsend lagoons required when land application is not feasible	◑	• Reduction in current CO_2 emissions • Achieves Class A biosolids standard – E. coli < 1,000 CFU/g; produces higher quality biosolids • Pathogen and Odour Reduction • Storage at Townsend lagoons no longer required • Enhanced Biogas Production which will be used for energy recovery	◔
Social	• Higher biosolids volume to be hauled from Simcoe WWTP (14 trucks per week) • Increased incoming sludge truck traffic (35 trucks/week) than current operation	◑	• Lower biosolids volume to be hauled from Simcoe WWTP (10 trucks per week) • Increased incoming sludge truck traffic (35 trucks/week) than current operation	◔
Economic	• Higher capital cost • Lower operating cost • Higher life cycle cost	●	• Lower capital cost • Higher operating cost • Lower life cycle cost	◑

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

Evaluation Criteria	Alternative Solution 3 – Centralized Anaerobic Digestion and Biosolids Storage with Thickening at Simcoe WWTP	Rating	Alternative Solution 4 – Centralized Thermal Hydrolysis Process Stabilization and Biosolids Storage at Simcoe WWTP	Rating
Technical	• Follows Non-agricultural source materials (NASM) regulatory requirements • Product quality will restrict its use • 240 days of storage and a larger storage footprint • Lower operational risk: o Operating temperatures (<40C) o Process includes gas emissions and explosion risk	◑	• Follows CFIA regulations • Pathogen destruction • Product quality will not restrict its use • Operational flexibility for increased capacity • Higher operational risk: o Operating temperatures (<100C) o Process includes high speed rotating equipment, chemical use, gas emissions, explosion risk	◑
Planning	• Larger footprint with no room for future expansion	◑	• Smaller footprint with room for future expansion	◔

Legend:

Most Preferred Least Preferred

○ ◔ ◑ ◕ ●

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

6. Details of the Preferred Solution

6.1 Description of Preferred Solution

The basis of design for Alternative Solution 4 – Centralized Thermal Hydrolysis Process includes the following:

- Construction of a new sludge receiving facility.
- Construction of a new THP building (29.5 m x 12.5 m) to house THP equipment including
  - Two dewatering centrifuge systems (polymer system, centrifuges, and dewatered cake tanks).
  - Two THP Modules (dewatered biosolids tanks, dewatered biosolids pumps, THP reactors, KOH storage tank, KOH dosing skids, and dual-fuel boilers).
- Electrical/instrumentation and controls panels.
- Construction of two odour control systems.
- Construction of one digestion tank.
- Construction of one storage tank and truck loading systems.
- Enhanced biogas production to be used for potential energy recovery.

In establishing the Simcoe WWTP as a centralized biosolids and storage facility for the County, there will be an increase in truck traffic to and from the treatment plant. To help mitigate truck traffic congestion on Oakwood Avenue and to divert heavy trucks away from sensitive areas including the school and cemetery, a new access road to the plant has been proposed along the west of the plant from either Victoria Street or Sherman Avenue. The road alignment feasibility is currently under review, pending the Class EA completion.

In addition to the items mentioned above, a Phase 2 upgrade would be required at the Simcoe WWTP to support the biosolids facility, which will include

- New headworks facility with screening and grit separators.
- New septage, raw sewage and leachate receiving stations.
- Electrical substation and stand-by power unit.
- Sludge recirculation pumping stations.
- The site layout of Alternative Solution 4 and the proposed access road is provided in Figure 6.

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

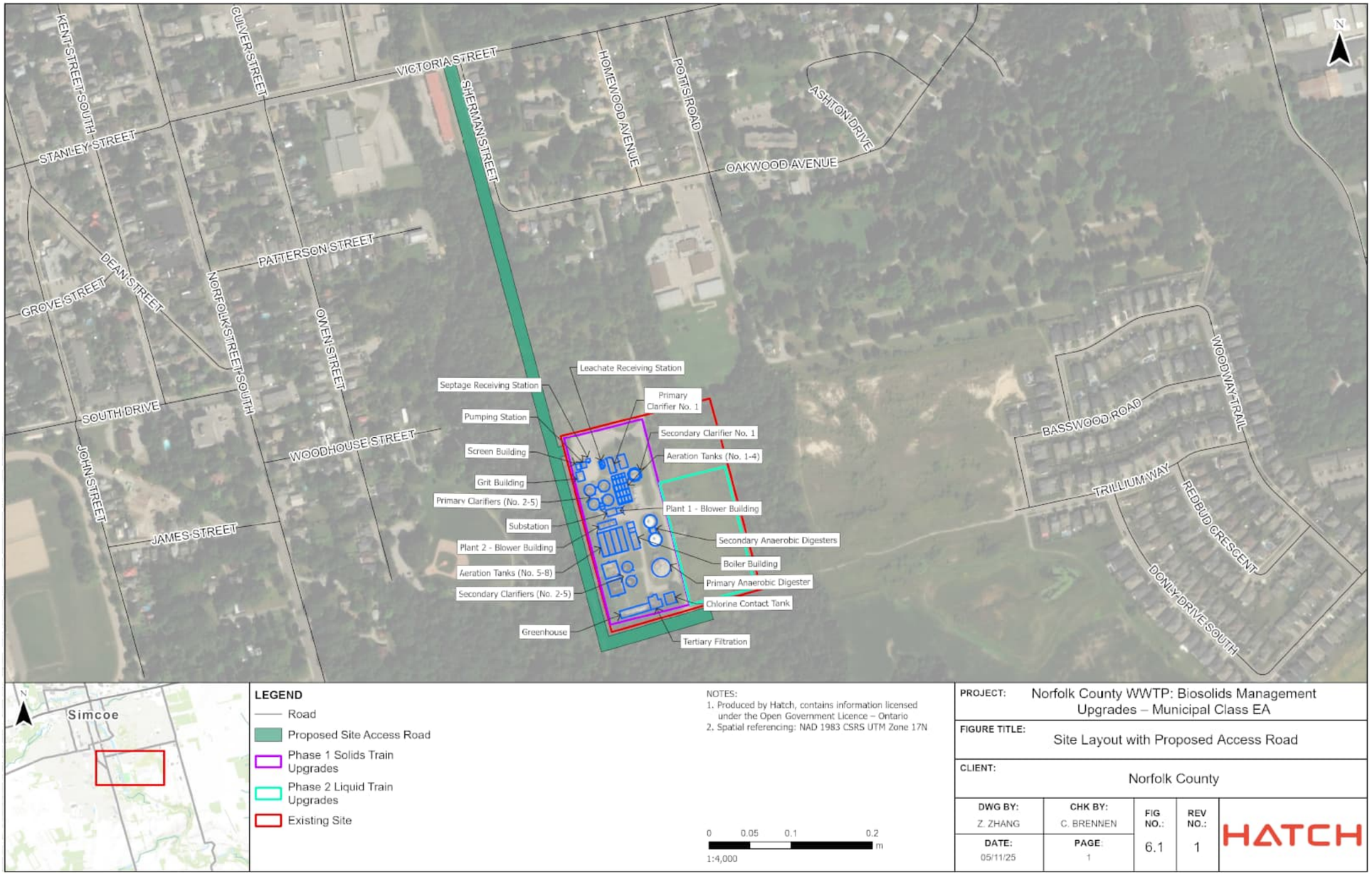


Figure 6-1: Alternative Solution 4 Site Layout and Proposed Access Road

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

6.2 Implementation Schedule

The Simcoe WWTP Biosolids Management Upgrades project is planned with detailed design, tendering, and award to be completed by Q4 2026, with construction anticipated to begin in 2027. However, the construction timeline is contingent upon County Council's approval of the capital budget.

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

7. Public, Indigenous, and Agency Consultation Process

7.1 Consultation and Engagement Strategy

In accordance with the Class EA, the County completed meaningful consultation efforts with Indigenous communities, relevant stakeholders, interested groups and local community members. The engagement and consultation activities fulfilled the regulatory requirements outlined in the Class EA study and compliance with the Accessibility for Ontarians with Disabilities Act (AODA). These efforts included formal notifications and individual meetings with Indigenous communities and affected stakeholders, as well as the hosting of a Public Information Centre (PIC) to facilitate broader public input.

A Project Contact List was developed during the initial phase of the project and has been regularly maintained to include individuals who requested ongoing updates about project milestones. Initial outreach was conducted via email, and on June 20, 2025, emails containing the Notice of Commencement were distributed to relevant agencies and ministries. Individuals on the contact list receive direct notifications regarding all upcoming meetings and consultation activities. Following the completion of the PIC, the list was updated to include participants who expressed interest in receiving future project updates. The most current version of the Project Contact List is provided in Appendix D.

Government Agencies and Ministries Informed of Notice of Commencement include

- Ministry of Environment, Conservation and Parks.
- Ministry of Natural Resources.
- Ministry of Tourism, Culture and Sport.
- Ministry of Indigenous Affairs and First Nations Economic Reconciliation.
- Ministry of Municipal Affairs and Housing.

On October 9, 2025, the County held a meeting with the Long Point Region Conservation Authority (LPRCA) to discuss the proposed biosolids upgrade project. During the meeting, the County presented an overview of the Class EA, highlighted the preferred design alternatives, and outlined related infrastructure improvements, including access road planning. The discussion also covered the County's long-term objectives in alignment with Ontario's Nutrient Management Act, along with a review of technical and environmental feasibility. Key topics included addressing community and conservation concerns, and identifying next steps related to regulatory approvals, traffic safety, and conceptual design development. Meeting minutes are provided in Appendix E.

7.2 Indigenous Engagement

Indigenous communities were provided a Notice of Commencement and invitation to participate in an engagement meeting to discuss the specifics of the Project with the Project Team.

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

On June 20, 2025, emails containing the Notice of Commencement were provided to the following Indigenous communities:

- Mississaugas of the Credit First Nation (MCFN).
- Six Nations of the Grand River (SNGR).
- Haudenosaunee Confederacy Chiefs Council (HCCC).
- Haudenosaunee Development Institute (HDI).

7.2.1 MCFN

On July 28, 2025, the County hosted a meeting with the MCFN's Department of Consultation and Accommodation. The County provided an overview of the Project and the purpose of the Class EA under Schedule 'B'. The goal of the meeting was to share project background, outline current activities, review key milestones, and provide an opportunity for MCFN to provide their input. The focus of the meeting remained on biosolids management, infrastructure components, and environmental considerations. Minutes from the July 28, 2025, meeting with MCFN are provided in Appendix F. MCFN participated in the Stage 2 Archaeological Assessment and had a representative involved in the fieldwork carried out in October and November 2025.

7.2.2 SNGR

Engagement with SNGR included delivering the Notice of Commencement, Notice of Public Information Centre, the Stage 1 Archaeological Assessment Reports, and Notice of Completion. No requests or concerns were received by the project team following the distribution of these materials. SNGR participated in the Stage 2 Archaeological Assessment and had a representative involved in the fieldwork carried out in October and November 2025.

7.2.3 HCCC/HDI

On January 30, 2026, the County HDI to discuss the Project and the requirements of the Schedule 'B' Municipal Class EA process. During the session, the County provided an overview of the Project's purpose, key background information, and the activities underway at this stage of the EA. The meeting focused on inviting HDI's input while reviewing anticipated milestones, technical components, and environmental considerations relevant to the County's biosolids management approach. Minutes from the January 30, 2026, meeting with HDI are provided in Appendix K. HDI participated in the Stage 2 Archaeological Assessment and had a representative involved in the fieldwork carried out in October and November 2025.

7.3 Engagement Tracking Log

An Engagement Tracking Log was created and updated to record feedback and outreach during the Project. Information recorded included contact information and a summary of the correspondence. Refer to Appendix G for a copy of the tracking log. The Tracking Log was updated consistently throughout the Class EA process and reflects comments from the PIC 1.

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

7.4 Public Consultation

The Project followed the Class EA Schedule 'B' consultation process, including a Notice of Commencement, Public Information Centre, and Comment Period.

7.4.1 Notice of Commencement

On June 20, 2025, a Notice of Commencement was issued to each of the identified Ministries, Agencies, and Indigenous communities. For the public and local community, the Notice of Commencement was posted on the County's website on June 23, 2025. A copy of the Notice is provided in Appendix H.

7.4.2 Public Information Centre Notification

On July 25, 2025, a PIC Notice was issued to the identified Ministries, Agencies, and Indigenous communities. The Notice was also made available to the public and local community by posting it on the County's website on the same day. A copy of the Notice is provided in Appendix H.

7.4.3 Public Information Centre

The Project Team hosted the PIC on August 12, 2025, at the Norfolk County Administration Building to solicit information and suggestions on the purpose of the Study, the Study Area, issues and concerns within the Study Area, the list of alternatives, and next steps in the study process. Participants of the PIC were encouraged to actively engage in discussion with the Project team and review the proposed options. Presentation boards, which provided an overview of the Project, were arranged throughout the venue and focused on impacts to the public. These presentation boards (Appendix I) were then uploaded to the County's website and were made accessible as required by the AODA.

7.4.4 Summary of Public Comments

Public feedback from the PIC was received through email correspondence and Feedback Forms. Feedback garnered from the PIC was generally positive, with concerns mainly focused on the proposed access road and maintaining the existing L.E. & N. Railway Trail. Mitigation measures related to the trail network are included in Section 8.1.11. The public shared positive feedback in response to the preferred Alternative Solution.

A summary of feedback from the PIC attendees is presented below in Table 7.1 and provided in Appendix J.

Table 7.1: Summary of PIC Public Feedback

Public Issue	Comments	Concerns
Proposed Access Road	Participants noted potential impacts on local trails and increased truck traffic.	Concerns were raised about safety, noise, and disruption to local traffic.
Trail Access & Maintenance	Community members emphasized the importance of preserving safe and reliable access to park trails during and after construction.	Feedback highlighted worries about trail closures, reduced maintenance, and long-term accessibility.

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

7.4.5 *Notice of Completion*

A Notice of Completion was issued on December 18, 2025, to the identified Ministries, stakeholders, and Indigenous communities, together with the completed Project File Report, initiating a 30-day review period. The Notice was also made available to the public and local community by posting it on the County's website on the same day. A copy of the Notice is provided in Appendix H.

7.4.6 *Review Period Comments*

On January 30, 2026, the MECP issued a letter to the County with project review comments. A response letter has been prepared as provided in Appendix N, and the Project File Report has been revised to address these comments. No other review comments were received during the 30-day review period.

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

8. Mitigation of Potential Impacts and Monitoring

8.1 Environmental Considerations and Mitigation Measures

This section outlines the anticipated impacts during construction of the preferred Simcoe WWTP Biosolids Management Upgrades, along with proposed mitigation measures to minimize or avoid them. Through the Schedule 'B' Class EA process, the Preferred Alternative Solution was identified as having the least impact across environmental, social, economic, cultural, and technical considerations.

Like any construction project, temporary impacts such as noise, dust, vibration, and visual changes are expected during the work period. The County will take steps to minimize these impacts and keep the community informed throughout the process. A public engagement process and notification plan will be developed to receive feedback and mitigate any potential construction impacts. All construction work will be carried out in accordance with the Occupational Health and Safety Act (OHSA) and other local regulations. Specific mitigation measures, as described below, are recommended for implementation to reduce anticipated potential impacts.

8.1.1 Natural Environment

As per the Natural Heritage Report in Appendix A, species at risk were found at the southwest corner of the existing facility. Prior to any construction work, any Endangered Species Act (ESA) and Species at Risk Act (SARA) authorizations must be obtained and any required coordination with the MECP be completed. Avoidance times for clearing activities will be adhered to. Vegetation clearing activities will be scheduled outside of wildlife avoidance periods: April 1 to September 30 for bats, and March 31 to October 1 for birds.

8.1.2 Cultural and Archaeological Resources

As noted in Section 3.5, a Stage 2 Archaeological Assessment of the proposed biosolids management upgrades location is to be completed prior to the start of any construction activities. Stage 1 AA and Stage 2 AA proposals have also been submitted for the access road location and will be scheduled prior to any construction activities. Indigenous communities have been invited to participate and monitor the archaeology. Findings from the assessment will be used to guide construction planning, with careful attention to avoiding significant areas and protecting sensitive features.

8.1.3 Noise, Odour, Dust, and Vibration

During construction, potential noise effects are expected from both construction traffic and equipment operations. Noise during operation of the Simcoe WWTP is not expected to differ from the existing conditions. The proposed mitigation measures include the following:

- Ensuring all vehicles and construction equipment are equipped with effective muffling devices and are operated in a fashion to minimize noise in the project area.
- Throughout the construction period, the County will ensure the contractors undertake measures to reduce noise disturbances as much as possible and adhere to local noise by-laws.

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

Construction traffic could create additional dust and/or mud. The proposed mitigation measures include the following:

- Dust control measures such as the application of water to be implemented as required.
- The County will ensure the contractor maintain public roadways clean and free of mud on a consistent basis.

Once the geotechnical assessment has been completed, there will be a clearer indication of what is buried beneath the proposed biosolids upgrade areas. Prior to construction, a review will be conducted to assess potential vibration disruptions and mitigation measures will be implemented if required.

During construction, the County will maintain a complaint and grievance tracker to document concerns, ensure timely responses, and support transparent communication with the community.

During operations, noise enclosures will be provided for all required equipment to ensure that no workers are exposed to noises greater than 85 A-weighted decibels (dBA) over an 8-hour workday as required by the Ontario Building Code and Occupational Health and Safety regulations. Odour control measures have been integrated into the design to minimize disruptions to surrounding properties, and the construction of two odour control systems will help mitigate odour emissions during operations.

8.1.4 Traffic and Access

As noted in Section 6.1, a new access road is being proposed to mitigate the impact of the increased number of trucks on the surrounding residential streets. The new access road is proposed to replace the existing Oakwood Avenue entrance, which is no longer viable due to restricted truck access during school drop-off and pick-up times and associated safety concerns. The proposed 1 km access route (from either Victoria Street or Sherman Avenue) will divert heavy vehicles away from sensitive areas such as St. Joseph's Elementary School and the Oakwood Cemetery, reducing public safety risks and minimizing disruptions. The road will be constructed to municipal standards, support safe two-way truck traffic, and preserve existing trails and natural features. The road alignment feasibility is currently under review, pending the Class EA completion.

8.1.5 Visual and Landscape Impacts

The proposed solution will be constructed entirely within existing property boundaries, minimizing disruption to surrounding land uses and maintaining low visibility from public roadways. During construction, the County will incorporate visual mitigation measures to limit aesthetic impacts. Post-construction landscaping will be implemented to blend with the natural environment and require minimal ongoing maintenance, supporting long-term operational efficiency. Minimal grading is anticipated for the site.

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

8.1.6 *Community Engagement*

To ensure transparency and minimize disruptions, notices will be distributed to nearby residents and stakeholders outlining anticipated construction schedules, potential traffic impacts, and mitigation measures. Opportunities for feedback will be provided where feasible, and updates will be shared through multiple channels to maintain clear and consistent communication.

8.1.7 *Erosion and Sediment Control*

In compliance with LPRCA requirements and MECP's B-6 guideline as well as any local guidelines, an erosion and sediment control plan will be developed prior to the start of construction to highlight areas of concern and to outline all required measures are in place to avoid contamination of surrounding water sources.

8.1.8 *Disposal of Excess Material/Soil Management*

An excess soil management plan, including an Assessment of Past Uses, Sampling and Analysis Plan, and a Soil Characterization Report will be developed to outline the expected volume and quality of excess soil and to determine appropriate disposal measures and locations in accordance with Ontario Regulation 406/19: On-site and Excess Soil Management. The plan will also highlight testing requirements to determine any possible contamination. Where possible, excess soil will be reused within the site boundaries.

Best management practices for unknown contamination to be prepared for use by the contractor. These will include isolation of impacted soils in sealed bins, sampling and analytical testing of these soils and the excavation perimeter to assess disposal options.

8.1.9 *Traffic Management During Construction*

There will be increased truck traffic throughout the construction period on the surrounding access roads, including Victoria Street, Sherman Avenue and Oakwood Avenue, from the delivery of construction equipment, construction materials, and removal of excavated material from site. The proposed mitigation measures include the following:

- Appropriate hours of work will be specified in the contract, considering neighbourhood requirements such as school pick up/drop off times where possible.
- Truck access to and from the site will be limited to the new access road entrance.
- Any lane closures will be completed in accordance with best practices to protect the safety of the workers and the general public.
- Residents in the area will be kept informed ahead of time of any road closures and anticipated timing, as well as the overall schedule of construction.
- All standard best practices for vehicle and pedestrian safety will be employed throughout the construction areas.

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

8.1.10 GHG Emissions Control/Efficient Design

A preliminary evaluation of GHG Emissions was conducted. Prior to construction, further evaluation will be completed to determine overall GHG emissions, and to ensure that all measures are in place to optimize the system while reducing overall emissions.

8.1.11 Lake Erie and Northern Railway Trail

It is recognized that the L.E. & N. Railway is an important trail connection between Simcoe and Port Dover supporting recreational and inter-community movements. The right of way for the proposed new access road, should be designed to accommodate a new trail within its western boulevard area and ideally buffered from the road with landscaping and minor berming (if possible). During construction, a trail detour should be considered – possibly along Sherman to Oakwood and south onto Potts Road to Oakwood Cemetery and into the development lands (by Agreement) to the east. Users could then re-connect with the trail by entering back into the WWTP lands at their south limit. The detour would minimize impact on trail users until the reconfigured trail could be re-opened along the new roadway.

8.2 Monitoring

Throughout the construction phase, the County will conduct regular checks to ensure that all required mitigation measures outlined above are being followed to ensure compliance with local by-laws.

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

9. Approval and Permits

Permits and approvals required to implement the preferred design for the Simcoe WWTP Biosolids Management Upgrades are shown in Table 9.1.

Table 9.1: Simcoe WWTP Biosolids Management Upgrades – Permits and Approvals

Approval Agency	Permits/Approval Required
Electrical Safety Authority	• Notification of Electrical Work Permit
Ministry of Environment, Conservation and Parks	• Species at Risk Act Permit • ECA Amendment • Permit to Take Water (PTTW)
Norfolk County	• Building Permit • Site Plan Approval
Long Point Region Conservation Authority	• Prohibited Activities, Exemptions and Permits

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

10. References

Map *Norf*olk Community Web Map. (2025). Retrieved from https://norfolk.maps.arcgis.com/apps/webappviewer/index.html?id=c6683057b83744dfb36afb773ba09135

Ministry of the Environment, Conservation and Parks. (2025). Ontario Source Protection Information Atlas. Retrieved from https://www.lioapplications.lrc.gov.on.ca/SourceWaterProtection/index.html?viewer=SourceWaterProtection.SWPViewer&locale=en-CA

Norfolk County. (2014). The Zoning By-Law of Norfolk County 1-Z-2014. Retrieved from https://www.norfolkcounty.ca/media/5nddfr3u/zoning-by-law-consolidation.pdfAppendix K below

Norfolk County. (2016). Integrated Sustainable Master Plan (ISMP). Retrieved from https://www.norfolkcounty.ca/media/lmuibvyh/the-ismp.pdf

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

Appendix A
Natural Heritage Report

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

Norfolk County
Simcoe Wastewater Treatment Plant - Biosolids Management Upgrades - Municipal Class Environmental Assessment

Natural Heritage Report

2025-12-15	0	Final	J. Néné	C. Sehl	O. Koc
Date	**Rev.**	**Status**	**Prepared By**	**Checked By**	**Approved By**
HATCH					

© Hatch 2025 All rights reserved, including all rights relating to the use of this document or its contents.

Table of Contents

1. Introduction 1

2. Desktop Analysis 1

3. Survey Methods 3

3.1 Breeding Birds 3
3.2 Vegetation Communities 3

4. Survey Results 4

4.1 Breeding Birds 4
4.2 Vegetation Communities 5
4.3 Incidental Wildlife 5

5. Potential Constraints 5

5.1 Species at Risk 5
5.1.1 Species of Conservation Concern 6
5.2 Significant Wildlife Habitat 6
5.3 Regulated Areas 7

6. Conclusion and Recommendations 7

6.1 Species at Risk 7
6.1.1 Red-headed Woodpecker 7
6.1.2 Chimney Swift 7
6.1.3 Eastern Massasauga 8
6.1.4 SAR Bats 8
6.2 Migratory Birds 8
6.3 Regulated Areas 8

7. References 9

List of Tables

Table 2-1: Desktop Review Results for SAR/SCC Within the Study Area 1
Table 4-1: Weather Conditions Summary 4

List of Figures

Figure 1: ELC and Survey Locations 11
Figure 2: Potential Constraints 12
Figure 3: Proposed Site Plans 13

List of Appendices

Appendix A SAR/SCC Screening Table
Appendix B Bird Species from Within the Study Area
Appendix C Vascular Plant Species from Within the Study Area

© Hatch 2025 All rights reserved, including all rights relating to the use of this document or its contents.

1. Introduction

Hatch Ltd. (Hatch) has been retained by Norfolk County to complete an Environmental Assessment in support of the Simcoe Wastewater Treatment Facility (WWTF) upgrades. The existing WWTF is located at 16 Oakwood Avenue, Simcoe. The subject property for the screening is defined as the existing facility and the proposed development adjacent the existing facility. The study area consists of the subject property and a 250-m radius. The subject property is located within the Long Point Region Conservation Authority (LPRCA) regulated area. The study area, subject property and LPRCA boundaries are located on Figure 2.

2. Desktop Analysis

A background review (desktop analysis) was previously conducted to determine potential Species at Risk (SAR) or Species of Conservation Concern (SCC) presence within the study area. During this exercise, data was compiled from various secondary sources. Sources include the Ontario Breeding Bird Atlas (OBBA), Ontario Butterfly Atlas (OBA), Natural Heritage Information Centre (NHIC), Ontario Reptile and Amphibian Atlas (ORAA), iNaturalist, and eBird. The following species were identified and are outlined in Table 2-1 below. SAR are those listed as Threatened or Endangered under the *Species at Risk Act, 2002* (SARA). SCC are those considered:

- Special Concern under SARA and the *Endangered Species Act, 2007* (ESA),
- Special Concern under the ESA but not under SARA, and
- Unregulated species with an S-Rank of S3 or lower.

Table 2-1: Desktop Review Results for SAR/SCC Within the Study Area

Species Common Name	Species Scientific Name	*Species at Risk Act* Status	*Endangered Species Act* Status	Background Source(s)
Birds				
Bank Swallow	*Riparia riparia*	Threatened	Threatened	OBBA (May 2025)
Barn Swallow	*Hirundo rustica*	Special Concern	Special Concern	OBBA (May 2025)
Bobolink	*Dolichonyx oryzivorus*	Threatened	Threatened	OBBA (May 2025)
Canada Warbler	*Cardellina canadensis*	Special Concern	Special Concern	OBBA (May 2025)

© Hatch 2025 All rights reserved, including all rights relating to the use of this document or its contents.

Species Common Name	Species Scientific Name	*Species at Risk Act* Status	*Endangered Species Act* Status	Background Source(s)
Chimney Swift	*Chaetura pelagica*	Threatened	Threatened	OBBA (May 2025)
Eastern Meadowlark	*Sturnella magna*	Threatened	Threatened	NHIC, OBBA (May 2025)
Eastern Wood-pewee	*Contopus virens*	Special Concern	Special Concern	NHIC, OBBA (May 2025)
Grasshopper Sparrow	*Ammodramus savannarum*	Special Concern	Special Concern	OBBA (May 2025)
Red-headed Woodpecker	*Melanerpes erythrocephalus*	Endangered	Endangered	NHIC, OBBA (May 2025)
Wood Thrush	*Hylocichla mustelina*	Threatened	Special Concern	NHIC, OBBA (May 2025)
Herpetofauna				
Blanding's Turtle (Great Lakes/St. Lawrence population)	*Emydoidea blandingii*	Endangered	Threatened	ORAA (May 2025)
Eastern Foxsnake (Carolinian and Great Lakes/St. Lawrence population)	*Pantherophis vulpinus*	Endangered	Threatened	ORAA (May 2025)
Eastern Hog-nosed Snake	*Heterodon platyrhinos*	Threatened	Threatened	ORAA (May 2025)
Massasauga (Carolinian Population)	*Sistrurus catenatus pop. 2*	Endangered	Endangered	ORAA (May 2025)
Northern Map Turtle	*Graptemys geographica*	Special Concern	Special Concern	ORAA (May 2025)
Northern Ribbonsnake (Great Lakes Population	*Thamnophis sauritus septentrionalis*	Special Concern	Special Concern	ORAA (May 2025)
Snapping Turtle	*Chelydra serpentina*	Special Concern	Special Concern	NHIC, ORAA (May 2025)
Insects				
Macropis Cuckoo Bee	*Epeoloides pilosulus*	Endangered	Extirpated	NHIC (May 2025)
Monarch	*Danaus plexippus*	Endangered	Not Regulated	OBA (May 2025)
One-banded Mason Wasp	*Ancistrocerus unifasciatus*	Not Regulated	Not Regulated	NHIC (May 2025)
Rusty-patched Bumblebee	*Bombus affinis*	Endangered	Endangered	NHIC (May 2025)

© Hatch 2025 All rights reserved, including all rights relating to the use of this document or its contents.

Species Common Name	Species Scientific Name	*Species at Risk Act* Status	*Endangered Species Act* Status	Background Source(s)
Mammals				
Eastern Small-footed Myotis	*Myotis leibii*	Not Regulated	Endangered	MWH (2023)
Little Brown Myotis	*Myotis lucifugus*	Endangered	Endangered	MWH (2023)
Northern Myotis	*Myotis septentrionalis*	Endangered	Endangered	MWH (2023)
Tri-coloured Bat	*Pipistrellus subflavus*	Endangered	Endangered	MWH (2023)
Eastern Red Bat	*Lasiurus borealis*	Endangered	Endangered	Added by Hatch
Hoary Bat	*Lasiurus cinereus*	Endangered	Endangered	Added by Hatch
Silver-haired Bat	*Lasionycteris noctivagans*	Endangered	Endangered	Added by Hatch
Plants				
Autumn Coralroot	*Corallorhiza odontorhiza*	Not Regulated	Not Regulated	NHIC (May 2025)
Bird's-foot Violet	*Viola pedate*	Endangered	Endangered	NHIC (May 2025)
Broad Beech Fern	*Phegopteris hexagonoptera*	Special Concern	Special Concern	NHIC (May 2025)
Carolina Vetch	*Vicia caroliniana*	Not Regulated	Not Regulated	NHIC (May 2025)
Hairy Hawkweed	*Hieracium longipilum*	Not Regulated	Not Regulated	NHIC (May 2025)
Moss Phlox	*Phlox subulate*	Not Regulated	Not Regulated	NHIC (May 2025)
Walter's Barnyard Grass	*Echinochloa walteri*	Not Regulated	Not Regulated	NHIC (May 2025)

3. Survey Methods

3.1 Breeding Birds

Targeted breeding bird surveys were completed across two site visits on May 28 and July 4, 2025, in accordance with the Ontario Breeding Bird Atlas survey protocols (2021). A combination of five-minute point counts and an area search was completed by a Hatch biologist to document the highest level of breeding evidence associated with all bird species observed within the subject property.

3.2 Vegetation Communities

A high-level vegetation assessment was completed for the subject property and adjacent woodlands in accordance with Ecological Lands Classification for Southern Ontario (Lee et al. 1998). Vegetation communities were identified to ecosite level where feasible, with the dominant plant species recorded.

© Hatch 2025 All rights reserved, including all rights relating to the use of this document or its contents.

4. Survey Results

The following sections outline the results of the surveys described in Section 3. Table 4-1 below outlines the weather conditions present on site during the time of the investigation.

Table 4-1: Weather Conditions Summary

Date (2025)	Time (24hrs)	Cloud Cover (%)	Wind Speed (Beaufort Scale)	Precipitation	Air Temperature (˚C)
May 28	0620	100	2	Light drizzle prior to survey	11
July 4	0732	0	1	None	17

4.1 Breeding Birds

A total of 35 bird species were observed during 2025 targeted breeding bird surveys. Of those observed, five species exhibited confirmed breeding evidence including Red-headed Woodpecker (*Melanerpes erythrocephalus*), Song Sparrow (*Melospiza melodia*), Yellow Warbler (*Setophaga petechia*), Gray Catbird (*Dumetella carolinensis*) and Red-winged Blackbird (*Agelaius phoeniceus*). Probable breeding evidence was observed for 13 species including, American Robin (*Turdus migratorius*), Indigo Bunting (*Passerina cyanea*), Cedar Waxwing (*Bombycilla cedrorum*) and Great Crested Flycatcher (*Myiarchus crinitus*).

SAR birds were observed exhibiting breeding evidence directly adjacent to the property including:

- Redheaded Woodpecker (*Chaetura pelagica*) – Endangered; and
- Chimney Swift (*Chaetura pelagica*) – Threatened.

One SCC, Barn Swallow (*Hirundo rustica*) was observed exhibiting possible breeding evidence within the subject property. One SCC species, Eastern Wood-pewee (*Contopus virens*), was observed exhibiting possible breeding evidence within the study area but was not observed within the subject property. A full list of bird species from within the study area can be found in Appendix B. Point count and area-search transect locations are shown on Figure 1.

© Hatch 2025 All rights reserved, including all rights relating to the use of this document or its contents.

4.2 Vegetation Communities

Vegetation communities within the subject property are characterized as primarily Mineral Cultural Meadow Ecosite (CUM1) and Black Walnut Deciduous Plantation Type (CUP1-3) ecosites. The CUM1 community is dominated by Canada/Tall Goldenrod (*Solidago sp.*) with occasional patches of Kentucky Bluegrass (*Poa pratensis*), Dame's Rocket (*Hesperis matronalis*) and Tufted Vetch (*Vicia cracca*). The CUP1-3 ecosite is dominated by Black Walnut (*Juglans nigra*) and Manitoba Maple (*Acer negundo*) with lesser proportions of *Prunus sp*., White Spruce (*Picea glauca*), Scots Pine (*Pinus sylvestris*), American Elm (*Ulmus americana*) and Eastern Cottonwood (*Populus deltoides*). A full list of plant species from within the study area can be found in Appendix C. Vegetation communities are shown on Figure 1.

4.3 Incidental Wildlife

Two mammal species, Eastern Cottontail (*Sylvilagus floridanus*) and White-tailed Deer (*Odocoileus virginianus*), were observed incidentally within the subject property during 2025 field visits.

5. Potential Constraints

5.1 Species at Risk

During the initial background review, 18 SAR and 16 SCC were observed to have potential to occur within the study area. Two SAR and two SCC were observed within the study area by Hatch Biologists during the 2025 field season. Of those, two SAR and one SCC, Red-headed Woodpecker, Chimney Swift (*Chaetura pelagica*) and Barn Swallow, respectively, were observed within or directly adjacent to the subject property. An additional nine SAR and four SCC were determined to have potential to occur within the subject property but were not observed. Full results of the SAR/SCC screening can be found in Appendix A.

Red-headed Woodpecker

A Red-headed Woodpecker individual was observed entering a nesting cavity in a large Eastern Cottonwood snag, immediately adjacent to the subject property (Figure 2) during the July 4 site visit. This species is listed as *Endangered* under the ESA and SARA. The federal recovery strategy (Pickett et al., 2019) identifies critical habitat for this species as a radius of 200m centered on a nesting cavity location. Within the 200m radius, critical habitat is defined as the extent of biophysical attributes within the area. Biophysical attributes generally include treed areas, decadent deciduous trees with minimum 18cm diameter at breast height (DBH) or dead/dying limbs with 13cm diameter or more, and other vegetated areas within 50m of a dripline or decadent tree.

© Hatch 2025 All rights reserved, including all rights relating to the use of this document or its contents.

Eastern Massasauga

The Eastern Massasauga (*Sistrurus catenatus*) was identified during the desktop investigation (ORAA 2025). It is noted that the species is largely considered extirpated from the general study area.

SAR Bats

Seven SAR bats found within the study area were determined to have potentially suitable habitat within the subject property. Buildings are present and may provide suitable roosting. Additionally, potentially suitable roosting trees have been observed within the study area and may be present within the CUP1-3 community. While no bats were observed during the 2025 site visits, targeted bat surveys were not completed.

5.1.1 Species of Conservation Concern

Northern Ribbonsnake

The Northern Ribbonsnake (*Thamnophis sauritus septentrionalis*) was determined to have potential to occur within the study area (ORAA 2025). Additionally, suitable habitat for this species persists within the subject property. While this species was not observed during the 2025 site visits, targeted surveys for this species were not completed.

Vascular Plants

Three SCC plant species found within the study area were determined to have potentially suitable habitat within the subject property including, Autumn Coralroot (*Corallorhiza odontorhiza*), Moss Phlox (*Phlox subulate*) and Hairy Hawkweed (*Hieracium longipilum*). While these species were not observed during the 2025 site visits, targeted vascular plant surveys were not completed.

5.2 Significant Wildlife Habitat

During the July 4 site visit three Barn Swallow individuals were observed within suitable breeding habitat within the subject property, indicating possible breeding evidence. Barn Swallow is designated as *Special Concern* under the ESA and *Threatened* under Schedule 1 of SARA.

Although presence of *Special Concern* species qualifies as Significant Wildlife Habitat under the Significant Wildlife Habitat Criteria Schedule for Ecoregion 7E, this species was only observed exhibiting possible breeding evidence. Additionally, this species was observed primarily in the vicinity of the man-made structures within the subject property. Barn Swallows nest on a variety of man-made structures (sheds, stables, barns, buildings, bridges, etc.). Given that these structures are more likely being utilized than natural features and that suitable foraging habitats persist directly adjacent to the subject property, significant wildlife habitat for this species is deemed not present within the subject property.

© Hatch 2025 All rights reserved, including all rights relating to the use of this document or its contents.

5.3 Regulated Areas

The Long Point Region Conservation Authority regulated area is mapped along the western boundary and encroaches on the southwest portion of the subject property (Figure 2). Under section 28 of the *Conservation Authorities Act* (1990) (CAA) development activities are not permitted within the jurisdiction of an authority. An application for permit must be completed in accordance with *O. Reg 41/24* for any proposed development activities within regulated areas.

6. Conclusion and Recommendations

6.1 Species at Risk

With the recent introduction of Bill 5, the ESA is set to be repealed and replaced by *The Species Conservation Act 2025* (SCA). Additionally, the definition of 'habitat' under the ESA has changed, as it pertains to SAR. Processes involving SAR continues to operate under the ESA framework until the SCA comes into force.

6.1.1 Red-headed Woodpecker

Critical habitat for Red-headed Woodpecker persists within the subject property (Figure 2). Given that critical habitat overlaps with the desired footprint of the facility upgrades, an authorization under the ESA may be required where construction is planned within forested habitat within 200 m of the nest occurrence. It is recommended an Information Gathering Form be submitted to the Ministry of the Environment, Conservation and Parks prior to any site clearing or construction activities within the CUM1 community during the active nesting season, to avoid contravention of the ESA. It should be noted that it is expected that the current ESA is expected to be repealed in early 2026, to be replaced by the *Species Conservation Act* (SCA). The SCA is not expected to be applicable to migratory birds regulated under the *Migratory Bird Convention Act or Species at Risk Act* and therefore this species is only expected to be regulated federally.

6.1.2 Chimney Swift

During the July 4 visit, two Chimney Swift individuals were observed flying above suitable nesting habitat directly adjacent to the subject property, indicating possible breeding evidence. The two individuals were observed circling above two large Eastern Cottonwood snags containing various cavities. Chimney Swifts primarily nest in chimneys and other man-made structures but will also nest in tree cavities. Chimney Swifts are listed as *Threatened* under the ESA and SARA. Although this species was observed during the July 4 visit it was not observed during the May 28 site visit, indicating possible breeding evidence. As such, it is unlikely this species is nesting in close proximity to the subject property and is likely utilizing man-made structures within the town of Simcoe.

© Hatch 2025 All rights reserved, including all rights relating to the use of this document or its contents.

6.1.3 Eastern Massasauga

Historical records from the ORAA indicate Eastern Massasauga within the study area. Populations of this species are tracked by the province and occurrences are well-known. The remaining Carolinian populations of this species are generally reserved to isolated areas in Niagara and Essex. Given that remaining populations are well-known and that historical records from the study area are well-dated (1961), this species is deemed not present within the study area.

6.1.4 SAR Bats

Potentially suitable bat roosting buildings were identified within the subject property. Additionally, potential bat roosting trees were identified within the study area and may persist within the CUP1-3 community. The proposed facility upgrades are not anticipated to affect any of the existing potential roost buildings on site. Some boundary trees associated with the CUP1-3 community may be cleared to facilitate facility upgrades. It is recommended all tree clearing activities be completed outside of the April 1 to September 30 bat active window. All pruning and tree removals should occur between October 1 and March 31 to avoid possible contravention of the ESA.

6.2 Migratory Birds

The *Migratory Birds Convention Act* (1994) (MBCA) prohibits the destruction of a nest or eggs of migratory birds. It is recommended all vegetation clearing be completed outside of the April 1 to August 31 migratory bird active nesting period. All vegetation removals should occur between September 1 and March 31 to avoid contravention of the MBCA.

6.3 Regulated Areas

In order to facilitate development within the LPRCA regulated area, a permit application must be submitted to remain in compliance with CAA. The proposed facility upgrades are not anticipated to occur within the LPRCA regulated area therefore, a permit application is not required (Figure 3).

© Hatch 2025 All rights reserved, including all rights relating to the use of this document or its contents.

7. References

Birds Canada. (2025). *Atlas Data Summary*. Retrieved from naturecounts.ca: https://naturecounts.ca/nc/onatlas/atlas_stats.jsp?type=species&square=17TNH54

Government of Canada. (1994). *Migratory Birds Convention Act, 1994 (S.C. 1994, c. 22).* Retrieved from laws-lois.justice.gc.ca: https://laws-lois.justice.gc.ca/eng/acts/m-7.01/

Government of Canada. (2002). *Species at Risk Act (S.C. 2002, c. 29).* Retrieved from laws-lois.justice.gc.ca: https://laws-lois.justice.gc.ca/eng/acts/s-15.3/

Government of Canada. (202, July 17). *Species at Risk Public Registry*. Retrieved from canada.ca: https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html

Government of Ontario. (2007). *Endangered Species Act, 2007, S.O. 2007, c. 6.* Retrieved from ontario.ca: https://www.ontario.ca/laws/statute/07e06#act-verion

Government of Ontario. (2025, July 18). *Conservation Authorities Act, R.S.O. 1990, c. C.27*. Retrieved from ontario.ca: https://www.ontario.ca/laws/statute/90c27#BK69

Government of Ontario. (2025, August 4). *Conservation Authorities Act, R.S.O. 1990, c. C.27.* Retrieved from ontario.ca: https://www.ontario.ca/laws/statute/90c27

Lee et al. (1998). *Ecological Land Classification .* Retrieved from ontario.ca: https://www.ontario.ca/files/2024-10/mnr-psd-ecological-land-classification-for-southern-ontario-2024-10-07.pdf

Long Point Region Conseration Authority. (2025). *LPRCA Mapping*. Retrieved from camaps.maps.arcgis.com: https://camaps.maps.arcgis.com/apps/webappviewer/index.html?id=c963d73e6f124ab6b68b06afc0a279e6

Map Norfolk Community Web Map. (2025). Retrieved from https://norfolk.maps.arcgis.com/apps/webappviewer/index.html?id=c6683057b83744dfb36afb773ba09135

Ministry of Natural Resources. (2015, January). *Significant Wildlife Habitat Criteria Schedules For Ecoregion 7E.* Retrieved from ontario.ca: https://www.ontario.ca/files/2025-02/schedule-7e-jan-2015-access-vers-final-s.pdf

Ministry of Natural Resources. (2024). *O. Reg. 41/24: PROHIBITED ACTIVITIES, EXEMPTIONS AND PERMITS*. Retrieved from ontario.ca: https://www.ontario.ca/laws/regulation/r24041#BK6

Ministry of Natural Resources. (2025). *Make A Map: Natural Heritage Areas*. Retrieved from lioapplications.lrc.gov.on.ca: https://www.lioapplications.lrc.gov.on.ca/Natural_Heritage/index.html?viewer=Natural_Heritage.Natural_Heritage&locale=en-CA

Ministry of the Environment, Conservation and Parks. (2021, August 12). *Broad beech fern*. Retrieved from ontario.ca: https://www.ontario.ca/page/broad-beech-fern

Ministry of the Environment, Conservation and Parks. (2024, April 19). *Species at Risk in Ontario*. Retrieved from ontario.ca: https://www.ontario.ca/page/species-risk-ontario

Ministry of the Environment, Conservation and Parks. (2025, April 15). *Bird's-foot violet*. Retrieved from ontario.ca: https://www.ontario.ca/page/birds-foot-violet

Ministry of the Environment, Conservation and Parks. (2025). *Ontario Source Protection Information Atlas*. Retrieved from https://www.lioapplications.lrc.gov.on.ca/SourceWaterProtection/index.html?viewer=SourceWaterProtection.SWPViewer&locale=en-CA

Minnesota Wildflowers. (2025). *Corallorhiza odontorhiza (Autumn Coralroot)*. Retrieved from minnesotawildlfowers.org: https://www.minnesotawildflowers.info/flower/autumn-coralroot

Minnesota Wildflowers. (2025). *Echinochloa walteri (Walter's Barnyard Grass)*. Retrieved from minnesota wildflowers.info: https://www.minnesotawildflowers.info/grass-sedge-rush/walters-barnyard-grass

Minnesota Wildlfowers. (2025). *Hieracium longipilum (Hairy Hawkweed)*. Retrieved from minnesotawildflowers.info: https://www.minnesotawildflowers.info/flower/hairy-hawkweed

© Hatch 2025 All rights reserved, including all rights relating to the use of this document or its contents.

Minnesota Wildlfowers. (2025). *Phlox subulata (Creeping Phlox)*. Retrieved from minnesotawildlfowers.info: https://www.minnesotawildflowers.info/flower/creeping-phlox

Norfolk County. (2014). *The Zoning By-Law of Norfolk County 1-Z-2014.* Retrieved from https://www.norfolkcounty.ca/media/5nddfr3u/zoning-by-law-consolidation.pdf

Norfolk County. (2016). *Integrated Sustainable Master Plan (ISMP).* Retrieved from https://www.norfolkcounty.ca/media/lmuibvyh/the-ismp.pdf

Ontario Breeding Bird Atlas. (2021, April). *Instructions for General Atlassing*. Retrieved from birdsontario.b-cdn.net: https://birdsontario.b-cdn.net/wp-content/uploads/Instructions-for-General-Atlassing-2021-04-07-download.pdf

Ontario Nature. (2025). *Ontario Reptile and Amphibian Field Guide.* Retrieved from ontarionature.org: https://ontarionature.org/programs/community-science/reptile-amphibian-atlas/species/

Ontario Nature. (2025). *Species list in taxonomic order for square 17NH54*. Retrieved from ontarioinsects.org: https://www.ontarioinsects.org/herp/php/SQLname.php?name=all&records=all&char1=&lowYear=1333&highYear=9999&spIndex=0&areaID=17NH54&areaName=undefined&type=spList&sp=na&area=squares&order=taxonomic

Toronto Entomologist's Association. (2025). *Species list in taxonomic order for square 17NH54*. Retrieved from ontarioinsects.org: https://www.ontarioinsects.org/atlas/php/SQLname.php?name=all&records=all&char1=&lowYear=1333&highYear=9999&spIndex=0&areaID=17NH54&areaName=undefined&type=spList&sp=na&area=squares&order=taxonomic

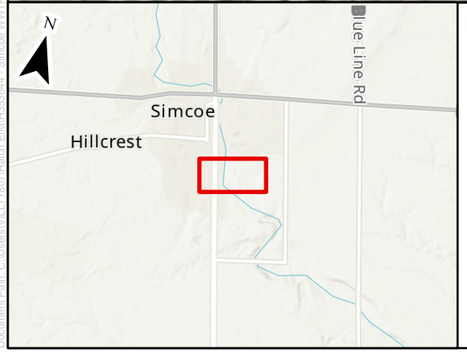
© Hatch 2025 All rights reserved, including all rights relating to the use of this document or its contents.

Figure 1: ELC and Survey Locations

© Hatch 2025 All rights reserved, including all rights relating to the use of this document or its contents.

Esri, NASA, NGA, USGS, Province of Ontario, Esri Canada, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, NRCan, Parks Canada, Maxar





LEGEND

- Breeding Bird Survey Location
- Breeding Bird Survey Transect
- Subject Property
- Study Area

Ecological Land Classification (ELC)

- CUM1 – Mineral Cultural Meadow Ecosite
- CUP1-3 Black Walnut Deciduous Plantation

NOTES:
1. Produced by Hatch, contains information licensed under the Open Government Licence – Ontario
2. Spatial referencing: NAD 1983 UTM Zone 17N

0 0.05 0.1 0.2 m

1:4,000

PROJECT:	Simcoe Wastewater Treatment Plant Upgrades Class Environmental Assessment (EA) Study
FIGURE TITLE:	Ecological Land Classification (ELC) and Survey Locations
CLIENT:	Norfolk County

DWG BY:	CHK BY:	FIG NO.:	REV NO.:
S. PERRY	J. NENE	1	1
DATE: 28/07/25	**PAGE:** 1		

HATCH

Plotted By: C. Davis/VAL1/HATCH on: 28/07/2025 10:38:00 AM | Drawing File: G:\GIS\NAMWP\Norfolk County\Simcoe WWTP Upgrades\GIS\MXD\Simcoe_BreedingBird_Survey.mxd

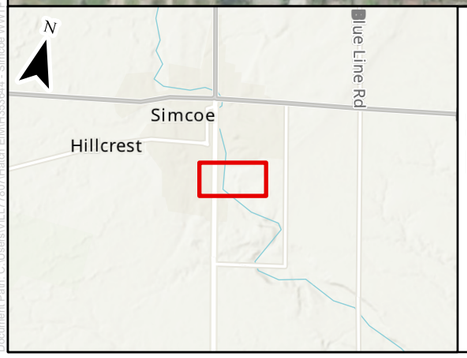
Figure 2: Potential Constraints

© Hatch 2025 All rights reserved, including all rights relating to the use of this document or its contents.

Esri, NASA, NGA, USGS, Province of Ontario, Esri Canada, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, NRCan, Parks Canada, Maxar

N

RHWO Nest



LEGEND

- Red-headed Woodpecker Nesting Snag
- Subject Property
- Study Area
- Red-headed Woodpecker Critical Habitat
- Long Point Region Conservation Authority Regulated Area

NOTES:
1. Produced by Hatch, contains information licensed under the Open Government Licence – Ontario
2. Spatial referencing: NAD 1983 UTM Zone 17N
3. Long Point Region Conservation Authority (LPRCA) Regulated Area digitized from LPRCA online mapping application, July 2025

0 0.05 0.1 0.2 m

1:4,000

PROJECT:	Simcoe Wastewater Treatment Plant Upgrades Class Environmental Assessment (EA) Study
FIGURE TITLE:	Potential Constraints
CLIENT:	Norfolk County

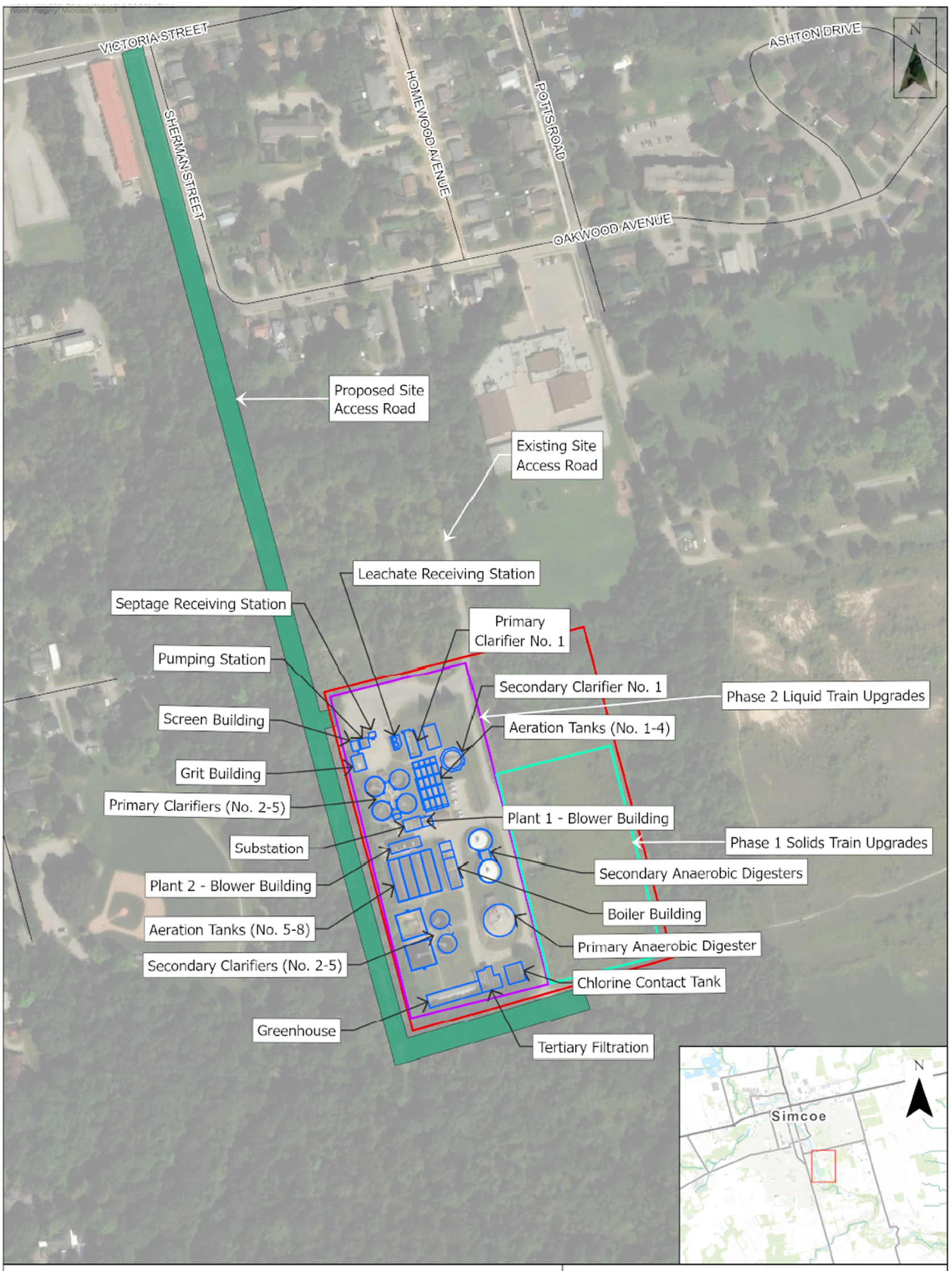
DWG BY:	CHK BY:	FIG NO.:	REV NO.:
S. PERRY	J. NENE	2	1
DATE: 28/07/25	PAGE: 1		

HATCH

Proposed Park - Options\WLE\PROJECTS\Simcoe\GIS\MXD\Simcoe_WWTP_Upgrades_EA\SIMCOE_Natural_Heritage_Report\Natural_Heritage_Report.prjx

Figure 3: Proposed Site Plans

© Hatch 2025 All rights reserved, including all rights relating to the use of this document or its contents.



© Hatch 2025 All rights reserved, including all rights relating to the use of this document or its contents.

Appendix A

SAR/SCC Screening Table

© Hatch 2025 All rights reserved, including all rights relating to the use of this document or its contents.

Species Common Name	Species Scientific Name	SARA Status	ESA Status	Background Source(s)	Habitat Description	Evaluation of Potential to be found within the Subject property
Birds						
Bank Swallow	*Riparia riparia*	Threatened	Threatened	OBBA (May 2025)	This species is a colonial nester, utilizing vertical cliffs or banks, which are most often found along natural bluffs or eroding streamside banks. They can also inhabit man-made sites such as sand, gravel or road cuts.	No – This species was not detected by Hatch biologists during targeted breeding bird surveys.
Barn Swallow	*Hirundo rustica*	Special Concern	Special Concern	OBBA (May 2025)	Commonly associated with human structures such as buildings, open barns, bridges and culverts where their mud nest-cups can be built.	Yes – This species was observed by a Hatch Biologist in suitable breeding habitat within the subject property, during the July 4, 2025 site visit.
Bobolink	*Dolichonyx oryzivorus*	Threatened	Threatened	OBBA (May 2025)	Commonly found in areas with medium to tall grass – meadows or tall grass prairies.	No – While no individuals were observed within the subject property during targeted breeding bird surveys, potential suitable habitats persist to the east of the subject property.

© Hatch 2025 All rights reserved, including all rights relating to the use of this document or its contents.

Species Common Name	Species Scientific Name	SARA Status	ESA Status	Background Source(s)	Habitat Description	Evaluation of Potential to be found within the Subject property
Canada Warbler	*Cardellina canadensis*	Special Concern	Special Concern	OBBA (May 2025)	Found in various forests with well-developed shrubbery, including: wet mixed forests, riparian shrub forests, and old-growth forests with open canopies.	No – While no individuals were observed within the subject property during targeted breeding bird surveys, potential suitable habitats persist to the south of the subject property.
Chimney Swift	*Chaetura pelagica*	Threatened	Threatened	OBBA (May 2025)	Originally nested in natural sites such as caves and hollow trees in old-growth forests. Modern nesting occurs in chimneys and other various artificial sites (silos, barns, sheds, air vents). Common in areas with large concentrations of chimneys for nest sites and roosts.	Possible – This species was observed by a Hatch Biologist in suitable breeding habitat immediately adjacent to the subject property, during the July 4, 2025 site visit.
Eastern Meadowlark	*Sturnella magna*	Threatened	Threatened	NHIC, OBBA (May 2025)	Primarily in moderately tall grasslands, such as pastures and hayfields – can also be found in alfalfa fields, weedy borders of croplands, roadsides, orchards, overgrown fields, and other open areas.	No – While no individuals were observed within the subject property during targeted breeding bird surveys, potential suitable habitats persist to the east of the subject property.

© Hatch 2025 All rights reserved, including all rights relating to the use of this document or its contents.

Species Common Name	Species Scientific Name	SARA Status	ESA Status	Background Source(s)	Habitat Description	Evaluation of Potential to be found within the Subject property
Eastern Wood-pewee	*Contopus virens*	Special Concern	Special Concern	NHIC, OBBA (May 2025)	Mid-canopy layer of forest clearings and edges of deciduous and mixed forests. Intermediate-age mature forest stands w/ little understory vegetation.	No – This species was observed by a Hatch Biologist in suitable breeding habitat within the study area, during the July 4, 2025 site visit.
Grasshopper Sparrow	*Ammodramus savannarum*	Special Concern	Special Concern	OBBA (May 2025)	Open grassland areas w/ well-drained, sandy soil. Also nest in hayfields and pasture, alvars, prairies; occasionally grain crops such as barley. Prefers areas sparsely vegetated.	No – While no individuals were observed within the subject property during targeted breeding bird surveys, potential suitable habitats persist to the east of the subject property.
Red-headed Woodpecker	*Melanerpes erythrocephalus*	Endangered	Endangered	NHIC, OBBA (May 2025)	Associated with open woodland and woodland edges; areas typically have many dead trees used for nesting and perching.	Yes – Confirmed breeding evidence was observed for this species by Hatch Biologists during the July 4, 2025 field visit, immediately adjacent to the subject property.

© Hatch 2025 All rights reserved, including all rights relating to the use of this document or its contents.

Species Common Name	Species Scientific Name	SARA Status	ESA Status	Background Source(s)	Habitat Description	Evaluation of Potential to be found within the Subject property
Wood Thrush	*Hylocichla mustelina*	Threatened	Special Concern	NHIC, OBBA (May 2025)	Nests mainly in second growth and mature deciduous and mixed forests, with saplings and well-developed understory layers. Prefers large forest mosaics but may also nest in small forest fragments.	No – This species was not observed within the subject property during targeted breeding bird surveys. Potential suitable habitats persist to the south of the subject property.
Herpetofauna						
Blanding's Turtle (Great Lakes/St. Lawrence population)	*Emydoidea blandingii*	Endangered	Threatened	ORAA (May 2025)	Inhabit shallow lakes, ponds and wetlands with clean water and mucky bottoms, make the largest overland movement of any Ontario turtles, travelling up to several kilometres between summer habitat and nesting sites or overwintering habitat. This species hibernates in the soft bottoms of water bodies. Particularly in the spring, the Blanding's turtle basks on rocks, logs or substrates in sunny locations.	No – No suitable habitats persist within the subject property or study area.

© Hatch 2025 All rights reserved, including all rights relating to the use of this document or its contents.

Species Common Name	Species Scientific Name	SARA Status	ESA Status	Background Source(s)	Habitat Description	Evaluation of Potential to be found within the Subject property
Eastern Foxsnake (Carolinian and Great Lakes/St. Lawrence population)	*Pantherophis vulpinus*	Endangered	Threatened	ORAA (May 2025)	Generally use unforested habitats such as shorelines, prairies, savannahs, rock barrens and wetlands, and are most commonly found in shoreline edge habitats. This species does use forests and forest edge habitat, however, especially along the eastern shore of Georgian Bay. Females require rotten logs, stumps, decaying leaf piles and other features with appropriate conditions for incubating eggs. In southwestern Ontario, will use building foundations, drainage ditches, hedgerows, old wells and so on. In this region, nesting sites often consist of old piles of rotten leaves, wood chips and compost.	No - Subject property is predominantly cultural meadow habitats which is unsuitable for this species.

© Hatch 2025 All rights reserved, including all rights relating to the use of this document or its contents.

Species Common Name	Species Scientific Name	SARA Status	ESA Status	Background Source(s)	Habitat Description	Evaluation of Potential to be found within the Subject property
Eastern Hog-nosed Snake	*Heterodon platyrhinos*	Threatened	Threatened	ORAA (May 2025)	Inhabits fields, forests, shrubland, beaches and old dune habitats. Along the eastern shore of Georgian Bay, it can also be found in forest clearings and rock outcrops, as long as other suitable habitat is available nearby. This species is generally found in habitats with sandy, well-drained soils, into which this snake burrows. It is commonly encountered on beaches due to its affinity for open, sandy areas.	No – Sandy soils that are preferred by this species are not present within the subject property.
Massasauga (Carolinian Population)	*Sistrurus catenatus pop. 2*	Endangered	Endangered	ORAA (May 2025)	Generally associated with water, are rarely found more than 50 kilometres from the Great Lakes, and often inhabit wetlands near rivers. The Massasauga is a habitat generalist and can be found in forests, meadows, shoreline habitats, wetlands, rock barrens, grasslands and old fields. The species requires very specific microhabitat features within these habitats for mating, hunting and especially thermoregulation.	Possible – Meadows and forested habitats persist within the subject property and may provide suitable habitat for this species.

© Hatch 2025 All rights reserved, including all rights relating to the use of this document or its contents.

Species Common Name	Species Scientific Name	SARA Status	ESA Status	Background Source(s)	Habitat Description	Evaluation of Potential to be found within the Subject property
Northern Map Turtle	*Graptemys geographica*	Special Concern	Special Concern	ORAA (May 2025)	Inhabit large rivers and lakes with slow-moving water and a soft bottom. They require high-quality water that supports the female's mollusc prey. These turtles may congregate in areas with abundant basking sites.	No – Subject property does not contain any waterbodies.
Northern Ribbonsnake (Great Lakes Population	*Thamnophis sauritus septentrionalis*	Special Concern	Special Concern	ORAA (May 2025)	Semi-aquatic and is almost always found close to water, such as wetlands and the shorelines of lakes and rivers. The wetland and shoreline habitats that ribbonsnakes inhabit are generally near forests, and this species tends to be absent from regions with little to no forest cover. The species may rely on forested areas to provide upland habitats that it uses for overwintering and birthing sites.	Possible – Subject property is in close proximity to an unnamed watercourse (<100m). This species may be present within forested habitats adjacent to the watercourse.

© Hatch 2025 All rights reserved, including all rights relating to the use of this document or its contents.

Species Common Name	Species Scientific Name	SARA Status	ESA Status	Background Source(s)	Habitat Description	Evaluation of Potential to be found within the Subject property
Snapping Turtle	*Chelydra serpentina*	Special Concern	Special Concern	NHIC, ORAA (May 2025)	Occurs in almost any freshwater habitat, though it is most often found in slow-moving water with a soft mud or sand bottom and abundant vegetation. This species may inhabit surprisingly small wetlands, ponds and ditches. It hibernates in the mud or silt on the bottom of lakes and rivers, usually not too far from the shore.	No – Subject property does not contain any waterbodies.
Insects						
Macropis Cuckoo Bee	*Epeoloides pilosulus*	Endangered	Extirpated	NHIC (May 2025)		
Monarch	*Danaus plexippus*	Endangered	Not Regulated	OBA (May 2025)		
One-banded Mason Wasp	*Ancistrocerus unifasciatus*	Not Regulated	Not Regulated	NHIC (May 2025)		
Rusty-patched Bumblebee	*Bombus affinis*	Endangered	Endangered	NHIC (May 2025)		

© Hatch 2025 All rights reserved, including all rights relating to the use of this document or its contents.

Species Common Name	Species Scientific Name	SARA Status	ESA Status	Background Source(s)	Habitat Description	Evaluation of Potential to be found within the Subject property
Mammals						
Eastern Small-footed Myotis	*Myotis leibii*	Not Regulated	Endangered	MWH (2023)	Roosting occurs in rocks, rock outcrops, buildings, under bridges, caves, mines, and hollow trees. Hibernation occurs within caves and abandoned mines.	Possible – Buildings persist within the subject property and may provide suitable roosting for this species. Potential roosting trees were observed within the study area during the July 4, 2025 site visit.
Little Brown Myotis	*Myotis lucifugus*	Endangered	Endangered	MWH (2023)	This species roosts in treed environments and select attics, abandoned buildings, and barns in colony format to raise their young. They hibernate from October/ November to March/April, most often in caves or abandoned mines that are humid and remain above freezing.	Possible – Buildings persist within the subject property and may provide suitable roosting for this species. Potential roosting trees were observed within the study area during the July 4, 2025 site visit.
Northern Myotis	*Myotis septentrionalis*	Endangered	Endangered	MWH (2023)	These bats are associated with forest environments, choosing to roost under loose bark and in the cavities of trees. They hibernate from October/ November to March/April like many other bat species; can be in caves or abandoned mines.	Possible – Potential roosting trees were observed within the study area during the July 4, 2025 site visit.

© Hatch 2025 All rights reserved, including all rights relating to the use of this document or its contents.

Species Common Name	Species Scientific Name	SARA Status	ESA Status	Background Source(s)	Habitat Description	Evaluation of Potential to be found within the Subject property
Tri-coloured Bat	*Pipistrellus subflavus*	Endangered	Endangered	MWH (2023)	This species is found in a variety of forested habitats. It forms day roosts in maternity colonies in old-growth forest and occasionally man-made structures. This species overwinter/hibernates in caves or underground locations like many other species of bats.	Possible – Buildings persist within the subject property and may provide suitable roosting for this species. Potential roosting trees were observed within the study area during the July 4, 2025 site visit.
Eastern Red Bat	*Lasiurus borealis*	Endangered	Endangered	Added by Hatch	This species typically roosts among foliage in trees and occasionally shrubs. Roosting can occur in both deciduous and coniferous forests of any age class. However, trees selected for roosting tend to be large in diameter and tall.	Possible – Potential roosting trees were observed within the study area during the July 4, 2025 site visit.
Hoary Bat	*Lasiurus cinereus*	Endangered	Endangered	Added by Hatch	Mostly treed habitats for roosting or foraging, with a particularly strong dependence on trees as roosting sites. Foraging habitats are less well known, but likely include the area above aquatic habitats (Barclay 1989), low-elevation meadows, grasslands, and fields, as well as open-canopied forest, the area above forest canopies, and forest edges.	Possible – Potential roosting trees were observed within the study area during the July 4, 2025 site visit.

© Hatch 2025 All rights reserved, including all rights relating to the use of this document or its contents.

Species Common Name	Species Scientific Name	SARA Status	ESA Status	Background Source(s)	Habitat Description	Evaluation of Potential to be found within the Subject property
Silver-haired Bat	*Lasionycteris noctivagans*	Endangered	Endangered	Added by Hatch	Roosting for this species tends to occur under the bark of trees and within suitable cavities. As such, they are reliant on large decaying trees. They can roost in a variety of large diameter coniferous and deciduous tree species. Size, height, roost aspect, and cavity temperature tend to be the deciding factors for where this species chooses to roost.	Possible – Potential roosting trees were observed within the study area during the July 4, 2025 site visit.
Plants						
Autumn Coralroot	*Corallorhiza odontorhiza*	Not Regulated	Not Regulated	NHIC (May 2025)	Part shade, shade; woods.	Possible – Suitable habitats persist within the subject property.
Bird's-foot Violet	*Viola pedate*	Endangered	Endangered	NHIC (May 2025)	In Ontario, Bird's-foot Violet is found only in black oak savanna, a very rare vegetation type having widely spaced open-grown trees with an understorey of tallgrass prairie herbs.	No – Black Oak savanna habitats are not present within the study area.

© Hatch 2025 All rights reserved, including all rights relating to the use of this document or its contents.

Species Common Name	Species Scientific Name	SARA Status	ESA Status	Background Source(s)	Habitat Description	Evaluation of Potential to be found within the Subject property
Broad Beech Fern	*Phegopteris hexagonoptera*	Special Concern	Special Concern	NHIC (May 2025)	Prefers to grow in rich soils in deciduous forests, often in areas dominated by maple and beech trees. It requires moist soil and usually grows in full shade.	No - Although woodlands persist within the subject property, these habitats are more upland (drier) and are dominated by Black Walnut (*Juglans nigra*) and conifers.
Carolina Vetch	*Vicia caroliniana*	Not Regulated	Not Regulated	NHIC (May 2025)		
Hairy Hawkweed	*Hieracium longipilum*	Not Regulated	Not Regulated	NHIC (May 2025)	sun; dry sandy soil; prairies open woods, roadsides	Possible – Field edges and conifer woodlands are present within the subject property and may provide suitable habitat for this species.
Moss Phlox	*Phlox subulata*	Not Regulated	Not Regulated	NHIC (May 2025)	Part shade, sun; dry sandy or rocky soil; barrens, woods, rock ledges, gardens.	Possible – Partly shaded habitats and woodlands are present within the subject property and may provide suitable habitat for this species.

© Hatch 2025 All rights reserved, including all rights relating to the use of this document or its contents.

Species Common Name	Species Scientific Name	SARA Status	ESA Status	Background Source(s)	Habitat Description	Evaluation of Potential to be found within the Subject property
Walter's Barnyard Grass	*Echinochloa walteri*	Not Regulated	Not Regulated	NHIC (May 2025)	Typically found along stream and river banks, on sandy shores, and in floodplains, marshes and wet meadows.	No – Although an unnamed watercourse and wetlands persists within the study area, no aquatic features are present within the subject property.

© Hatch 2025 All rights reserved, including all rights relating to the use of this document or its contents.

Appendix B

Bird Species from Within the Study Area

© Hatch 2025 All rights reserved, including all rights relating to the use of this document or its contents.

Common Name	Scientific Name	Schedule 1	COSEWIC	SARO	OBBA	NHIC	BBS-01 & Transect		Highest Level of Breeding Evidence
					2025	2025	28-May-25	4-Jul-25	Hatch Results from 2025
American Crow	*Corvus brachyrhynchos*				FY		X	PO	PO
American Goldfinch	*Spinus tristis*				P			PO	PO
American Kestrel	*Falco sparverius*				CF				
American Redstart	*Setophaga ruticilla*				T				
American Robin	*Turdus migratorius*				CF		PO	PO	PR
American Woodcock	*Scolopax minor*				H				
Baltimore Oriole	*Icterus galbula*				CF		PO	PO	PR
Bank Swallow	*Riparia riparia*	THR	THR	THR	AE				
Barn Swallow	*Hirundo rustica*	THR	SC	SC	NY			PO	PO
Belted Kingfisher	*Megaceryle alcyon*				AE				
Black-billed Cuckoo	*Coccyzus erythropthalmus*				T				
Black-capped Chickadee	*Poecile atricapilla*				CF		PO	PO	PR
Blue Jay	*Cyanocitta cristata*				T		PO		PO
Blue-winged Warbler	*Vermivora cyanoptera*				S				
Bobolink	*Dolichonyx oryzivorus*	THR	SC	THR	S				
Broad-winged Hawk	*Buteo platypterus*				H				
Brown Thrasher	*Toxostoma rufum*				T				
Brown-headed Cowbird	*Molothrus ater*				D		PO	PR	PR
Canada Goose	*Branta canadensis*				FY				
Canada Warbler	*Cardellina canadensis*	THR	SC	SC	S				
Carolina Wren	*Thryothorus ludovicianus*				D			PO	PO
Cedar Waxwing	*Bombycilla cedrorum*				P			PR	PR
Chestnut-sided Warbler	*Setophaga pensylvanica*				T				
Chimney Swift	*Chaetura pelagica*	THR	THR	THR	AE			PO	PO
Chipping Sparrow	*Spizella passerina*				FY		PO		PO
Common Grackle	*Quiscalus quiscula*				CF		PO	PO	PR
Common Raven	*Corvus corax*				FY				
Common Yellowthroat	*Geothlypis trichas*				T		PO		PO
Cooper's Hawk	*Accipiter cooperii*				H				

Common Name	Scientific Name	Schedule 1	COSEWIC	SARO	OBBA	NHIC	BBS-01 & Transect		Highest Level of Breeding Evidence
					2025	2025	28-May-25	4-Jul-25	Hatch Results from 2025
Downy Woodpecker	*Dryobates pubescens*				FY			PO	PO
Eastern Bluebird	*Sialia sialis*				CF				
Eastern Kingbird	*Tyrannus tyrannus*				T		PO	PO	PR
Eastern Meadowlark	*Sturnella magna*	THR	THR	THR		X			
Eastern Phoebe	*Sayornis phoebe*				T				
Eastern Towhee	*Pipilo erythrophthalmus*				A				
Eastern Wood-Pewee	*Contopus virens*	SC	SC	SC	T	X		PO	PO
European Starling	*Sturnus vulgaris*				CF		PR	PO	PR
Field Sparrow	*Spizella pusilla*				CF				
Grasshopper Sparrow	*Ammodramus savannarum*	SC	SC	SC	A				
Gray Catbird	*Dumetella carolinensis*				CF			CO	CO
Great Blue Heron	*Ardea herodias*				T				
Great Crested Flycatcher	*Myiarchus crinitus*				T		PR	PO	PR
Hairy Woodpecker	*Dryobates villosus*				S				
Hooded Merganser	*Lophodytes cucullatus*				H				
Hooded Warbler	*Setophaga citrina*				T				
Horned Lark	*Eremophila alpestris*				S				
House Finch	*Haemorhous mexicanus*				T				
House Sparrow	*Passer domesticus*				AE				
Indigo Bunting	*Passerina cyanea*				T		PO	PO	PR
Killdeer	*Charadrius vociferus*				DD				
Mallard	*Anas fulvigula*				FY		X	PO	PO
Merlin	*Falco columbarius*				FY				
Mourning Dove	*Zenaida macroura*				FY			PO	PO
Mourning Warbler	*Geothlypis philadelphia*				S				
Northern Cardinal	*Cardinalis cardinalis*				CF		PO	PO	PR
Northern Flicker	*Colaptes auratus*				AE		PO	PO	PR
Northern House Wren	*Troglodytes aedon*				AE				
Northern Rough-winged Swallow	*Stelgidopteryx serripennis (L)*				AE			PO	PO

Common Name	Scientific Name	Schedule 1	COSEWIC	SARO	OBBA	NHIC	BBS-01 & Transect		Highest Level of Breeding Evidence
					2025	2025	28-May-25	4-Jul-25	Hatch Results from 2025
Northern Waterthrush	*Parkesia noveboracensis*				S				
Orchard Oriole	*Icterus spurius (L) (C)*				T				
Ovenbird	*Seiurus aurocapilla (L)*				T				
Pileated Woodpecker	*Dryocopus pileatus*				S				
Pine Warbler	*Setophaga pinus (L)*				T			PO	PO
Purple Martin	*Progne subis (L)*				AE				
Red-bellied Woodpecker	*Melanerpes carolinus (L)*				FY				
Red-breasted Nuthatch	*Sitta canadensis*				S				
Red-eyed Vireo	*Vireo olivaceus*				T		PO	PO	PR
Red-headed Woodpecker	*Melanerpes erythrocephalus (L)*	END	END	END	AE	X		CO	CO
Red-tailed Hawk	*Buteo jamaicensis*				T				
Red-winged Blackbird	*Agelaius phoeniceus*				NY		CO	PO	CO
Rock Pigeon (Feral Pigeon)	*Columba livia*				NY				
Rose-breasted Grosbeak	*Pheucticus ludovicianus*				T				
Ruby-throated Hummingbird	*Archilochus colubris*				H				
Ruffed Grouse	*Bonasa umbellus*				H				
Savannah Sparrow	*Passerculus sandwichensis*				A				
Scarlet Tanager	*Piranga olivacea (L)*				T			PO	PO
Song Sparrow	*Melospiza melodia*				CF		CO	PO	CO
Tree Swallow	*Tachycineta bicolor*				AE				
Turkey Vulture	*Cathartes aura (L)*				H				
Veery	*Catharus fuscescens (L)*				T				
Vesper Sparrow	*Pooecetes gramineus (L)*				T				
Warbling Vireo	*Vireo gilvus*				T				
White-breasted Nuthatch	*Sitta carolinensis (L)*				T			PO	PO
Wild Turkey	*Meleagris gallopavo*				T				
Willow Flycatcher	*Empidonax traillii (L) (C)*				T				
Winter Wren	*Troglodytes hiemalis*				T				
Wood Duck	*Aix sponsa*				H				

Common Name	Scientific Name	Schedule 1	COSEWIC	SARO	OBBA	NHIC	BBS-01 & Transect		Highest Level of Breeding Evidence
					2025	2025	28-May-25	4-Jul-25	Hatch Results from 2025
Wood Thrush	*Hylocichla mustelina (L)*	THR	THR	SC	T	X			
Yellow Warbler	*Setophaga petechia*				T		CO	PO	CO
Yellow-bellied Sapsucker	*Sphyrapicus varius*				D		PO		PO
Yellow-billed Cuckoo	*Coccyzus americanus*				T				
Yellow-throated Vireo	*Vireo flavifrons (L)*				T				
				Total	**91**	**4**	**21**	**31**	**35**

Appendix C

Vascular Plant Species from Within the Study Area

© Hatch 2025 All rights reserved, including all rights relating to the use of this document or its contents.

Common Name	Scientific Name	Schedule 1	COSEWIC	SARO	NHIC	Observed by Hatch
					2025	Results from 2025
American Elm	*Ulmus americana*					X
Bird's-foot Violet	*Viola pedata*	END	END	END	X	
Black Walnut	*Juglans nigra*					X
Broad Beech Fern	*Phegopteris hexagonoptera*	Not Listed	SC	SC	X	
Carolina Vetch	*Vicia caroliniana*				X	
Cherry sp.	*Prunus sp.*					X
Common Burdock	*Arctium minus*					X
Common Teasel	*Dipsacus fullonum*					
Dame's Rocket	*Hesperis matronalis*					X
Eastern Cottonwood	*Populus Deltoides*					X
Goldenrod Sp.	*Solidago sp.*					X
Hairy Hawkweed	*Hieracium longipilum*				X	
Kentucky Bluegrass	*Poa pratensis*					X
Manitoba Maple	*Acer negundo*					X
Moss Phlox	*Phlox subulata*				X	
Scots Pine	*Pinus sylvestris*					X
Trembling Aspen	*Populus tremuloides*					X
Tufted Vetch	*Vicia cracca*					X
Walter's Barnyard Grass	*Echinochloa walteri*				X	
White Spruce	*Picea glauca*					X
Wild Rose sp.	*Rosa spp.*					X
				Total	**6**	**14**

Appendix B
Stage 1 Archaeological Assessment

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

Stage 1 Archaeological Assessment: Simcoe Wastewater Treatment Plant, 16 Oakwood Avenue (Lot 1, Concession 5, Geographical Township of Woodhouse, County of Norfolk) Town of Simcoe, Norfolk County

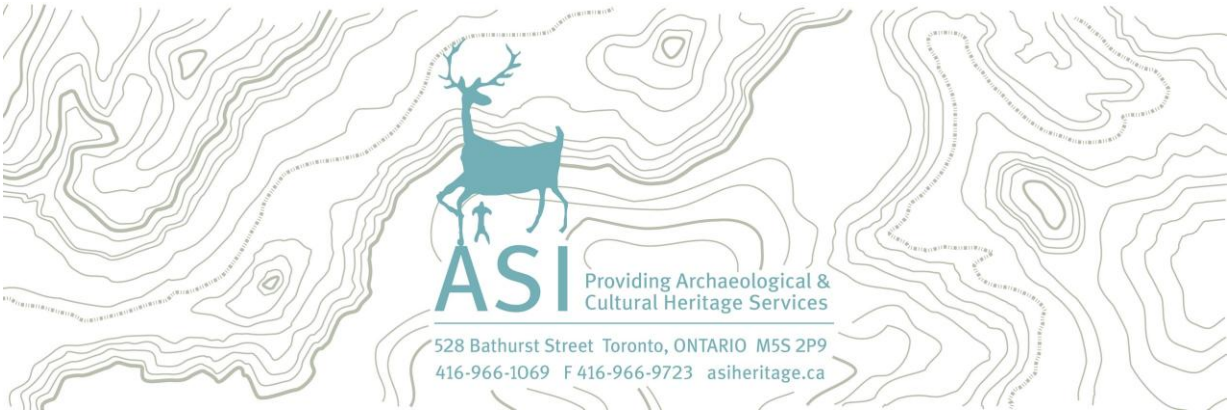
Original Report

Prepared for:

Hatch Ltd.
1235 North Service Road West
Oakville ON, L6M 2W2

Archaeological Licence: P094 (Merritt)
PIF# P094-0455-2025
Archaeological Services Inc. File: 25EA-019

25 June 2025



Executive Summary

Archaeological Services Inc. was contracted by Hatch Ltd., on behalf of Norfolk County, to conduct a Stage 1 Archaeological Assessment (Background Research and Property Inspection) as part of the Simcoe Wastewater Treatment Plant project. This project is being conducted to support an addendum to the Norfolk County Integrated Sustainable Master Plan (MMM Group Ltd, 2016), and it involves potential upgrades to the Wastewater Treatment Plant located at 16 Oakwood Avenue in the town of Simcoe, Ontario. The Stage 1 Project Area is located adjacent to the east of the existing facilities at the Simcoe WWTP. It measures approximately 150 metres by 90 metres and covers an area of approximately 1.35 hectares.

The Stage 1 background research determined that 16 previously registered archaeological sites are located within one kilometre of the Project Area, but none within 50 metres. The property inspection determined that parts of the Project Area exhibit archaeological potential and will require Stage 2 archaeological assessment.

The following recommendations are made:

1) Parts of the Project Area exhibit archaeological potential. These lands require Stage 2 archaeological assessment by test pit survey at five-metre intervals (Figure 11). Stage 2 is required prior to any proposed construction activities on these lands;

2) The remainder of the Project Area does not retain archaeological potential on account of deep and extensive land disturbance. These lands do not require further archaeological assessment; and,

3) Should the proposed work extend beyond the current Project Area, further archaeological assessment should be conducted to determine the archaeological potential of the surrounding lands.

Project Personnel

- **Principal**: Lisa Merritt, MSc. (P094) Partner, Director, Infrastructure
- **Senior Project Manager**: Sarah Jagelewski, BA Hons (R405), Lead Archaeologist, Manager, Infrastructure
- **Division Coordinator**: Katrina Thach, BA Hons. (R1225), Associate Archaeologist, Assistant Manager, Infrastructure
- **Project Administrator**: Justine Tenzer, BA Hons, Archaeologist, Project Administrator, Infrastructure
- **Project Director (Licensee)**: Lisa Merritt
- **Project Manager**: Jason Barrett, PhD, Lead Archaeologist, Project Manager, Infrastructure
- **Field Director**: Poorya Kashani, PhD (P1133), Associate Archaeologist, Assistant Manager, Field Services, Operations
- **Report Preparation**: Ciprian Ardelean, PhD, Senior Associate, Technical Writer and Researcher, Infrastructure
- **Graphics**: Peter Bikoulis, PhD, Archaeologist, GIS Technician, Operations Practice Area; Carolyn Nettleton, BA, Archaeologist, GIS Technician, Operations
- **Report Review**: Jason Barrett; Eliza Brandy, MA (R1109), Lead Archaeologist, Project Manager, Infrastructure; Sarah Jagelewski

Table of Contents

Executive Summary 1
Project Personnel 2
Table of Contents 3
1.0 Project Context 6
1.1 Development Context 6
1.1.1 Treaties and Traditional Territories 7
1.2 Historical Context 9
1.2.1 Indigenous Land Use and Settlement 9
1.2.2 Post-Contact Settlement 11
1.2.3 Map Review 14
1.2.4 Aerial, Orthoimagery, and LiDAR Review 16
1.3 Archaeological Context 16
1.3.1 Geography 17
1.3.2 Previously Registered Archaeological Sites 19
1.3.3 Previous Archaeological Assessments 21
2.0 Property Inspection 21
2.1 Field Methods 21
2.2 Current Land Use and Field Conditions 22
3.0 Analysis of Archaeological Potential 22
3.1 Conclusions 23
4.0 Recommendations 24
5.0 Advice on Compliance with Legislation 24
6.0 Bibliography and Sources 26
7.0 Images 31
7.1 Field Photography 31
7.2 Historical Imagery 36

8.0 Maps 37

List of Tables

Table 1: Registered Sites within One Kilometre of the Project Area 19

List of Images

Image 1: Project Area disturbed by grading and existing infrastructure – no archaeological potential.....31
Image 2: Project Area disturbed by grading and existing infrastructure – no archaeological potential.....31
Image 3: Project Area disturbed by grading and former constructions – no archaeological potential.....32
Image 4: Project Area disturbed by built-up berm – no archaeological potential (see also Figure 8).....32
Image 5: Part of Project Area disturbed by narrow berm; parts preserve archaeological potential – test pit survey required.....33
Image 6: Project Area exhibits archaeological potential around small concrete structure – test pit survey required.....33
Image 7: Project Area exhibits archaeological potential – test pit survey required.....34
Image 8: Project Area exhibits archaeological potential – test pit survey required.....34
Image 9: Project Area exhibits archaeological potential – test pit survey required.....35
Image 10: Google Earth satellite view of the Project Area from 2006.....36
Image 11: Google Earth satellite view of the Project Area from 2010.....36

List of Figures

Figure 1: Location of the Project Area.....37
Figure 2: Project Area (Approximate Location) Overlaid on the 1865 Tremaine Map of Norfolk County.....38
Figure 3: Project Area (Approximate Location) Overlaid on the 1877 Illustrated Atlas of Norfolk County.....39

Figure 4: Project Area (Approximate Location) Overlaid on the 1909 Topographic Simcoe Sheet. 40
Figure 5: Project Area (Approximate Location) Overlaid on the 1996 Topographic Simcoe Sheet. 41
Figure 6: Project Area (Approximate Location) Overlaid on the 1954 Aerial Photograph. 42
Figure 7: Project Area Overlaid on the LiDAR-Based Digital Terrain Model (DTM). 43
Figure 8: Project Area – Physiographic Landforms. 44
Figure 9: Project Area – Surficial Geology. 45
Figure 10: Project Area – Soil Drainage. 46
Figure 11: Results of the Stage 1 Archaeological Assessment. 47

1.0 Project Context

Archaeological Services Inc. (ASI) was contracted by Hatch Ltd., on behalf of Norfolk County, to conduct a Stage 1 Archaeological Assessment (Background Research and Property Inspection) as part of the Simcoe Wastewater Treatment Plant (WWTP) project. This project is being conducted to support an addendum to the Norfolk County Integrated Sustainable Master Plan (MMM Group Ltd, 2016), and it involves potential upgrades adjacent to the east of the existing facilities at the Simcoe WWTP at 16 Oakwood Avenue in the Town of Simcoe, Ontario.

The Stage 1 Project Area measures approximately 150 metres by 90 metres and covers an area of approximately 1.35 hectares (Figure 1).

All activities carried out during this assessment were completed in accordance with the *Ontario Heritage Act* (1990, as amended in 2024) and the 2011 *Standards and Guidelines for Consultant Archaeologists* (S & G), administered by the Ministry of Citizenship and Multiculturalism (MCM 2011).

1.1 Development Context

All work has been undertaken as required by the *Environmental Assessment Act* (Environmental Assessment Act, R.S.O. c. E.18, 1990 as amended 2024) and regulations made under the Act, and are therefore subject to all associated legislation. This project is being conducted in accordance with the *Municipal Class Environmental Assessment* process (Municipal Engineers Association, 2023).

Authorization to carry out the activities necessary for the completion of the Stage 1 archaeological assessment and property inspection was granted by Hatch Ltd. on March 31, 2025.

1.1.1 Treaties and Traditional Territories

1.1.1.1. Deed from the Five Nations to the King, of their Beaver Hunting Ground

In 1701 the Haudenosaunee and British Crown signed the "Deed from the Five Nations to the King, of their Beaver Hunting Ground", sometimes referred to as the 1701 Treaty of Fort Albany or Nanfan Treaty, where they agreed to place their beaver hunting grounds under the protection of the King of Britain and to reject the French from building forts on their lands, which included most of southcentral and southwestern Ontario.

In the following years, the Haudenosaunee called upon the King to honour this agreement and "tear down" the French forts at Detroit, Niagara and Fort Frontenac (Kingston) from their Beaver Hunting Grounds. The King did honour the terms of the 1701 deed. To confirm the Kings' commitment to the Five Nations and to allow their forts in the Five Nations lands as protection against the French an affirming agreement was entered into on September 14, 1726.

The protection of the Five Nations interests throughout their Beaver Hunting Grounds was again affirmed in Article 15 of the Treaty of Utrecht, signed in 1713 between the British and the French, wherein the Five Nations specifically would not be interfered with between (Lakes) Ontario, Erie and Huron (Six Nations of the Grand River, 2020).

1.1.1.2. Treaty 3, Between the Lakes Purchase

Following the American Revolutionary War (1775-1783), the British Crown needed to find lands on which to settle United Empire Loyalists, including approximately 2,000 members of the Six Nations confederacy who had fought alongside British troops. Led by Sir Frederick Haldimand who was the governor of Quebec at that time, the Crown was initially planning on providing lands for Loyalist settlers in Quebec and Southeastern Ontario, including providing land in the Bay of Quinte for Six Nations refugees. This was not suitable for many of the members of Six Nations and a contingent of approximately 1,800 community members, led by Chief Joseph Brant, requested land north of Lake Erie along the

Grand River. Brant felt that the location in the Bay of Quinte was too isolated and that his followers could be better served by being closer to the Six Nations communities that chose to remain in the United States in western New York (Surtees, 1984, p. 21).

Recognizing that, under the terms of the Royal Proclamation of 1763, the land needed to be purchased prior to settlement, Colonel John Butler was sent to negotiate with the Mississaugas of the Credit for lands east of Lake Ontario and north of Lake Erie. On May 22, 1784, the Mississaugas of the Credit agreed to cede approximately 3,000,000 acres (1,214,057 hectares) of land containing all or part of Brant, Elgin, Middlesex, Oxford, and Wellington Counties as well as the Regions of Haldimand-Norfolk, Halton, Hamilton-Wentworth, Niagara, and Waterloo. In exchange for these lands, the Mississaugas received £1180.74 worth of trade goods (Crown-Indigenous Relations and Northern Affairs, 2016; Surtees, 1984). Of the 3,000,000 acres (1,214,057 hectares), approximately 550,000 acres (222,577 hectares) was set aside for the settlement of Six Nations people.

However, due to uncertainties with the description of the lands in the original surrender, Treaty 3 was renegotiated on December 7, 1792, to clarify what was ceded. This largely revolved around the northern boundary of the Treaty area and in particular the area set aside for Six Nations settlement along the Grand River (see Haldimand Tract and Treaty 4). The signees on the side of the British included Lieutenant Governor John Graves Simcoe, John Butler, Robert Kerr, Peter Russell, John McGill, and Davie William Smith. The signees on the side of the Mississauga included Chiefs Wabakayne, Wabanip, Kautabus, Wabaniship and Mottotow (Crown-Indigenous Relations and Northern Affairs, 2016; Mississaugas of the Credit First Nation, 2017; Surtees, 1984).

The original text stipulated that the north-west boundary of the parcel was an imaginary line between Burlington Bay and the Thames River, which is inconsistent with the geography of the area. The boundaries of the parcel were corrected to create a polygon encompassing the Niagara peninsula up to Burlington Bay and then up north to the present-day town of Arthur then south to the present-day town of Woodstock to finally meet Lake Erie at Port Bruce.

Treaty 3 lands exclude a corridor along the Grand River set aside for Six Nations (Crown-Indigenous Relations and Northern Affairs, 2016; Native Land Digital, 2018).

1.2 Historical Context

1.2.1 Indigenous Land Use and Settlement

Current archaeological evidence indicates humans were present in southern Ontario approximately 13,000 years before present (BP) (Ferris, 2013). Populations at this time would have been highly mobile, inhabiting a boreal-parkland similar to the modern sub-arctic. By approximately 10,000 BP, the environment had progressively warmed (Edwards & Fritz, 1988) and populations now occupied less extensive territories (Ellis & Deller, 1990).

Between approximately 10,000-5,500 BP, the Great Lakes basins experienced low-water levels, and many sites which would have been located on those former shorelines are now submerged. This period produces the earliest evidence of heavy wood working tools, an indication of greater investment of labour in felling trees for fuel, to build shelter, and watercraft production. These activities suggest prolonged seasonal residency at occupation sites. Polished stone and native copper implements were being produced by approximately 8,000 BP; the latter was acquired from the north shore of Lake Superior, evidence of extensive exchange networks throughout the Great Lakes region. The earliest archaeological evidence for cemeteries dates to approximately 4,500-3,000 BP and is interpreted by archaeologists to be indicative of increased social organization and the investment of labour into social infrastructure (Brown, 1995, p. 13; Ellis et al., 1990, 2009).

Between 3,000-2,500 BP, populations continued to practice residential mobility and to harvest seasonally available resources, including spawning fish. The Woodland period begins around 2,500 BP and exchange and interaction networks broaden at this time (Spence et al., 1990, pp. 136, 138) and by approximately 2,000 BP, evidence exists for small community camps, focusing on the seasonal harvesting of resources (Spence et al., 1990, pp. 155, 164). By 1,500 BP there is macro botanical evidence for maize in southern Ontario, and it

is thought that maize only supplemented people's diet. There is earlier phytolithic evidence for maize in central New York State by 2,300 BP – it is likely that once similar analyses are conducted on Ontario ceramic vessels of the same period, the same evidence will be found (Birch & Williamson, 2013, pp. 13–15). As is evident in detailed Anishinaabek ethnographies, winter was a period during which some families would depart from the larger group as it was easier to sustain smaller populations (Rogers, 1962). It is generally understood that these populations were Algonquin-speakers during these millennia of settlement and land use.

From the beginning of the Late Woodland period at approximately 1,000 BP, lifeways became more similar to that described in early historical documents. Between approximately 1000-1300 Common Era (CE), larger settlement sites focused on horticulture begin to dominate the archaeological record. Seasonal dispersal of the community for the exploitation of a wider territory and more varied resource base was still practised (Williamson, 1990, p. 317). By 1300-1450 CE, archaeological research focusing on these horticultural societies note that this episodic community dispersal was no longer practised and these populations now occupied sites throughout the year (Dodd et al., 1990, p. 343). By the mid-sixteenth century these small villages had coalesced into larger communities (Birch et al., 2021). Through this process, the socio-political organization of these First Nations, as described historically by the French and English explorers who first visited southern Ontario, was developed. Other First Nation communities continued to practice residential mobility and to harvest available resources across landscapes they returned to seasonally/annually.

By 1600 CE, the Confederation of Nations were encountered by the first European explorers and missionaries in Simcoe County. Samuel de Champlain in 1615 reported that a group of Iroquoian-speaking people situated between the Haudenosaunee and the Huron-Wendat were at peace and remained "la nation neutre". Like the Huron-Wendat, Petun, and Haudenosaunee, the Neutral or Attawandaron people were settled village agriculturalists.

By the 1640s, devastating epidemics and the traditional enmity between the Haudenosaunee and the Attawandaron and the Huron-Wendat (and their

Algonquian allies such as the Nippissing and Odawa) led to their dispersal from southern Ontario. Shortly afterwards, the Haudenosaunee established a series of settlements at strategic locations along the trade routes inland from the north shore of Lake Ontario. Peace was achieved between the Haudenosaunee and the Anishinaabe Nations in August of 1701 when representatives of more than twenty Anishinaabe Nations assembled in Montreal to participate in peace negotiations. Peace was confirmed again at council held at Lake Superior when the Haudenosaunee delivered a wampum belt to the Anishinaabe Nations. This agreement between the Haudenosaunee and Anishinaabe nations is referred to as the Dish with One Spoon.

In 1763, following the fall of Quebec, New France was transferred to British control at the Treaty of Paris. The British government began to pursue major land purchases to the north of Lake Ontario in the early nineteenth century. The Crown acknowledged the Mississaugas of the Credit as the owners of the lands between Georgian Bay and Lake Simcoe and entered into negotiations for additional tracts of land as the need arose to facilitate European settlement.

1.2.2 Post-Contact Settlement

Historically, the Project Area is located in the Geographical Township of Woodhouse, County of Norfolk, in Lot 1, Concession 5.

The S & G stipulates that areas of early Euro-Canadian settlement (pioneer homesteads, isolated cabins, farmstead complexes), early wharf or dock complexes, pioneer churches, and early cemeteries are considered to have archaeological potential. Early historical transportation routes (trails, passes, roads, railways, portage routes), properties listed on a municipal register or designated under the Ontario Heritage Act or a federal, provincial, or municipal historic landmark or site are also considered to have archaeological potential.

For the Euro-Canadian period, the majority of early nineteenth century farmsteads (i.e., those that are arguably the most potentially significant resources and whose locations are rarely recorded on nineteenth century maps) are likely to be located in proximity to water. The development of the network of concession roads and railroads through the course of the nineteenth century

frequently influenced the siting of farmsteads and businesses. Accordingly, undisturbed lands within 100 metres of an early settlement road are also considered to have potential for the presence of Euro-Canadian archaeological sites.

The first Europeans to arrive in the area were transient merchants and traders from France and England, who followed Indigenous pathways and set up trading posts at strategic locations along the well-traveled river routes. All of these occupations occurred at sites that afforded both natural landfalls and convenient access, by means of the various waterways and overland trails, into the hinterlands. Early transportation routes followed existing Indigenous trails, both along the lakeshore and adjacent to various creeks and rivers (ASI 2006). Early European settlements occupied similar locations as Indigenous settlements as they were generally accessible by trail or water routes and would have been in locations with good soil and suitable topography to ensure adequate drainage.

Throughout the period of initial European settlement, Indigenous groups continued to fish, gather, and hunt within their traditional and treaty territories, albeit often with legal and informal restrictions imposed by colonial authorities and settlers. In many cases, Indigenous peoples acted as guides and teachers, passing on their traditional knowledge to settlers, allowing them to sustain themselves in their new homes. Indigenous peoples entered into economic arrangements and partnerships, and often inter-married with settlers. However, pervasive and systemic oppression and marginalization of Indigenous peoples also characterized Euro-Canadian colonization, with thousands being displaced from their lands, denied access to traditional and treaty hunting, fishing, and collecting grounds, and forced to assimilate with Euro-Canadian culture through mandatory attendance at Day and Residential Schools (Ray, 2005; Rogers & Smith, 1994).

1.2.2.1. Town of Simcoe

The Town of Simcoe is located on the Lynn River 38 kilometres south of the City of Brantford. The town was visited by Sir John Graves Simcoe, first lieutenant-governor of Upper Canada, in 1795. Governor Simcoe made this stop during his

journey to establish Fort Norfolk on Fort Erie and granted land to potential settlers, including Aaron Culver with the provision that he was to build mills on the river (Ontario Heritage trust, 2025). By 1812, a settlement formed surrounding the saw and grist mills Culver had built. The mills were burnt during the War of 1812. Captain Bird, a prominent merchant in the settlement, was deeded some land by Culver and subsequently the town was initially called Birdtown (American Biographical Publishing Company, 1880). Aaron Culver further subdivided his land into village lots between 1819 and 1823, proposing the village be renamed in remembrance of the late lieutenant-governor Simcoe's visit.

The Simcoe Post Office opened in 1829 with Duncan Campbell as postmaster (American Biographical Publishing Company, 1880). In 1836 a courthouse and jail were constructed. Simcoe became the seat of the newly created Talbot District in 1837, and in 1851 was incorporated as a village and became the seat of Norfolk County. A branch of the Great Western Railway was completed from Glencoe through Simcoe to Fort Erie in 1872. A line from Woodstock to Port Dover was built in 1875. These lines cause an increase in Simcoe's population. Simcoe was incorporated as a town in 1878. Dr. John Wilson was the first mayor of Simcoe.

In addition to saw and grist mills, Simcoe's early industries included Cable's Carriage Works and the "alligator tug" tugboat (Churcher, 2022). The alligator tug was created by John West of West, Peachy and Sons and was able to operate on both water and land using cables and winches. The alligator tug was an asset to the lumbering industry. During the Depression, the flue-cured tobacco industry was a saving factor for Simcoe, as was fruit production. These industries drew people to the area. A large tin can manufacture plant was established around 1930.

Simcoe features several historic churches. Presbyterian minister Reverend Jabez Culver held services in his own log home until his death in 1818 (Wilson, 1983). A frame church was built to hold Methodist Episcopal services by 1820. In 1868, a new brick church was completed, then known as the Windham Memorial Chapel of the New Connection Methodist Church. Its name was later changed

to the Windham United Church (United Church of Canada, 1962). A church named the Old Windham Church, which stands present-day, was completed in 1962. The Methodist Church was built in 1840. The three churches eventually united to form the Methodist Church of Canada. The Old Mud Church was constructed in 1843 of clay and straw bricks by the Congregationalists of Simcoe and destroyed by a fire in 1876 (Owen, 1898). Saint Andrew's Church of Scotland, constructed in 1847, and the Canadian Presbyterian Church, built in 1868, were united in 1876. The united congregation built St. Paul's Presbyterian Church in 1886. Trinity Anglican Church was originally completed in 1850 and then renovated in 1882. Central School, constructed in 1858, was a Union School offering education to all students of Simcoe until a high school was erected in 1893-4. The South Ward Public School was erected in 1917, and the North Ward School in 1928.

In 1974, Simcoe became part of the Regional Municipality of Haldimand-Norfolk and the town was enlarged to include part of the Townships of Charlotteville, Townsend, Windham, and Woodhouse.

1.2.3 Map Review

The 1865 *Tremaine's Historical Map of Norfolk County* (Tremaine, 1856), 1877 *Illustrated Atlas of Norfolk County* (Page & Co., 1877), 1909 *Topographic Simcoe Sheet* (Department of Militia and Defence, 1909), 1939 *Topographic Simcoe Sheet* (Department of National Defence, 1939), and 1996 *National Topographic System (NTS) Simcoe Sheet* (Natural Resources Canada, 1996) were examined to determine the presence of historic features within the Project Area during the nineteenth and twentieth centuries (Figure 2-Figure 5).

It should be noted that not all features of interest were mapped systematically in the Ontario series of historical atlases. For instance, they were often financed by subscription limiting the level of detail provided on the maps. Moreover, not every feature of interest would have been within the scope of the atlases. The use of historical map sources to reconstruct or predict the location of former features within the modern landscape generally begins by using common reference points between the various sources. The historical maps are geo-referenced to provide the most accurate determination of the location of any

property on a modern map. The results of this exercise can often be imprecise or even contradictory, as there are numerous potential sources of error inherent in such a process, including differences of scale and resolution, and distortions introduced by reproduction of the sources.

The 1865 Tremaine map (Figure 2) shows the Project Area just outside the southern limits of the urban area of the village of Simcoe, approximately 100 metres east of the Lynn River. The Project Area was on the lands owned by William Salmon, marked on the map as "Judge Salmon". The location of a homestead is not indicated. An unlabeled railroad (probably Great Western Railways) is shown passing through the northeast corner of Lot 1, approximately 150 metres east of the Project Area. The trajectory of the railroad is probably inaccurate, as it should show south and west of the Project Area.

The 1877 Illustrated Atlas (Figure 3) shows a less precise cartography, but the railroad is now more accurately placed on a trajectory crossing the Lynn River south and west of the Project Area. The landowner of the northern subdivision of Lot 1 is still William Salmon. The urban grid of the Town of Simcoe is shown approximately 300 metres west of the Project Area. No built structures are mapped within 100 metres of the Project Area.

The 1909 topographic map (Figure 4) shows the Project Area remained undeveloped in wooded land east of the river and approximately 150 meters northeast of the wooden bridge where the Grand Trunk railroad crosses the Lynn River. The map shows the growth of the Town of Simcoe, but no historic structures are shown within 100 metres of the Project Area.

By 1996 (Figure 5), the main facilities of the Simcoe WWTP had been constructed on the west side of Oakwood Avenue, adjacent to the west side of the Project Area. No structures are shown within its limits and the lot remained undeveloped. Except for the considerable growth of the Town of Simcoe, no other changes are apparent in the surroundings of the Project Area.

1.2.4 Aerial, Orthoimagery, and LiDAR Review

Historical aerial imagery from 1954 (City of Toronto Archives, 1954) (Figure 6) shows the Project Area just over 100 metres east of the Lake Erie and Northern Electric Railway that intersects the Canadian National Railway approximately 150 metres southwest of the Project Area. The surrounding lands are mostly agricultural lots. The area immediately to the exterior of the Project Area shows two contiguous rectangular dark features that may suggest mid-twentieth century disturbance by two open water reservoirs. The area adjacent to the west, where the modern WWTP stands today, looks affected by a series of contiguous polygonal shapes, possibly graded or excavated areas, perhaps indicating the early stages of the WWTP.

A review of available Google satellite imagery between 2003 and 2023 shows:

- Imagery from 2006 shows the presence of a small structure on the west side while the rest of the Project Area remained undeveloped (Image 10);
- By the Spring of 2010, a paved rectangular area appeared in the northwest corner of the Project Area, with a narrow and long white construction, probably a provisory feature (Image 11). The Project Area remained relatively unchanged through 2023.

The LiDAR-based Digital Terrain Model (DTM) of the Project Area provides a better understanding of the disturbed areas, with two graded areas along the western limits, one dirt pile near the northwest corner and an elongated berm perpendicular to the east limits of the Project Area (Figure 7).

1.3 Archaeological Context

This section provides background research pertaining to previous archaeological fieldwork conducted within and in the vicinity of the Project Area, its environmental characteristics (including drainage, soils or surficial geology and topography, etc.), and current land use and field conditions. Three sources of information were consulted to provide information about previous archaeological research: the site record forms for registered sites available

online from the MCM through "Ontario's Past Portal"; published and unpublished documentary sources; and the files of ASI.

1.3.1 Geography

In addition to the known archaeological sites, the state of the natural environment is a helpful indicator of archaeological potential. Accordingly, a description of the physiography and soils are briefly discussed for the Project Area.

The S & G stipulates that primary water sources (lakes, rivers, streams, creeks, etc.), secondary water sources (intermittent streams and creeks, springs, marshes, swamps, etc.), ancient water sources (glacial lake shorelines indicated by the presence of raised sand or gravel beach ridges, relic river or stream channels indicated by clear dip or swale in the topography, shorelines of drained lakes or marshes, cobble beaches, etc.), as well as accessible or inaccessible shorelines (high bluffs, swamp or marsh fields by the edge of a lake, sandbars stretching into marsh, etc.) are characteristics that indicate archaeological potential.

Water has been identified as the major determinant of site selection, and the presence of potable water is the single most important resource necessary for any extended human occupation or settlement. Since water sources have remained relatively stable in Ontario since 5,000 B.P. (Karrow & Warner, 1990, Figure 2.16), proximity to water can be regarded as a useful index for the evaluation of archaeological site potential. Indeed, distance from water has been one of the most commonly used variables for predictive modeling of site location.

Other geographic characteristics that can indicate archaeological potential include elevated topography (eskers, drumlins, large knolls, and plateaux), pockets of well-drained sandy soil, especially near areas of heavy soil or rocky ground, distinctive land formations that might have been special or spiritual places, such as waterfalls, rock outcrops, caverns, mounds, and promontories and their bases. There may be physical indicators of their use, such as burials, structures, offerings, rock paintings or carvings. Resource areas, including food

or medicinal plants (migratory routes, spawning areas) are also considered characteristics that indicate archaeological potential (S & G, Section 1.3.1).

1.3.1.1. Physiography

The Project Area is located within the sand plains physiographic landforms of the Norfolk Sand Plain physiographic region of southern Ontario (Chapman & Putnam, 1984) (Figure 8).

The Norfolk Sand Plain physiographic region is a wedge-shaped feature that extends from the Lake Erie shoreline and tapers northward to a point in Brantford on the Grand River (Chapman & Putnam, 1984). The region encompasses an area of 3,134 square kilometres and consists of sands and silts that were deposited as a delta in glacial Lakes Whittlesey and Warren. A massive discharge of meltwater from the Grand River area entered the lakes between the ice front and the moraines to the northwest, building the delta from west to east as the glacier withdrew, thus covering most of the area west of the Galt Moraine with sand. In the vicinity of the subject property, glaciolacustrine deep water sediments belonging to mainly glacial Lake Warren and younger deposits and consisting of stratified to varved silt and clay, minor sand, are overlain by veneer of sand (Zone 10) (Cowan, 1972).

The Project Area is located approximately 200 metres south of a till moraine and within one kilometre of paleo-beaches situated to the east (Figure 8). The Project Area is also crossed by the fluvial terrace of the Lynn Reiver.

1.3.1.2. Surficial Geology

The surficial geology mapping (Figure 9) shows the Project Area is underlain mostly by fine-textured glaciolacustrine deposits (silt and clay, minor sand and gravel, massive to well laminated), and to a lesser extent by older alluvial deposits (clay, silt, sand, gravel, which may contain organic remains).

1.3.1.3. Soil Types and Drainage

The Project Area is sitting mostly on top of disturbed urban lands with no soil information (Land Resource Research Institute, 1983) (Figure 10).

1.3.1.4. Watershed, Water Sources

The Project Area is situated within the Black Creek – Lynn River watershed and within 150 metres of the Lynn River.

1.3.2 Previously Registered Archaeological Sites

In Ontario, information concerning archaeological sites is stored in the Ontario Archaeological Sites Database maintained by the MCM. This database contains archaeological sites registered within the Borden system. Under the Borden system, Canada has been divided into grid blocks based on latitude and longitude. A Borden block is approximately 13 kilometres east to west, and approximately 18.5 kilometres north to south. Each Borden block is referenced by a four-letter designator, and sites within a block are numbered sequentially as they are found. The Project Area is situated in the Borden block *AeHb.*

According to the Ontario Archaeological Sites Database, 16 previously registered archaeological sites are located within one kilometre of the Project Area, none of which are located within 50 metres (MCM, 2025). A summary of the sites is provided below in Table 1.

Table 1: Registered Sites within One Kilometre of the Project Area

Borden number	Site Name	Temporal/ Cultural Affiliation	Site type	Researcher
AeHb-90	Pott's Homestead	Euro-Canadian	Homestead	Mayer Heritage Consultants (MHC), 1980
AeHb-91	Pott's 54	Pre-Contact	Findspot	MHC, 1982
AeHb-92	Pott's 92	Pre-Contact	Artifact scatter	MHC, 1981

Borden number	Site Name	Temporal/ Cultural Affiliation	Site type	Researcher
AeHb-93	Pott's 62	Pre-Contact	Findspot	MHC, 1982, 2008
AeHb-94	Pott's 64	Pre-Contact	Campsite	MHC, 1977, 2008
AeHb-95	Pott's 65	Pre-Contact	Campsite	MHC, 1980, 2008
AeHb-96	Pott's 69	Pre-Contact	Campsite	MHC, 1974, 2008
AeHb-97	Pott's 75	Pre-Contact	Campsite	MHC, 1980, 2008
AeHb-98	Pott's 1977	Pre-Contact	Campsite	MHC, 1982, 2008
AeHb-99	Pott's 36	Pre-Contact	Findspot	MHC, 1980, 2008
AeHb-100	Pott's 98	Middle/Late Woodland	Campsite	MHC, 1982, 2008
AeHb-103	Pott's 102	Pre-Contact	Findspot	MHC, 1981
AeHb-104	Pott's 103	Late Archaic	Findspot	MHC, 1981
AeHb-105	Pott's 47	Pre-Contact	Findspot	MHC, 1981

Borden number	Site Name	Temporal/ Cultural Affiliation	Site type	Researcher
AeHb-113	Pott's 82	Pre-Contact	Campsite	MHC, 2008
AeHb-114	Pott's 83	Pre-Contact	Artifact scatter	MHC, 2008

1.3.3 Previous Archaeological Assessments

No archaeological assessments of direct relevance to the present undertaking were identified within 50 metres of the Project Area.

2.0 Property Inspection

2.1 Field Methods

A Stage 1 property inspection must adhere to the S & G, Section 1.2, Standards 1-6, which are discussed below. The entire property and its periphery must be inspected. The inspection may be either systematic or random. Coverage must be sufficient to identify the presence or absence of any features of archaeological potential. The inspection must be conducted when weather conditions permit good visibility of land features. Natural landforms and watercourses are to be confirmed if previously identified. Additional features such as elevated topography, relic water channels, glacial shorelines, well-drained soils within heavy soils and slightly elevated areas within low and wet areas should be identified and documented, if present. Features affecting assessment strategies should be identified and documented such as woodlots, bogs or other permanently wet areas, areas of steeper grade than indicated on topographic mapping, areas of overgrown vegetation, areas of heavy soil, and recent land disturbance such as grading, fill deposits and vegetation clearing. The inspection should also identify and document structures and built features that will affect assessment strategies, such as heritage structures or landscapes, cairns, monuments or plaques, and cemeteries.

The Stage 1 archaeological assessment property inspection was conducted on May 20, 2025, under the field direction of Poorya Kashani (P1133) in order to gain first-hand knowledge of the geography, topography, and current conditions and to evaluate and map archaeological potential of the Project Area. It was a systematic visual inspection from inside the property grounds and did not include excavation or collection of archaeological resources. Fieldwork was conducted when weather conditions were deemed clear with good visibility (partly cloudy, with seasonal temperatures of 5-12 degrees Celsius), as per S & G Section 1.2., Standard 2. Field photography is presented in Section 7.1 (Image 1-Image 9), and field observations are overlaid onto the existing conditions of the Project Area in Section 8 (Figure 11).

2.2 Current Land Use and Field Conditions

The Project Area is a rectangular parcel mostly covered by tall unmaintained grasses, trees, and woodlot on a higher terrain extending along its eastern limits. Two fenced areas near the northwest corner and adjacent to the west side of the Project Area contained graded surfaces partly paved or graveled. The northern one was once used as an equipment storage area, while the southern one contains functional facilities related to the WWTP. An irregular mound of pushed earth covers the area between the northernmost fenced area and the northern boundaries of the Project Area, presumably related to the grading of these locations. A second narrow berm crosses part of the Project Area transversally, in east-west direction, perpendicular to the eastern limits. There are multiple small concrete features across the Project Area, presumably old wells. Most of the property is heavily covered in overgrown vegetation, therefore reducing the visibility of the surface.

3.0 Analysis of Archaeological Potential

The S & G, Section 1.3.1, lists criteria that are indicative of archaeological potential. The Project Area meets the following criteria indicative of archaeological potential:

- Water sources within 300 metres: primary, secondary, or past water source (Lynn River);

- Elevated topography (Lynn River terrace); and
- Early settlements within 100 metres (possible homesteads).

According to the S & G, Section 1.4 Standard 1e, no areas within a property containing locations listed or designated by a municipality can be recommended for exemption from further assessment unless the area can be documented as disturbed. The Municipal Heritage Register of the Town of Simcoe was consulted and no property within the Project Area is Listed or Designated under the *Ontario Heritage Act*.

The property inspection determined that parts of the Project Area exhibit archaeological potential. These areas will require Stage 2 archaeological assessment prior to any construction activities or other proposed impacts. According to the S & G Section 2.1.2, test pit survey is required on terrain where ploughing is not viable, such as wooded areas, properties where existing landscaping or infrastructure would be damaged, overgrown farmland with heavy brush or rocky pasture, and narrow linear corridors up to 10 metres wide (Image 6-Image 9; Figure 11: areas highlighted in green).

Part of the Project Area has been subjected to deep soil disturbance events due to the construction of graded, paved areas for equipment storage and small built infrastructure, and a built-up berm along the northern fence. According to the S & G Section 1.3.2 these areas do not retain archaeological potential (Image 1-Image 4; Figure 11: areas highlighted in yellow) and do not require further survey.

3.1 Conclusions

The Stage 1 background research determined that 16 previously registered archaeological sites are located within one kilometre of the Project Area, but none within 50 metres. The property inspection determined that parts of the Project Area exhibit archaeological potential and will require Stage 2 archaeological assessment (Figure 11: areas highlighted in green).

4.0 Recommendations

The following recommendations are made:

1) Parts of the Project Area exhibit archaeological potential. These lands require Stage 2 archaeological assessment by test pit survey at five-metre intervals (cite figures again). Stage 2 is required prior to any proposed construction activities on these lands;

2) The remainder of the Project Area does not retain archaeological potential on account of deep and extensive land disturbance. These lands do not require further archaeological assessment; and,

3) Should the proposed work extend beyond the current Project Area, further archaeological assessment should be conducted to determine the archaeological potential of the surrounding lands.

NOTWITHSTANDING the results and recommendations presented in this study, ASI notes that no archaeological assessment, no matter how thorough or carefully completed, can necessarily predict, account for, or identify every form of isolated or deeply buried archaeological deposit. If archaeological remains are found during subsequent construction activities, the consultant archaeologist, approval authority, and the Archaeology Programs Unit of the MCM should be immediately notified.

The above recommendations are subject to MCM approval, and it is an offence to alter any archaeological site without MCM concurrence. No grading or other activities that may result in the destruction or disturbance of any archaeological sites are permitted until notice of MCM approval has been received.

5.0 Advice on Compliance with Legislation

ASI advises compliance with the following legislation:

- This report is submitted to the Ministry of Citizenship and Multiculturalism as a condition of licensing in accordance with Part VI of the *Ontario Heritage Act*, R.S.O. 1990, c 0.18. The report is reviewed to

ensure that it complies with the standards and guidelines that are issued by the Minister, and that the archaeological field work and report recommendations ensure the conservation, preservation, and protection of the cultural heritage of Ontario. When all matters relating to archaeological sites within the project area of a development proposal have been addressed to the satisfaction of the Ministry of Citizenship and Multiculturalism, a letter will be issued by the ministry stating that there are no further concerns with regards to alterations to archaeological sites by the proposed development.

- It is an offence under Sections 48 and 69 of the *Ontario Heritage Act* for any party other than a licensed archaeologist to make any alteration to a known archaeological site or to remove any artifact or other physical evidence of past human use or activity from the site, until such time as a licensed archaeologist has completed archaeological fieldwork on the site, submitted a report to the Minister stating that the site has no further cultural heritage value or interest, and the report has been filed in the Ontario Public Register of Archaeological Reports referred to in Section 65.1 of the *Ontario Heritage Act*.

- Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48 (1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with Section 48 (1) *of the Ontario Heritage Act*.

- The *Funeral, Burial and Cremation Services Act*, 2002, S.O. 2002, c.33 requires that any person discovering human remains must notify the police or coroner and the Registrar of Cemeteries at the Ministry of Public and Business Services Delivery.

- Archaeological sites recommended for further archaeological field work or protection remain subject to Section 48 (1) of the *Ontario Heritage Act* and may not be altered, or have artifacts removed from them, except by a person holding an archaeological license.

6.0 Bibliography and Sources

American Biographical Publishing Company. (1880). *The Canadian Biographical Dictionary and Portrait Gallery of Eminent and Self-Made Men: Vol. Ontario Volume*. American Biographical Publishing Company. https://www.canadiana.ca/view/oocihm.08545/1

Archaeological Services Inc. (2006). *Historical Overview and Assessment of Archaeological Potential Don River Watershed, City of Toronto*.

Birch, J., Manning, S. W., Sanft, S., & Conger, M. A. (2021). Refined Radiocarbon Chronologies for Northern Iroquoian Site Sequences: Implications for Coalescence, Conflict, and the Reception of European Goods. *American Antiquity*, *86*(1), 61–89.

Birch, J., & Williamson, R. F. (2013). *The Mantle Site: An Archaeological History of an Ancestral Wendat Community*. Rowman & Littlefield Publishers, Inc.

Brown, J. (1995). On Mortuary Analysis – with Special Reference to the Saxe-Binford Research Program. In L. A. Beck (Ed.), *Regional Approaches to Mortuary Analysis* (pp. 3–23). Plenum Press.

Chapman, L. J., & Putnam, F. (1984). *The Physiography of Southern Ontario* (3rd ed., Vol. 2). Ontario Ministry of Natural Resources.

Churcher, C. (2022). *Local Railway Items from Area Papers—1895*. Colin Churcher's Railway Pages. https://churcher.crcml.org/circle/Papers%20by%20Year/1895.pdf

City of Toronto Archives. (1954). *Aerial Photographs 1954* [Map]. https://mdl.library.utoronto.ca/collections/air-photos/1954-air-photos-southern-ontario/index

Cowan, W. R. (1972). *Pleistocene Geology of the Brantford Area, Southern Ontario* (37; Industrial Mineral Report). Ontario Department of Mines and Northern Affairs.

Crown-Indigenous Relations and Northern Affairs. (2016). *Saugeen Peninsula Treaty (1854) No. 72*. Treaty Texts – Upper Canada Land Surrenders. https://www.rcaanc-cirnac.gc.ca/eng/1370372152585/1581293792285#ucls24

Department of Militia and Defence. (1909). *Simcoe Sheet* [Map].

Department of National Defence. (1939). *Simcoe Sheet* [Map].

Dodd, C. F., Poulton, D. R., Lennox, P. A., Smith, D. G., & Warrick, G. A. (1990). The Middle Ontario Iroquoian Stage. In C. J. Ellis & N. Ferris (Eds.), *The Archaeology of Southern Ontario to A.D. 1650* (pp. 321–360). Ontario Archaeological Society Inc.

Edwards, T. W. D., & Fritz, P. (1988). Stable-Isotope Paleoclimate Records from Southern Ontario, Canada: Comparison of Results from Marl and Wood. *Canadian Journal of Earth Sciences*, *25*, 1397–1406.

Ellis, C. J., & Deller, D. B. (1990). Paleo-Indians. In C. J. Ellis & N. Ferris (Eds.), *The Archaeology of Southern Ontario to A.D. 1650* (pp. 37–64). Ontario Archaeological Society Inc.

Ellis, C. J., Kenyon, I. T., & Spence, M. W. (1990). The Archaic. In C. J. Ellis & N. Ferris (Eds.), *The Archaeology of Southern Ontario to A.D. 1650* (pp. 65–124). Ontario Archaeological Society Inc.

Ellis, C. J., Timmins, P. A., & Martelle, H. (2009). At the Crossroads and Periphery: The Archaic Archaeological Record of Southern Ontario. In T. D. Emerson, D. L. McElrath, & A. C. Fortier (Eds.), *Archaic Societies: Diversity and Complexity across the Midcontinent.* (pp. 787–837). State University of New York Press.

Ferris, N. (2013). Place, Space, and Dwelling in the Late Woodland. In M. K. Munson & S. M. Jamieson (Eds.), *Before Ontario: The Archaeology of a Province* (pp. 99–111). McGill-Queen's University Press. http://www.jstor.org/stable/j.ctt32b7n5.15

Karrow, P. F., & Warner, B. G. (1990). The Geological and Biological Environment for Human Occupation in Southern Ontario. In *The Archaeology of Ontario to A.D. 1650* (pp. 5–36). London Chapter, Ontario Archaeological Society.

Land Resource Research Institute. (1983). *Soils of Haldimand-Norfolk Regional Municipality, Ontario, Sheet 1—Middleport-Caledonia* [Pedology]. Land Resource Research Institute, Research Branch, Agriculture Canada.

MCM, (Ministry of Citizenship and Multiculturalism). (2025). *Ontario's PastPortal*. PastPortal. https://www.pastport.mtc.gov.on.ca

Ministry of Citizenship and Multiculturalism. (1990). *Ontario Heritage Act, R.S.O. c. O.18*.

Ministry of Citizenship and Multiculturalism. (2022). *Ontario's Past Portal*. PastPortal. https://www.pastport.mtc.gov.on.ca

Ministry of the Environment. (1990). *Environmental Assessment Act, R.S.O. c. E.18*.

Mississaugas of the Credit First Nation. (2017). *12 Mile Creek, 16 Mile Creek and Credit River Reserves – Treaty Nos. 22 and 23 (1820)*. Mississaugas of the New Credit First Nation. https://mncfn.ca/between-the-lakes-treaty-no-3-1792/

MMM Group Ltd. (2016). *Norfolk County Integrated Sustainable Master Plan*. https://www.norfolkcounty.ca/media/lmuibvyh/the-ismp.pdf

MTC, (Ministry of Tourism and Culture). (2011). *Standards and Guidelines for Consultant Archaeologists*. Archaeology Programs Branch, Ontario Ministry of Tourism and Culture.

Municipal Engineers Association. (2023). *Municipal Class Environmental Assessment*.

Native Land Digital. (2018). *Treaty 3, 1792*. Native Land. https://native-land.ca/

Natural Resources Canada. (1996). *Simcoe NTS Topographic Sheet 040I16* [Map].

Ontario Heritage trust. (2025). *Founding of Simcoe*. Online Plaque Guide. https://www.heritagetrust.on.ca/plaques/founding-of-simcoe

Owen, E. A. (1898). *Pioneer Sketches of Long Point Settlement*. William Briggs.

Page & Co. (1877). *Illustrated Historical Atlas of the Counties of Haldimand and Norfolk* [Map].

Ray, A. J. (2005). *I Have Lived Here Since the World Began: An Illustrated history of Canada's Native People*. Key Porter Books.

Rogers, E. S. (1962). *The Round Lake Ojibwa*. Royal Ontario Museum.

Rogers, E. S., & Smith, D. B. (Eds.). (1994). *Aboriginal Ontario: Historical Perspectives on the First Nations*. Dundurn Press.

Six Nations of the Grand River. (2020). *Land Rights—A Global Solution for the Six Nations of the Grand River*. Six Nations Lands & Resources Department. https://www.tidridge.com/uploads/3/8/4/1/3841927/snglobalsolutions-web.pdf

Spence, M. W., Pihl, R. H., & Murphy, C. (1990). Cultural Complexes of the Early and Middle Woodland Periods. In C. J. Ellis & N. Ferris (Eds.), *The Archaeology of Southern Ontario to A.D. 1650*. Ontario Archaeological Society Inc.

Surtees, R. (1984). *Indian Land Surrenders in Ontario 1763-1867*. Research Branch, Corporate Policy, Department of Indian and Northern Affairs Canada.

Tremaine, G. C. (1856). *Map of the County of Norfolk* [Map].

United Church of Canada. (1962). *Dedication service and history: Old Windham United Church, May 27, 1962.* United Church of Canada Archives; United Church of Canada Archives Pamphlet Collection. https://catalogue.unitedchurcharchives.ca/dedication-service-and-history-old-windham-united-church-may-27-1962

Williamson, R. F. (1990). The Early Iroquoian Period of Southern Ontario. In C. J. Ellis & N. Ferris (Eds.), *The Archaeology of Southern Ontario to A.D. 1650* (pp. 291–320). Ontario Archaeological Society Inc.

Wilson, B. (1983). *Dictionary of Canadian Biography: Vol. V (1801-1820)*. University of Toronto Press.

7.0 Images

7.1 Field Photography



Image 1: Project Area disturbed by grading and existing infrastructure – no archaeological potential.



Image 2: Project Area disturbed by grading and existing infrastructure – no archaeological potential.



Image 3: Project Area disturbed by grading and former construction activities – no archaeological potential.



Image 4: Project Area disturbed by berm – no archaeological potential (see also Figure 8).



Image 5: Part of Project Area disturbed by berm; areas beyond berm retain archaeological potential – test pit survey required.



Image 6: Project Area exhibits archaeological potential around small concrete structure (potential pier) – test pit survey required.



Image 7: Project Area exhibits archaeological potential – test pit survey required.



Image 8: Project Area exhibits archaeological potential – test pit survey required.



Image 9: Project Area exhibits archaeological potential – test pit survey required.

7.2 Historical Imagery



Image 10: Google Earth satellite view of the Project Area from 2006.



Image 11: Google Earth satellite view of the Project Area from 2010.

8.0 Maps

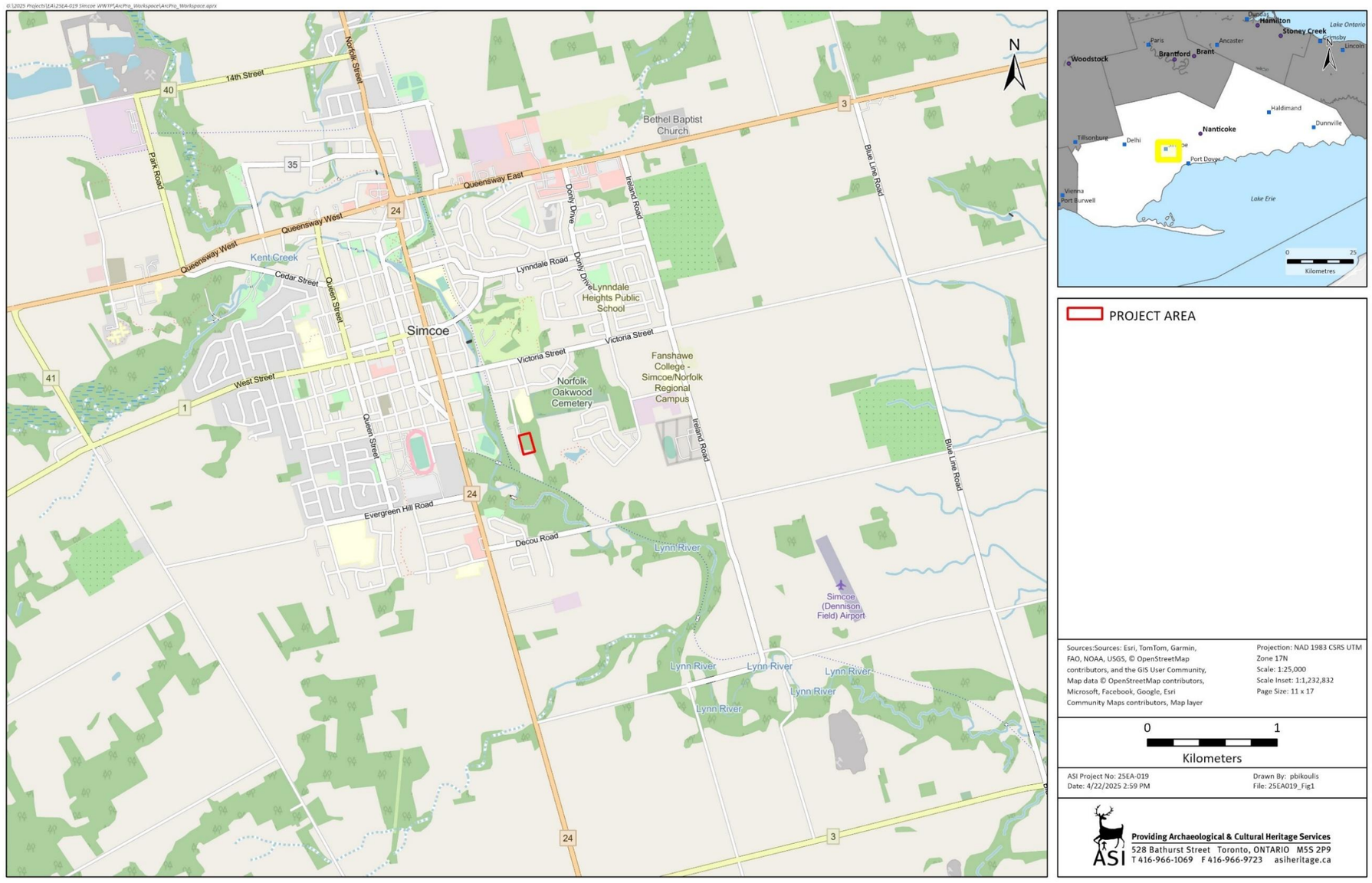


Figure 1: Location of the Project Area.



Figure 2: Project Area (Approximate Location) Overlaid on the 1865 Tremaine Map of Norfolk County.

G:\2025 Projects\EA\25EA-019 Simcoe WWTP\ArcPro_Workspace\ArcPro_Workspace.aprx

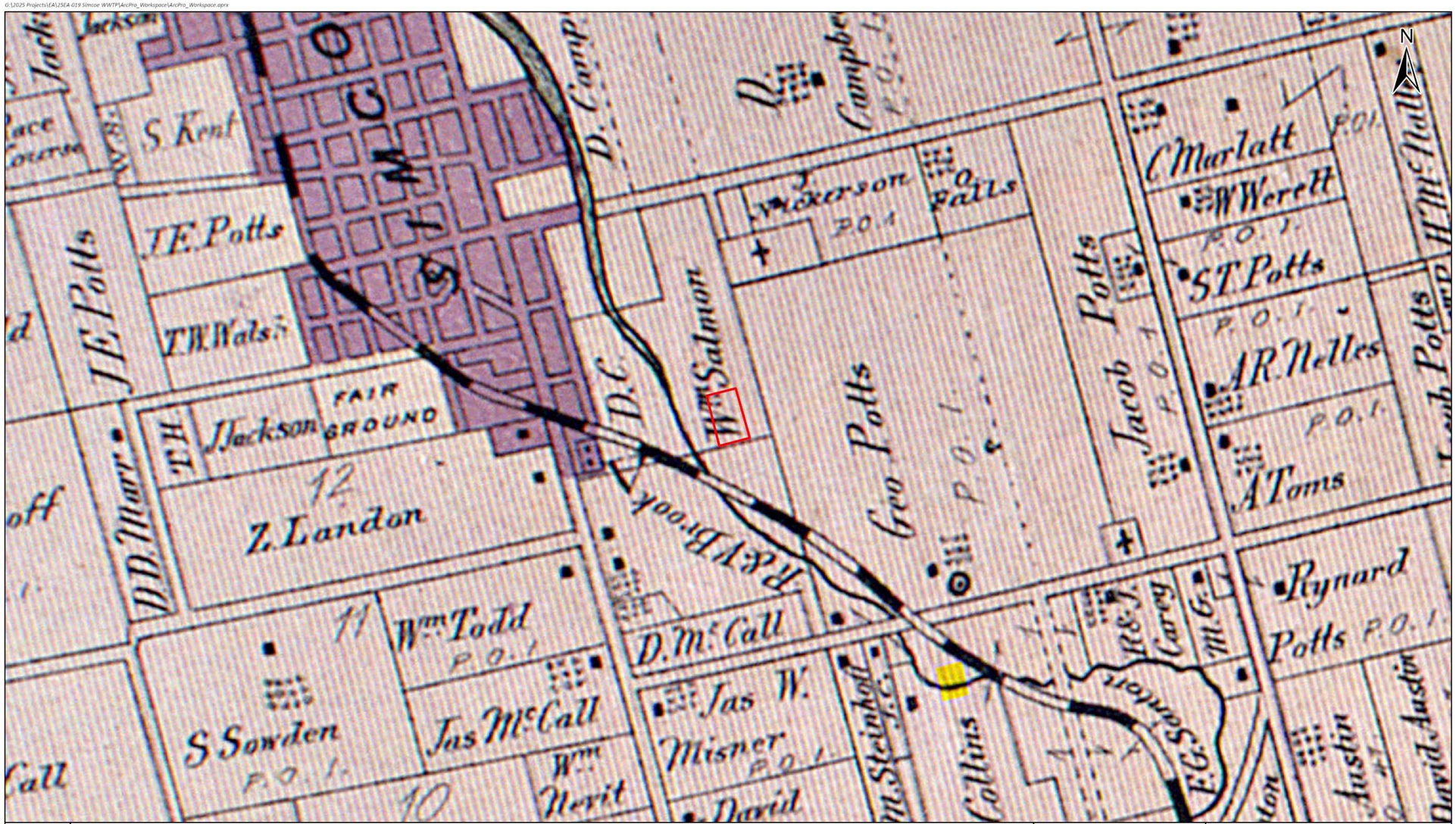


Figure 3: Project Area (Approximate Location) Overlaid on the 1877 Illustrated Atlas of Norfolk County.

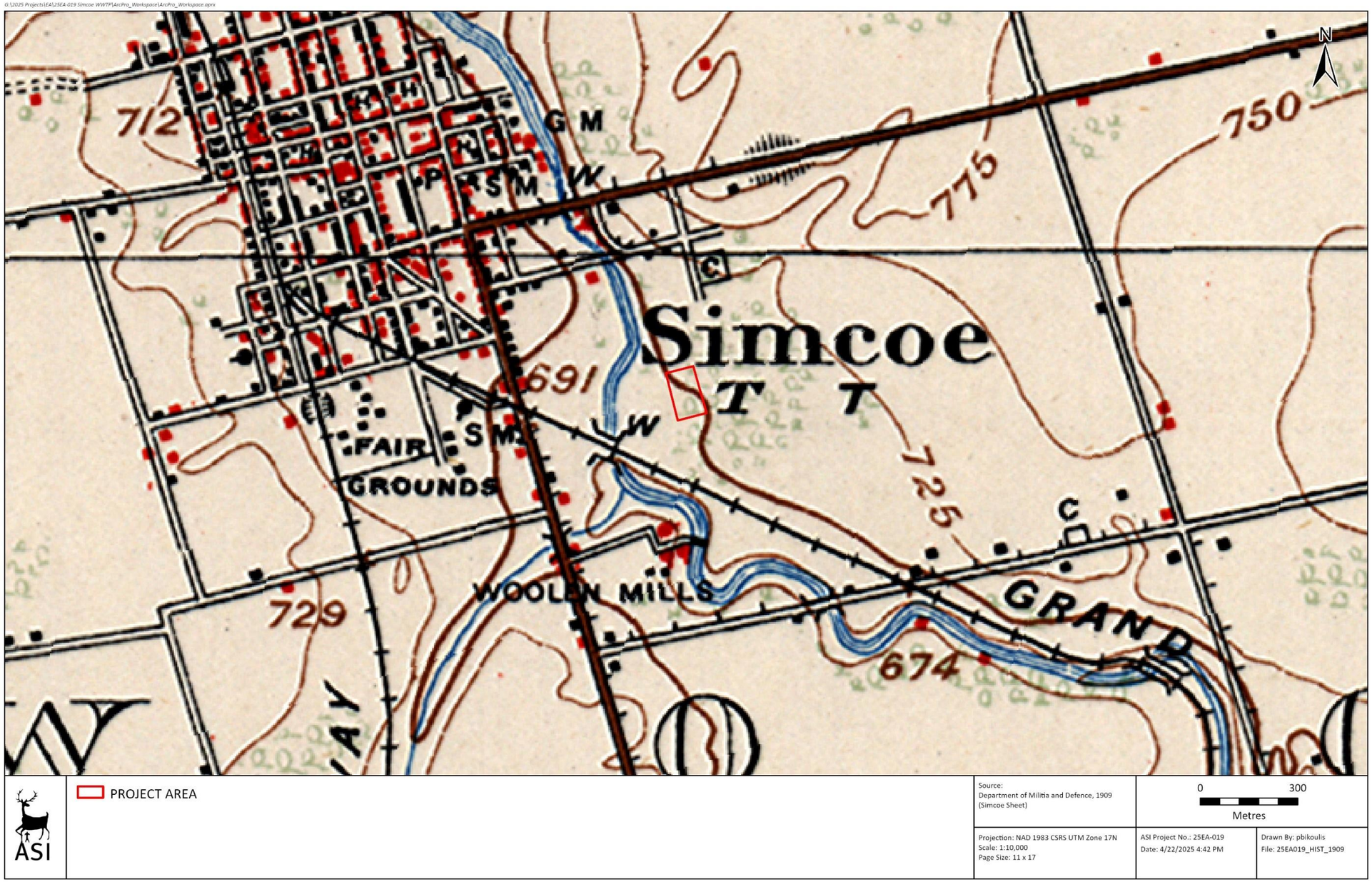


Figure 4: Project Area (Approximate Location) Overlaid on the 1909 Topographic Simcoe Sheet.

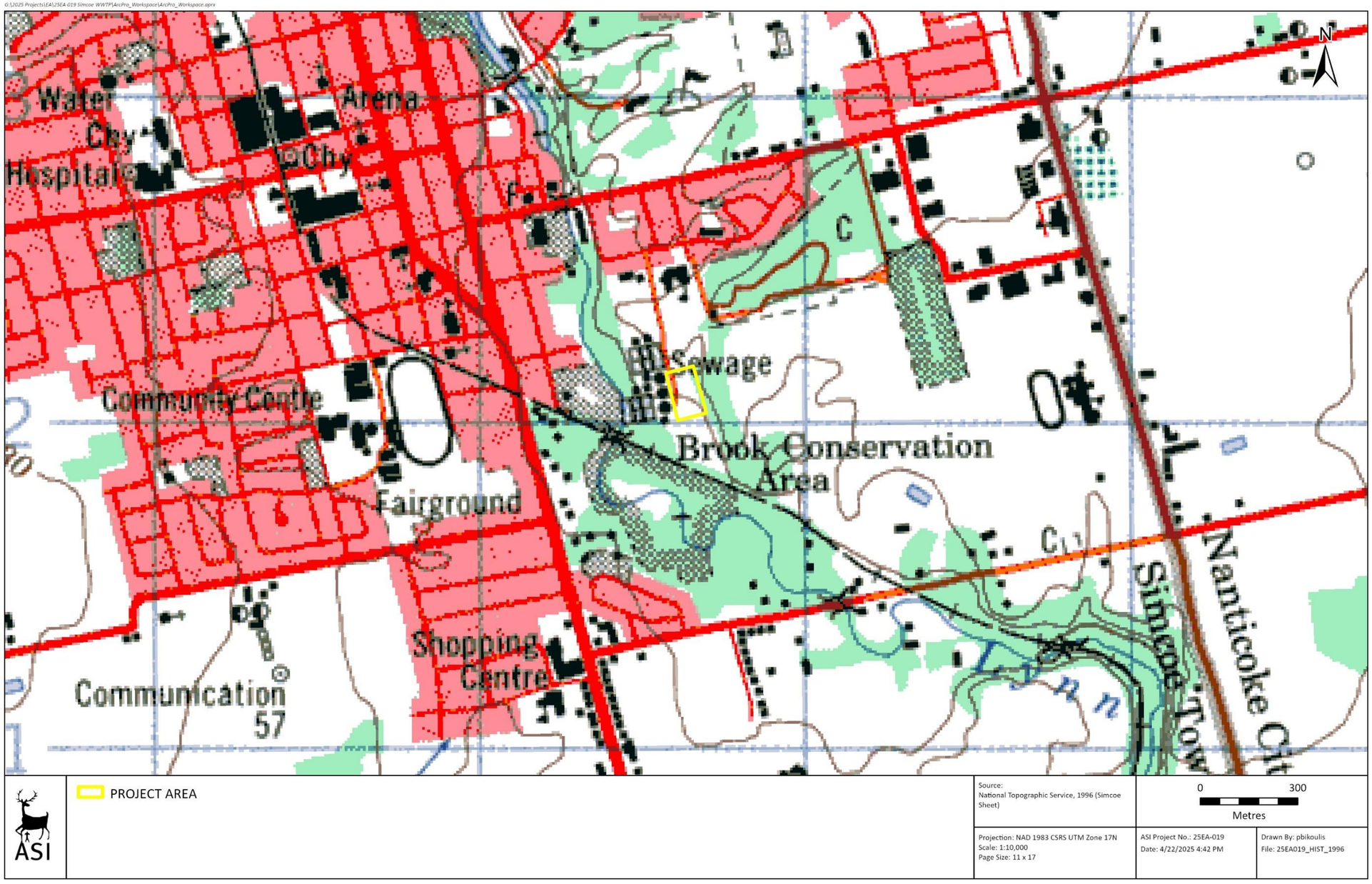


Figure 5: Project Area (Approximate Location) Overlaid on the 1996 Topographic Simcoe Sheet.



Figure 6: Project Area (Approximate Location) Overlaid on the 1954 Aerial Photograph.



Figure 7: Project Area Overlaid on the LiDAR-Based Digital Terrain Model (DTM).

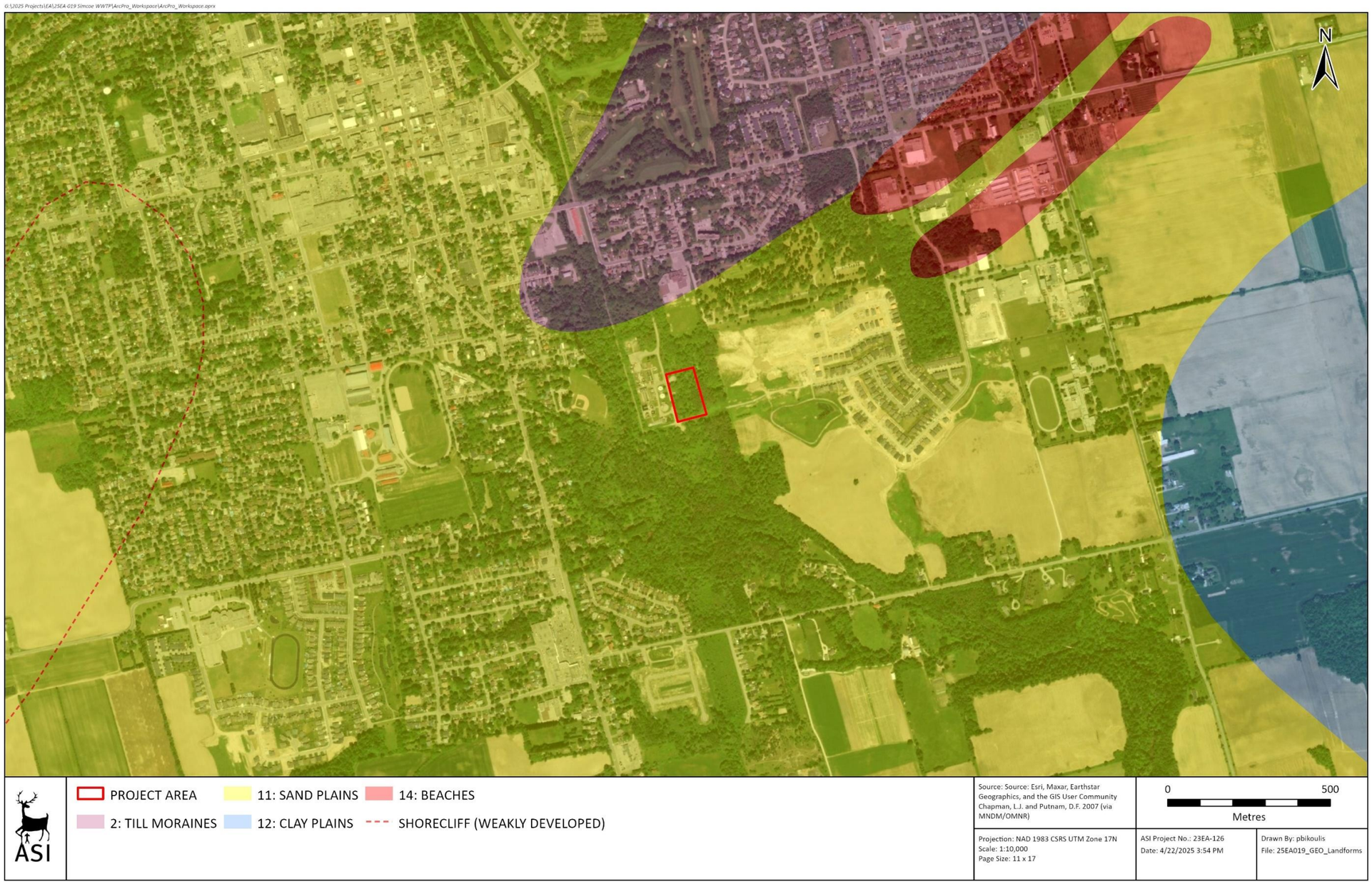


Figure 8: Project Area – Physiographic Landforms.

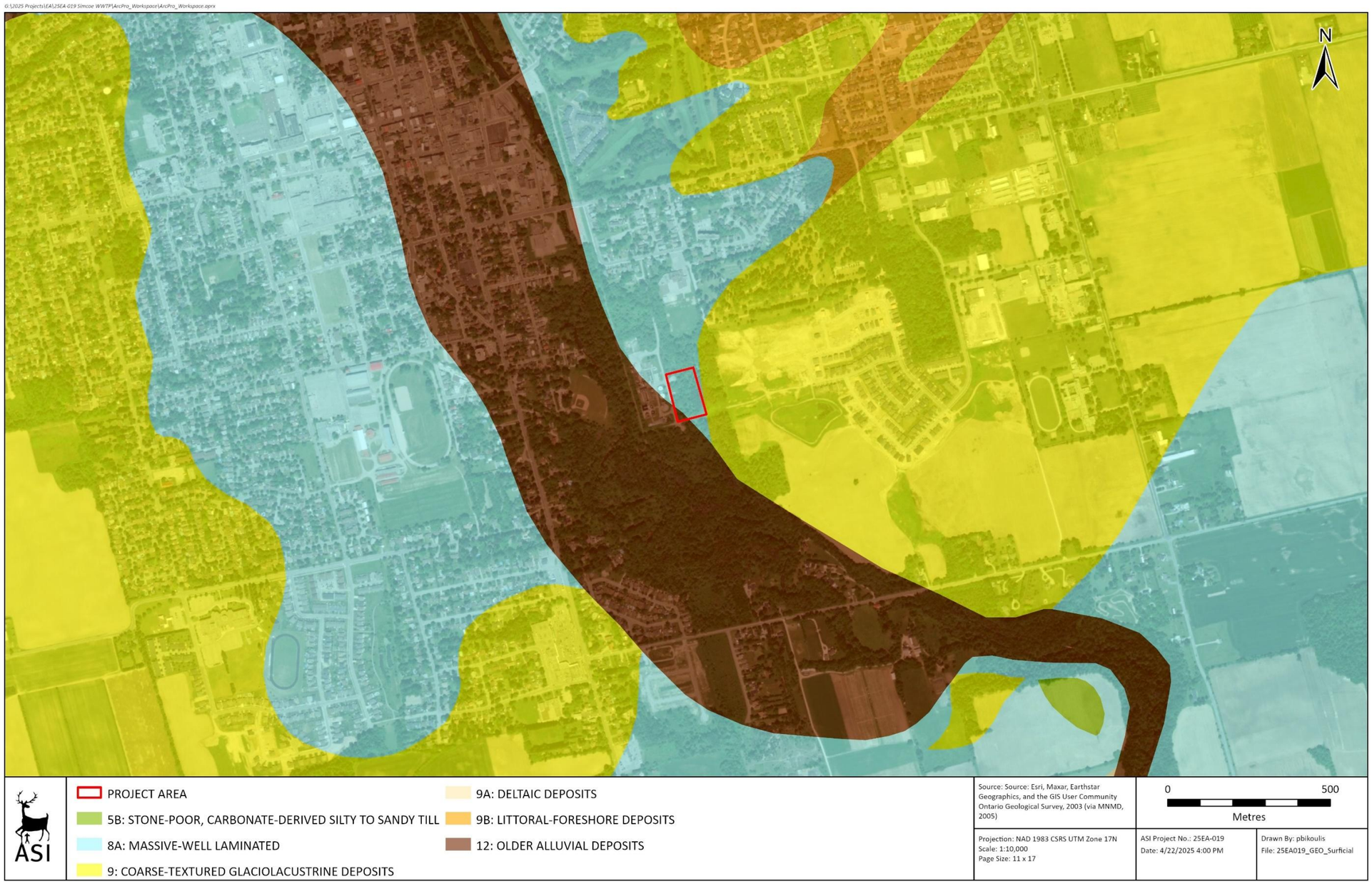


Figure 9: Project Area – Surficial Geology.

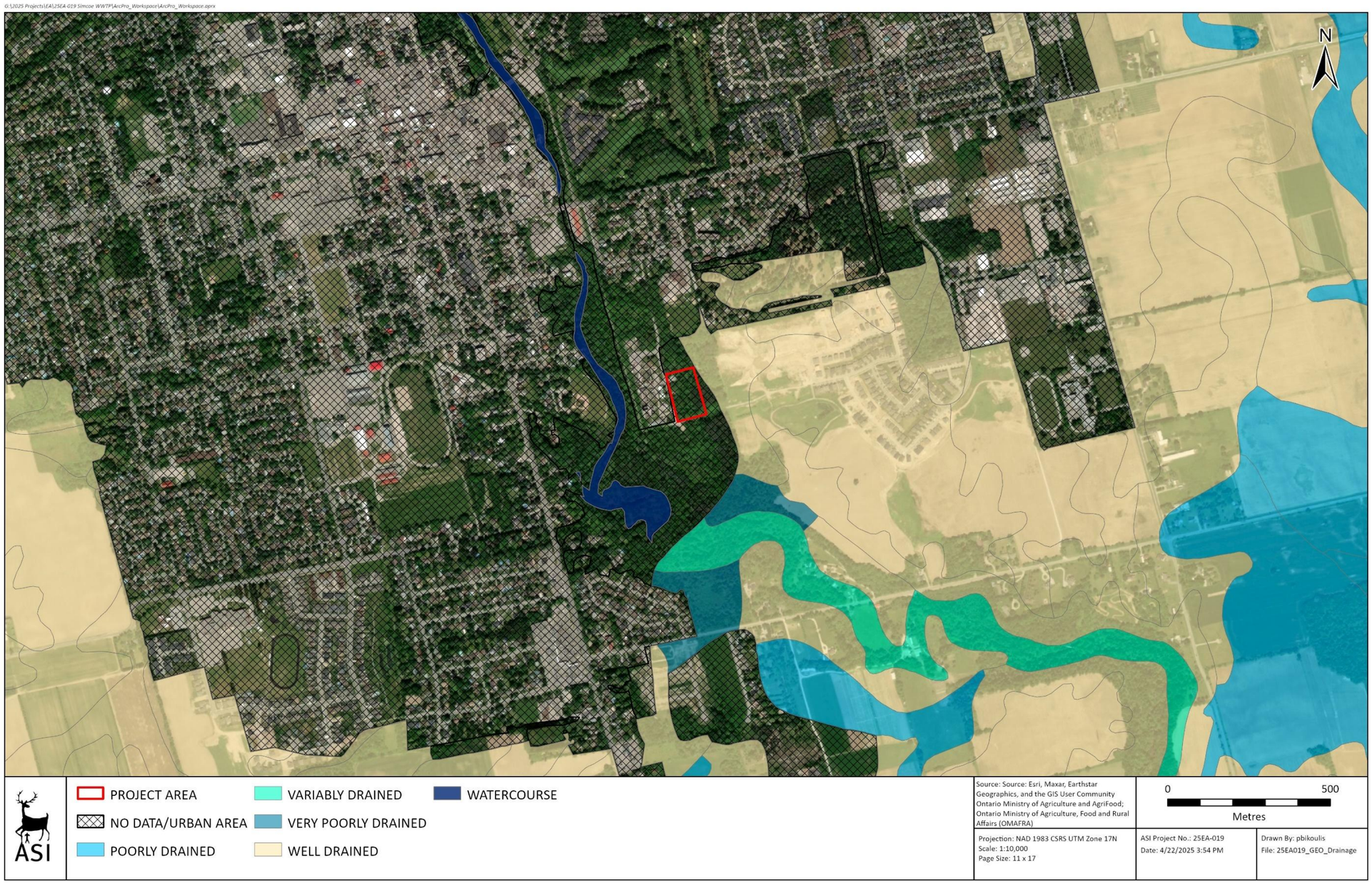


Figure 10: Project Area – Soil Drainage.



Figure 11: Results of the Stage 1 Archaeological Assessment.

Appendix C
Geotechnical and Hydrogeologic Investigations

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

Terraprobe
Consulting Geotechnical & Environmental Engineering
Construction Materials Inspection & Testing

GEOTECHNICAL INVESTIGATION
NORFOLK COUNTY
WASTE WATER TREATMENT PLANT EXPANSION
16 OAKWOOD AVENUE
SIMCOE, ONTARIO

PREPARED FOR: **Hatch**
5035 South Service Road, 6th Floor
Burlington, Ontario
L7L 6M9

ATTENTION: Mr. Glen Douglas
Project Manager

File No. 7-17-0120-01
November 8, 2017
©Terraprobe Inc.

Distribution:

Copies - Hatch
\- Terraprobe Inc.

EXECUTIVE SUMMARY

This report presents the results of a geotechnical investigation carried out for the design of the planned expansion of the Norfolk County Waste Water Treatment Plant (WWTP) in Simcoe, Ontario.

The results of eight boreholes together with laboratory testing are reported. The predominant subsurface conditions at the site comprised loose surficial soils consisting of silty sand and sandy silt, overlying compact to dense sand. Two of the deeper boreholes fully penetrated the sand and were terminated in a deposit of dense silt layered with silty clay. The ground water levels measured in monitoring were in the range of about 4 to 6m below the existing ground surface.

A discussion of the geotechnical engineering aspects of the design of the various elements of the WWTP upgrading has been provided.

The construction of the headworks facility will require excavation to a depth approaching about 14m below the existing grade which corresponds to several metres below the reported ground water level. It is expected that the excavation will need to be shored and ground water control must be established and maintained. Some of the other plant will involve excavations below the ground water level and dewatering systems will be needed at those locations. At other locations the excavations may be marginally above the ground water level and further monitoring will be needed to assess the dewatering requirements at these locations.

The results of soil chemistry analyses did not identify concerns regarding the management of surplus excavated soil that may be generated during the construction.

This report has been issued in draft format for review and comment and for use in the preliminary design of the works.

TABLE OF CONTENTS

1. INTRODUCTION 1

2. SITE DESCRIPTION 2

3. PROCEDURE 3

4. SUBSURFACE CONDITIONS 5
4.1 General 5
4.2 Soil Conditions 5
4.2.1. Fill 5
4.2.2. Sandy Silt and Silty Fine Sand 5
4.2.3. Sand 6
4.2.4. Silt 6
4.3. Ground Water Conditions 6

5. DISCUSSION 8
5.1 Overview 8
5.1.1. Headworks Facility 8
5.1.2. RAS/WAS 9
5.1.3. New Sludge Receiving Building 9
5.1.4. Digester Facility 10
5.1.5. Biosolids Holding Tank No. 1 10
5.1.6. New Administration Building 10
5.2 Foundation Design Parameters 11
5.3 Seismic Site Classification 12
5.4 Earth Pressure Design Parameters 12
5.5 Underground Services 13
5.2.1. General 13
5.2.2. Pipe Bedding 13
5.2.3. Backfill 14
5.2.4. Soil Corrosivity 14
5.6 Pavements 15
5.2.5. Asphaltic Concrete Pavement Design 16
5.2.6. Drainage 17

6. DESIGN CONSIDERATIONS FOR CONSTRUCTABILITY 18
6.1 Excavation 18
6.2 Dewatering 18
6.3 Shoring 19
6.4 Quality Control 20

7. SOIL QUALITY 21
7.1 General Soil Quality 21
7.1.1. Methodology 21
7.1.2. Results of Analyses 22
7.2 TCLP Analysis 22
7.3 Other Considerations 22

8. LIMITATIONS AND USE OF REPORT 24
8.1 Procedures 24
8.2 Changes in Site and Scope 25
8.3 Use of Report 25

FIGURES

Figure 1 Site Location Plan
Figure 2 Borehole Location Plan

APPENDICES

Appendix A Borehole Logs
Appendix B Geotechnical Laboratory Results
Appendix C Certificates of Analysis (Soil)

1. INTRODUCTION

This report presents the results of a geotechnical investigation carried out for the design of upgrades to the Norfolk County Waste Water Treatment Plant (WWTP) located at 16 Oakwood Avenue in Simcoe, Ontario. The location of the site is shown on Figure 1.

A proposal and work plan was initially outlined in our letter of August 4, 2016. A revised proposal that included a scope of work specified by Hatch was submitted on July 25, 2017. Authorization to proceed with the revised work plan was provided by Hatch on July 25, 2017.

The intents of the investigation were to determine the soil and ground water conditions in a series of boreholes drilled at the following venues:

- New headworks;
- new RAS/WAS chamber and
- new sludge receiving station;
- new digester;
- new biosolids holding tank;
- new administration building
- underground piping, and
- access roads

Information and advice on the geotechnical aspects of the design of the upgrades is provided based on the results of the boreholes. The anticipated construction conditions pertaining to excavation, backfill and temporary ground water control are discussed also, but only with regard to how these might influence the design. A hydrogeological investigation is being carried out in conjunction with the geotechnical investigation and will be reported under separate cover.

This report was previously issued in draft format for review and comment.

2. SITE DESCRIPTION

The site consists of the existing County of Norfolk wastewater treatment plant located at 16 Oakwood Avenue in Simcoe, Ontario. The existing WWTP complex is approximately 2 hectares in size and was comprised of various infrastructure and buildings. The site access consists of a paved road which extends south from Oakwood Avenue along the east side of the existing plant. The Lynn River is located to the west of the existing plant. The subject property gently slopes from the northeast to the southwest, with an overall grade change of about 6 metres across the site. An existing fenced-in hydro transformer is located adjacent to the northeast corner of the property.

Upgrades to the existing plant are proposed and new works are planned for the undeveloped property on the east side of the access road.

The site is situated in the Physiographic Region of southern Ontario known as the Norfolk Sand Plain. The soil stratigraphy characteristic to this region generally consists of deltaic sand deposits overlaying strata of silt and clay.

3. PROCEDURE

The fieldwork for this investigation was carried out between August 29 and 31, 2017 during which time eight (8) boreholes were drilled to depths in the range of 3.5 to 14.2m below the existing ground surface. On October 11, 2017 one of the boreholes (BH3), was explored an additional 7.6m to a depth to 21.8m below the existing ground surface. The locations and depths of the boreholes were specified by Hatch. The locations of the boreholes are shown on the Location Plan, Figure 2. The results of the boreholes are shown on the Log of Borehole sheets in Appendix A.

The existing underground services at the site were located in advance of the drilling by Ontario One Call. In addition, Frontier Utility Locating Services Inc. was retained to confirm that there were no private services conflicting with the borehole locations. Tree clearing was carried out by County forces to provide access to the boreholes located in the area to the east of the existing plant.

The drilling was carried out using fully equipped CME 75 truck and track mounted drill rigs supplied and operated by specialist, licenced (O. Reg. 903) drilling contractor. An engineer from our staff arranged for underground service locates, observed the drilling and sampling operations, logged the boreholes and cared for the samples obtained.

The boreholes were advanced using conventional interval augering using hollow core augers. Soil samples were recovered by split barrel sampling in accordance with ASTM Standard D1586 at regular intervals of depth. Soil samples recovered from the boreholes were sealed in clean, single use containers and transferred to Terraprobe's Stoney Creek laboratory for further examination and laboratory testing. Samples for soil quality analyses were stored in dedicated glass containers provided by the analytical laboratory.

The ground water conditions in the open boreholes were observed during and immediately after drilling. In addition, ground water monitoring wells were constructed in four selected boreholes. The wells were constructed using nominal 50mm diameter, Schedule 40 well screen and riser pipe. The wells were provided with protective steel casings and flush mount steel covers. As-built details on the wells are shown schematically on the Record of Borehole sheets in Appendix A.

The ground surface elevations at the borehole locations have been inferred from the site topographical mapping provided by Hatch.

A program of geotechnical laboratory testing was carried out on the soil samples recovered from the boreholes including moisture content (ASTM D 2216) and particle size analysis

(ASTM D422). The results of the laboratory testing are presented in Appendix B and are shown on the Records of Borehole sheets in Appendix A.

Selected soil samples were submitted to AGAT Laboratories for soil quality analyses. The analyses included O. Reg. 153-04 metals and inorganics. Details on the rationale for the analyses as well as the results of the analyses are discussed in Section 7 of this report. The Certificates of Analyses for the chemical analyses are provided in Appendix C.

4. SUBSURFACE CONDITIONS

4.1 General

The subsurface soil and ground water conditions encountered in the boreholes are shown on the Log of Boreholes sheets provided in the accompanying Appendix A. The subsurface conditions were confirmed at the borehole locations only and the conditions will vary between and beyond the boreholes. The boundaries between the various strata shown on the Record of Borehole sheets were based on non-continuous sampling and observations of drilling resistance. These boundaries typically represent a transition between the various stratigraphic units and are not to be interpreted as precise planes of stratigraphic change.

The subsurface conditions encountered at the site generally consisted of fill overlying near surface strata of loose silty sand and sandy silt. A stratum of sand was encountered beneath the fill and surficial soils. The deeper boreholes penetrated a layered silt and silty clay deposit beneath the sand.

Ground water observations were made in the boreholes during and after completion of drilling and ground water monitoring wells were constructed in selected boreholes. The results of short-term ground water level monitoring are reported. Fluctuation in the ground water levels will occur due to seasonal variations and precipitation conditions.

The following is a general description of the major stratigraphic units and the ground water conditions encountered in the boreholes.

4.2 Soil Conditions

4.2.1. Fill

Fill was encountered below asphalt pavement in boreholes 3, 4 and 6 and below topsoil in borehole 8. The fill in borehole 3, 4 and 8 generally consisted of sandy silt and the fill in borehole 6 consisted of clayey silt. The N values determined in the standard penetration testing carried out within the fill ranged from 4 to 12 blows per 0.3m inferring a relatively loose state of packing. The in-situ water content of the samples of fill recovered from the penetration testing was in the range of about 7 to 22 percent.

4.2.2. Sandy Silt and Silty Fine Sand

Strata of sandy silt and silty fine sand were encountered beneath the fill and topsoil in all of the boreholes. These strata were fully penetrated at depths of about 1.5 to 2.9m below the existing ground surface. The N values determined in these fine grained granular strata were in the range of 4 to 19 blows per 0.3m with an average N value of about 9 blows per 0.3m, generally

inferring a loose relative density. The natural water contents of the silty sand and sandy silt ranged from about 6 to 22 percent with an average natural water content of about 15 percent.

4.2.3. Sand

All of the boreholes encountered a stratum of medium sand below the silty sand and sandy silt. The sand was fully penetrated at depths of 9.4 and 9.8m below the existing ground surface in boreholes 3 and 4 respectively. The remaining boreholes were terminated in sand. The N values determined in the sand ranged from 10 to 59 with an average N value of about 22 blows per 0.3m inferring a compact relative density. The natural water content of the sand recovered above the ground water level was in the range of about 2 to 6 percent with an average of about 3 percent. The sand recovered from the penetration testing carried out near to and below the encountered ground water level ranged from 13 to 23 percent with an average of about 19 percent. Particle size distribution curves for selected samples of the medium sand are shown on Figure B2 in Appendix B.

4.2.4. Silt

Boreholes 3 and 4 encountered a deposit of silt with layers and seams of silty clay below the sand and to the depths explored. The N values determined in this deposit ranged from 20 to 74 blows per 0.3m with an average N value of about 49 blows per 0.3m inferring a dense relative density. The natural water content of the silt ranged from about 15 to 21 percent with an average natural water content of about 18 percent. Particle size distribution curves for samples of the silt are shown on Figure B2 in Appendix B.

4.3. Ground Water Conditions

Boreholes 5 and 6 which were explored to depths of 6.0 and 3.5m respectively were dry during and upon completion of drilling. Ground water was encountered in the remaining boreholes at depths of about 4.5 to 6.0m below ground surface or between elevations 205.9 and 206.8m. These encountered ground water conditions are not interpreted as representing stabilized conditions.

Table 4.1 provides a summary of ground water levels subsequently measured in the monitoring wells.

Table 4.1 Summary of Ground Water Level Monitoring					
Borehole No.	Screened Interval (m)	Soil Stratum	Elevation of Ground Water Level (m)		
			Aug. 31, 2017	Sept. 13, 2017	October 1, 2017
1	58.8 – 60.3	Sand	206.6	206.5	206.6
4	52.3 – 53.8	Silt	206.6	206.6	206.6
7	70.7 – 73.8	Sand	206.4	206.4	206.4
8	66.9 – 69.9	Sand	206.3	206.3	206.3

Some variation in ground water levels is expected due to seasonal effects and precipitation conditions.

5. DISCUSSION

The following discussion and recommendations are based on the factual data obtained from this investigation and is intended for use by the owner and the design engineer(s). Comments made regarding the construction aspects are provided only in as much as they may impact on design considerations. Contractors bidding on or undertaking work at the site should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction and make their own interpretation of the factual data as it affects their proposed construction techniques, schedule, equipment capabilities, costs, sequencing and the like.

The following discussion is based in part on the preliminary design drawings provided by Hatch. Some aspects of the following discussion are therefore considered preliminary and needs to be reviewed and updated as necessary when the final design information is available.

This following discussion is provided on the presumption that the design features relevant to the geotechnical analyses will be in accordance with applicable codes, standards and guidelines of practice.

5.1 Overview

5.1.1. Headworks Facility

The headworks facility will generally consist of a new single storey building approximately 12 by 18m in plan, which will house a wet well, control room and screen room. As presently proposed, the finished main floor elevation will be at 212.6m or about 0.3m above the finished exterior grade. The valve room finished floor will be at 208.5m. The wet well finished floor elevation will be at 199.1 or some 13.2m below grade.

The results of boreholes 3 and 4 drilled at this site indicated a ground water level at about elevation 206.5m. Based on the results of boreholes 3 and 4, excavation for the wet well will penetrate the sand deposits and terminate in the underlying dense silt stratum. Excavation to a depth of some 8m below the ground water level will be required. Ground water control will be needed to construct the facility. A supported excavation will be needed at this site and the ground water control plan should be developed in conjunction with the excavation plan.

While considered competent to support the expected foundation loading, the silt stratum on which the deeper elements of the facility will be supported, is highly susceptible to disturbance, particularly when ground water seepage is encountered. For this reason measures

will be required to preserve the integrity of the bearing stratum during construction. This can be achieved by constructing a working slab using lean concrete of adequate thickness or by placing a 300mm thick layer of nominally compacted clear crushed stone on a suitable nonwoven geotextile (Terrafix 270R or equivalent). Use of vibratory compaction equipment is not recommended during this stage of the work.

5.1.2. RAS/WAS

The proposed RAS/WAS building is about 5 by 9 m in plan and will provide access to valves and piping. This building will be supported on a slab foundation with an underside of slab elevation at about 207.3m or some 5m below the existing ground. The results of borehole 8 indicated that the foundation slab will be supported on sand, marginally above the ground water level measured at the time of the investigation.

The design of this facility is not considered problematic however it is expected that the ground conditions for the support of the slab may be adversely affected by excavations for the pipes that will enter the building. Although the foundation slab may be above the ground water level, the invert elevations of some of the piping may be deeper and it may be necessary to lower the ground water level slightly to maintain the stability of the bearing stratum during the underground construction. Additional ground water level monitoring will be beneficial in assessing the dewatering requirements for final design purposes.

It will be important that the excavations for the underground plant are adequately supported and then properly backfilled so that the foundation soil will not be compromised.

Consideration should be given to constructing a working pad of 200mm of well compacted Granular “A” to preserve the integrity of the bearing stratum during construction.

5.1.3. New Sludge Receiving Building

The new sludge receiving building will be about 10 by 12m in plan with an attached sludge receiving tank some 5m by 5m in plan and a septage/leachate receiving tank some 5m by 10 m in plan. The base slab at this facility will be at elevation 209.0m or at about 4m below the existing grade. The results of borehole 5 indicate that the foundation slab will be supported on sand, above the ground water level. Additional ground water level monitoring will be required to verify these conditions.

A working pad of Granular “A” is recommended to protect the bearing stratum during construction.

5.1.4. Digester Facility

The digester will consist of two 12.8m diameter digester tanks with an interconnecting control building. The top of basement floor slab in the control building will be at 209.3m. The floor of the tanks will be sloped toward the centre with an invert elevation of about 207.3m or about 6m below the existing grade.

Based on the results of boreholes 1 and 2, the excavations for the tanks will penetrate the sand stratum to depths approaching the ground water level. Dewatering may be required to construct the tank bases. Additional ground water level monitoring will be beneficial in assessing the dewatering requirements for final design purposes.

A working pad of Granular "A" is recommended to protect the bearing stratum during construction.

5.1.5. Biosolids Holding Tank No. 1

The biosolids holding tank will be a large diameter tank of similar design to the digester tanks. The invert elevation of the tank floor will be about 6m below grade (204.4m) or about 2m below the measured ground water level. Dewatering will also be required at this venue. A working pad of Granular "A" is recommended to protect the bearing stratum during construction.

5.1.6. New Administration Building

As presently proposed the new administration building will be a single storey floor slab on grade structure approximately 26 by 9m in plan. It is proposed to support the building on conventionally designed strip footings at a nominal depth of 1.2m below the existing ground surface.

Borehole 6 was drilled near the southeast corner of the proposed building site and encountered clayey fill to a depth of about 2.1m below the existing ground. On this basis it will be necessary to lower the footings sufficiently that they will be supported in the native undisturbed compact sand that underlies the site. Alternatively consideration could be given to excavating all existing fill and constructing engineered fill to restore the grade and support the foundations and slabs on grade.

5.2 Foundation Design Parameters

The subsurface conditions at the various venues and the potential impacts on the foundation design at each site are outlined above. The following Table 5.1 provides a summary of the geotechnical parameters that are recommended for the design of the foundations at the various venues.

Table 5.1 – Summary of Foundation Design Parameters

Venue	Anticipated Founding Elevation (m)	Bearing Stratum	Dewatering Required	Geotechnical Resistance (kPa)		Subgrade Modulus (MPa/m)
				SLS	ULS	
Headworks	208.1 - 205.8 198.8	Sand Silt	Yes	200 300	300 450	25 25
RAS/WAS	207.3	Sand	Possibly	200	300	25
Sludge Receiving	208.6	Sand	No	150	225	20
Digester	206.6 – 208.9	Sand	Possibly	150	225	20
Biosolids Holding	204.0 ±	Sand	Yes	150	225	20
Admin Bldg.	209.4 or lower	Sand	No	150	225	20

Where required, the dewatering must be carried out in advance of excavating for the foundations. In all cases, the adequacy of the bearing strata must be confirmed by the geotechnical engineer at the final excavation stage. As outlined above some works that are intended to protect the bearing stratum during construction have been recommended.

In cases where permanent foundation drainage is not provided, the foundations must be designed to resist uplift forces due to buoyancy computed using the ground water levels provided in Table 4.1. This will be especially critical at the headworks facility. Where the mass of the foundations is not sufficient to resist the uplift, consideration could be given to extending the base slabs outward beyond the end walls in order that the weight of the backfill can also be used to resist uplift. Alternatively consideration could be given to the use of micropiles or helical pier tie downs to resist uplift.

In the case of the headworks facility, such anchorages will develop resistance in the dense saturated cohesionless deposit encountered below elevation 203.5m. It is expected that nominal 150mm diameter post grouted micropiles within the dense silt will safely resist up to 60kN/m of adhered anchor length. Conventional earth anchors made in this deposit can be designed using a working adhesion of 60kPa. Helical piers (SS5 square shaft HPs) anchored in the silt can be designed using s tensile capacity of 80 kN ULS. One or more prototype anchors must be performance tested to 200% of the design load to demonstrate the anchor capacity and validate the design assumptions.

5.3 Seismic Site Classification

The Ontario Building Code (2012) stipulates the methodology for earthquake design analysis, as set out in Subsection 4.1.8.7. The determination of the type of analysis is predicated on the importance of the structure, the spectral response acceleration and the site classification.

The parameters for determination of Site Classification for Seismic Site Response are set out in Table 4.1.8.4A of the Ontario Building Code (2012). The classification is based on the determination of the average shear wave velocity in the top 30 metres of the site stratigraphy, where shear wave velocity (v_s) measurements have been taken. Alternatively, the classification is estimated on the basis of rational analysis of undrained shear strength (s_u) or penetration resistance (N-values).

Based on the results of the boreholes the site designation for seismic analysis is best represented by **Site Class D**, as shown in Table 4.1.8.4.A of the Ontario Building Code (2012). Tables 4.1.8.4.B and 4.1.8.4.C. of the same code provide the applicable acceleration- and velocity-based site coefficients.

Table 5.2 Summary of Seismic Design Parameters

Site Class	Values of F_a as a Function of Site Class and Sa(0.2)				
	$S_a(0.2) \le 0.25$	$S_a(0.2) = 0.50$	$S_a(0.2) = 0.75$	$S_a(0.2) = 1.00$	$S_a(0.2) \ge 1.25$
D	1.3	1.2	1.1	1.1	1.0
	Values of F_v as a Function of Site Class and Sa(0.1)				
	$S_a(1.0) \le 0.1$	$S_a(1.0) = 0.2$	$S_a(1.0) = 0.3$	$S_a(1.0) = 0.4$	$S_a(1.0) \ge 0.50$
	1.4	1.3	1.2	1.1	1.1

5.4 Earth Pressure Design Parameters

The appropriate values for use in the design of structures subject to unbalanced earth pressures at this site are tabulated as follows:

Table 5.3 - Summary of Soil Parameters for Computation of Earth Pressures

Soil Type / Parameter	γ (kN/m^3)	ϕ (^{o})	K_a	K_o	K_p
Compact Granular Fill Granular 'B' (OPSS.MUNI 1010)	21	32	0.31	0.47	3.26
Select excavated sand	20	30	0.33	0.50	3.0
Non-select excavated earth	19	28	0.36	0.53	2.78

The above earth pressure coefficients pertain to a horizontal grade condition behind a retaining structure. Values of earth pressure parameters for an inclined retained grade condition will vary.

Walls subject to unbalanced earth pressures must be designed to resist a pressure that can be calculated based on the following equation:

$$P = K[\gamma(h - h_w) + \gamma' h_w + q] + \gamma_w h_w$$

where,

P	=	the horizontal pressure at depth, **h** (m)
K	=	the earth pressure coefficient
h_w	=	the depth below the ground water level (m)
γ	=	the bulk unit weight of soil, (kN/m^3)
γ'	=	the submerged unit weight of the exterior soil, (γ - 9.8 kN/m^3)
q	=	the complete surcharge loading (kPa)

The ground water levels shown in Table 4.1 should be considered for design purposes. In cases where the wall backfill can be drained effectively to eliminate hydrostatic pressures on the wall that would otherwise act in conjunction with the earth pressure, the above equation is simplified to:

$$P = K[\gamma h + q]$$

Consideration must also be given to the possible effects of frost on structures retaining earth.

5.5 Underground Services

5.2.1. General

The precise layout and invert elevations of the underground piping have not been provided however it is expected that the pipes will be located at depths in the range of about 3 to 5m below the existing ground surface.

Based on the results of the boreholes it is expected that the excavations for the pipes will generally penetrate fill and surficial soils and will terminate in the medium sand stratum that underlies the site. Ground water was generally encountered at depths of about 5 to 6m below ground surface and it is likely that dewatering will be required for the deeper services.

5.2.2. Pipe Bedding

A Class B bedding condition as shown on OPSD 802.031 is generally required for conventional sewer construction. The bedding for the pipes should consist of well graded free

draining granular material such as Granular "A", which is compatible with the size and type of pipe and consistent with the current County standards. Bedding materials with a high porosity, such as clear stone are not recommended for this project unless adequate filter protection is provided. Such protection could be achieved using a suitable geotextile.

It is possible that fill and or loose surficial soil could be encountered at the pipe invert elevation in some sections. Care will be required to ensure that fill and any loose or disturbed soil is removed prior to placing pipe bedding.

5.2.3. Backfill

It is anticipated that the excavated soil will generally consist of the surficial soils (silty sand and sandy silt) and medium sand. The natural water content of the silty sand and sandy silt was variable but generally within a range where mechanical compaction to an acceptable standard is feasible. The medium sand was generally dry of the laboratory optimum water content for compaction although somewhat wetter near to and below the ground water level. Based on the above it is expected that most of the excavated soil will be suitable for re-use as trench backfill however it may be necessary to add water to the backfill to achieve the specified degree of compaction. Any fill, topsoil or excessively wet soil should be excluded from the backfill material.

The trench backfill must be placed in lifts of 300mm thickness or less and uniformly compacted to 95 percent of standard Proctor maximum dry density. The upper 1m of backfill, forming pavement subgrade, should be uniformly compacted to 98 percent of standard Proctor maximum dry density. For optimal performance, the placement water content of the backfill should be within about 2 percent of the corresponding laboratory optimum water content for compaction.

5.2.4. Soil Corrosivity

The aggressiveness of the subsurface environment to underground plant has been assessed by carrying out a suite of analyses on soil samples recovered from the boreholes at depths approximately corresponding to the expected invert elevations. A copy of the Certificate of Analysis for the testing is included in Appendix C. The results of the analysis are summarized in the following Table 5.4.

Table 5.4 - Summary of Corrosion Analysis			
Parameter	**BH3 Sa3 Silty Sand**	**BH6 Sa3 Sand**	**BH1 Sa6 Sand**
pH (pH)	8.64	9.11	9.13
Chloride (µg/g)	31	5	2
Sulphate (µg/g)	39	10	10
Sulphide (µg/g)	<0.05	<0.05	<0.05
Redox Potential (mV)	203	193	186
Resistivity (ohm-cm)	6580	13700	15400
Moisture	moist	dry	Wet
AWWA Rating	6	5	7

The water soluble sulphate concentrations reported for the three samples tested ranged were below the range of concentrations that has been categorized as “Moderate” or a “Class S-3" degree of exposure with respect to sulphate attack on Portland cement concrete as shown in CSA A23.1-14, Table 3. On this basis the potential for sulphate attack on underground concrete at this site is considered low. The mix design requirements for concrete exposed to various conditions are provided in the above document.

The soil resistivity in combination with other parameters and environmental factors provides an indication of the potential for corrosion of buried metal pipe. Application of the American Water Works Association (AWWA) ten point soil evaluation criteria to the results of the testing indicated a rating in the range of 5 to 7 for the samples tested. A rating of greater than 10 is considered to represent a potentially corrosive environment. Other studies suggest that soil with a resistivity of less than about 2000 ohm-cm should be considered aggressive.

Based on the above analysis, the subsurface conditions at the site are not regarded as being particularly aggressive to buried metal or concrete plant. It must be noted that the analytical results provide only an indication of the potential for corrosion. Irrespective of the results of the testing, if a high incidence of corrosion related failure has been reported in the area of the site, corrosion protection or the use of PVC pipe should be considered.

5.6 Pavements

New vehicular pavements and surface parking will be required in the area to be developed for the new digester facility and sludge receiving building located to the east of the existing facilities. This area was tree covered at the time of the investigation.

Development of this area will consist of clearing and grubbing and pre-grading. It is expected that some cutting and filling may be needed to achieve the design subgrade elevation. The

subgrade soil will generally consist of sandy silt and silty fine sand. Where fill is required to achieve the design grade it may consist of select cut material from the site or select surplus excavated soil from the adjacent construction. Subgrade fill should be placed and uniformly compacted in 300mm thick lifts to at least 95 percent of standard Proctor maximum dry density.

The final subgrade surface beneath all pavements should be shaped and grade to promote drainage. The subgrade in areas of cut may be in a relatively loose condition and for this reason the final subgrade surface should be uniformly compacted using a large diameter smooth drum roller. The subgrade should be proof-rolled under the direction of a geotechnical engineer to identify any soft or weak zones requiring remedial work.

5.2.5. Asphaltic Concrete Pavement Design

The precise nature of the traffic loading at the site is not known however it is expected that the pavement will be subjected to relatively heavy loading, possibly consisting of semi tanker trailers and the like. Parking for staff and service vehicles is also proposed. The pavement component thicknesses shown in Table 5.4 are recommended for preliminary design consideration for flexible pavements at the site.

Table 5.4 – Pavement Component Thickness Design

Pavement Layer	Compaction Requirements	Heavy Duty Thickness	Surface Parking Thickness
Surface Course Asphaltic Concrete HL4 (OPSS 1150)	92-96.5% MRD	50 mm	40 mm
Base Course Asphaltic Concrete HL8 (OPSS 1150)	92-96.5% MRD	80 mm	40 mm
Base Course: Granular A (OPSS 1010)	98% standard Proctor Maximum Dry Density (ASTM-D1557)	150 mm	150 mm
Subbase Course: Granular B Type II (OPSS 1010)	98% standard Proctor Maximum Dry Density (ASTM-D1557)	300 mm	300 mm

Some adjustment to the thickness of the granular subbase material may be required depending on the condition of the subgrade at the time of the pavement construction. The need for such adjustments can be best assessed by the geotechnical engineer during construction. Equivalent Super Pave mixes may be used in place of the Marshall mix designations given above.

Consideration should be given to the use of rigid pavement for improved durability in some locations such as aprons, unloading zones and other hard standing areas.

5.2.6. Drainage

Control of surface water is a significant factor in achieving good pavement performance and longevity. Grading adjacent to the pavement must be designed so that water is not allowed to pond adjacent to the outside edges of the pavement or curb. The native soils are highly susceptible to frost heave, and pavements must be designed accordingly. The subgrade must be free of depressions and sloped (preferably at a minimum grade of two percent) to provide effective drainage toward subgrade drains.

Continuous, adequately filtered pavement subdrains along both sides of the roadways, or alternatively roadside ditches should be provide along both sides of the roadways to provide effective drainage of the granular pavement materials. The subdrain invert should be maintained at least 0.3 metres below subgrade level. Subdrains should also be provided at all catch-basins.

It should be noted that in addition to a strict adherence to the above pavement design recommendations an effective quality assurance inspection and testing program is required to verify compliance of the materials to the design and that the various compaction requirements are consistently being achieved.

6. DESIGN CONSIDERATIONS FOR CONSTRUCTABILITY

6.1 Excavation

Excavations must be carried out in accordance with the *Occupational Health and Safety Act and Regulations for Construction Projects, Ontario Regulation 213/91 as amended by Ontario Regulation 142/17 (Part III - Excavations, Section 222 through 242).* These regulations designate four (4) broad classifications of soils to stipulate appropriate measures for excavation safety. Within this context, *Type 3 Soil* conditions should be assumed for all excavations provided that ground water seepage is adequately controlled and surface water is directed away from open excavations. It is noted that flatter excavations may be needed in the dry sand deposits

Where workmen must enter a trench or excavation deeper than 1.2 m, the soil must be suitably sloped and/or braced in accordance with the regulation requirements. Minimum support system requirements for steeper excavations are stipulated in Sections 235 through 238 and 241 of the Act and Regulations and include provisions for timbering, shoring and moveable trench boxes.

6.2 Dewatering

The ground water levels have been measured between about elevations 206.3 and 206.6m in the monitoring wells constructed at the site. It is expected that excavation for the foundations at some of the venues will extend below the ground water level. Adequate ground water control will be necessary to maintain the stability of the excavations, to prevent bottom heave and to properly construct the foundations.

A hydrogeological investigation is being carried out in conjunction with the geotechnical investigation which will be reported under separate cover as it becomes available. The following comments are provided for preliminary design consideration.

It is anticipated that the excavation for the biosolids holding tank may extend to some 2m below the ground water level and the excavations at the digester may be only marginally above the ground water level. It is likely that effective ground water control at these sites can probably be achieved by pumping from a ring of vacuum well points. The ground water level should be lowered to and maintained at 1m below the deepest excavation.

The dewatering requirements at the headworks facility are more onerous due to the depth of the excavation required. It is likely that a shoring system consisting of interlocking steel sheet piling supported with walers and struts or restrained using soil anchors may be required. Depending on the design, the sheet piling would extend at least several metres into the

interlayered silt and silty clay deposit which may also be required to control ground water seepage. Continuous pumping from properly filtered sumps located in the excavation will be required to lower the ground water level and to manage the seepage volumes expected.

6.3 Shoring

It is expected that a shoring system will be needed to support the excavations for the headworks facility. Open cut excavations may be feasible at the other venues.

Shoring systems must be designed and constructed in accordance with the Occupational Health and Safety Act of Ontario (OHSA). The shape of the soil pressure distribution diagram to be considered for designing the shoring depends on the type and condition of the soil encountered and the amount of movement that can be tolerated. The shoring system can be restrained, fixed or flexible. Earth pressure computations must also take into account the ground water level. Earth pressure above the ground water level is computed based on the bulk unit weight of the retained soil. Earth pressures below the ground water level will be computed using the submerged (buoyant) unit weight of the soil. A hydrostatic pressure is also applied if the retained soil is not fully drained.

As outlined in Section 6.2, the shoring system may be an integral part of the dewatering scheme at the headworks site. The depth of excavation at this site will approach about 14m. Based on the results of boreholes 3 and 4 drilled at the site and the design information presently available, it is expected that excavations for the headworks will penetrate the surficial soils, the sand deposit and terminate in the underlying interlayered silt and silty clay stratum. A ground water level at 206.6m or about 5.8m below the existing ground surface has been reported at this venue. The recommended unfactored soil parameters that may be considered in the design of the support system are shown in Table 6.1.

Table 6.1 - Soil Parameters for Shoring Design

Elevation (m)	Stratigraphic Unit	ϕ (degrees)	γ (kN/m³)	γ' (kN/m³)	Earth Pressure Coefficient		
					K_a	K_o	K_p
210.0 – 212.3	Surficial Soil Loose	28	18	-	0.36	0.53	2.787
206.6 – 210.0	Sand Compact	30	19	-	0.33	0.50	3.00
202.5 - 206.6	Sand Compact – dense	30	19	9.2	0.33	0.50	3.00
198.1 – 202.5	Silt/Silty Clay Dense	32	20	10.2	0.31	0.47	3.22

The shoring could consist of a system of interlocking steel sheet piling supported with walers and struts or restrained using earth anchors. Depending on the design, the sheet piling would need to extend at least several metres into the silt deposit which will also be required to control ground water seepage.

Use of soil anchors to support the shoring system is considered feasible. Soil anchors can be installed as the excavation proceeds, minimizing the potential for relaxation in the supported soil. Soil anchors placed in the sand deposit can be designed for a working adhesion of up to 60 kPa. The upper level shoring anchorages must not be placed lower than 3.0 metres below the top of level ground surface. The installations would require pressure grouting through hollow stem augers to preserve the integrity of the bored holes and the anchor bond zone. The contractor must decide the anchor capacity and confirm its availability. All anchors must be tested as indicated in the Canadian Foundation Engineering Manual, 4th edition and the PTI Guidelines. It is suggested that 10 percent % of all tiebacks be Performance tested and 100 percent of all tiebacks be Proof Tested.

6.4 Quality Control

The on-site review of the condition of the foundation soil as the foundations are constructed is an integral part of the geotechnical design function and is required by Section 4.2.2.2 of the Ontario Building Code. The geotechnical engineer should be retained to review the geotechnical aspects of the final design and to verify the conditions encountered during construction.

The design advice in this report is based on an assessment of the subgrade support capabilities as indicated by the boreholes. These conditions may vary across the site depending on the final design grades and therefore, the preparation of the subgrade and the compaction of all fill should be monitored by the geotechnical engineer at the time of construction to confirm material quality, thickness, and to ensure adequate compaction.

The requirements for backfill placement on this project have been stipulated relative to Standard Proctor Maximum Dry Density (SPMDD). In situ determinations of density during fill and asphaltic pavement placement on site are required to demonstrate that the specified placement density is achieved.

Concrete design and construction should be specified in accordance with the requirements of CAN3 - CSA A23.1.

7. SOIL QUALITY

7.1 General Soil Quality

7.1.1. Methodology

Chemical analyses were carried out on sixteen (16) soil samples recovered from the boreholes drilled at the site. The soil samples were submitted to AGAT Laboratories. The chemical parameter groups selected for analysis were chosen to provide general information regarding the soil quality and to be considered in developing a soil management plan for the construction.

The analyses were conducted for the following parameters groups, as specified in Ministry of Environment and Climate Change (MOECC) *"Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act"*, July 1, 2011.

Inorganic Parameter Groups

- Metals (M)
- Metals, Hydride-Forming As, Se and Sb (H-M)
- Other Regulated Parameters (ORPS):
    - boron, hot water soluble (HWS)
    - cyanide
    - electrical conductivity
    - hexavalent chromium
    - mercury
    - pH
    - sodium adsorption ratio (SAR)

The certificates of analyses are provided in Appendix C.

The results of the chemical analysis was compared to the Ministry of Environment and Climate Change (MOECC) Standards as found in the *"Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act"*, April 15, 2011. The Standards which the results were compared to were the following:

Table 1 Full Depth Background Site Condition Standards (Table 1)

Table 3 Full Depth Generic Site Condition Standards in a Non-Potable Ground Water Condition for Industrial, Commercial and Community Land Use (Table 3 ICC)

The Standards were chosen for the following reasons:

Table 1 – The results were compared to the Table 1 Standards in order to determine if the soil material was suitable as clean fill for reuse by any potential receiving site.
Table 3 ICC – The results were compared to the Table 3 ICC Standards in order to determine if the soil material should be considered a waste.

7.1.2. Results of Analyses

The results of the Ontario Regulation 153-04 analyses are presented in Table 7.1 of this report. The results of the analyses indicated that all of the samples tested met the MOECC Table 1 and Table 3 standards. On this basis the soil quality is not considered a major constraint in managing the excess excavated soil from the site.

7.2 TCLP Analysis

One composite soil sample of the soil recovered from the boreholes was submitted for analysis of Ontario Regulation 558 Schedule 4 parameters (TCLP analysis) for waste classification purposes.

The analyses were conducted for the following parameters

- Benzo(a)pyrene (bulk)
- Metals & Inorganics (leachate)
- Volatile Organic Compounds (leachate)

The laboratory Certificates of Analysis are included in Appendix C and summarized in Table 7.2. The results of the analyses indicate that the soil can be managed as solid, non-hazardous waste.

7.3 Other Considerations

The following additional comments regarding soil quality and management should be considered.

Receiving sites accepting soil may have a soil fill management plan with specific aesthetic, engineering property requirements as well as specific requirements for chemical analysis (additional parameters and/or frequency of sampling) that have not been assessed in this investigation.

The above conclusions were based on limited analytical data. The actual quality of the excavated soils will vary and additional sampling and analyses may be warranted during

construction, if dissimilar materials are encountered or if aesthetic impact (staining or odours) is observed. Additional sampling and analysis of the soil may also be required by the receiver based on the volume of soil to be received. Qualitative monitoring of the excavated soil should be considered part of the inspection tasks during construction.

Additional information on soil management practices is provided in the Ontario Ministry of the Environment (Central Region) publication entitled 'Management of Excess Soil – A Guide for Best Management Practices', dated January 2014.

8. LIMITATIONS AND USE OF REPORT

8.1 Procedures

This investigation has been carried out using investigation techniques and engineering analysis methods consistent with those ordinarily exercised by Terraprobe and other engineering practitioners, working under similar conditions and subject to the time, financial and physical constraints applicable to this project. The discussions and recommendations that have been presented are based on the factual data obtained from this investigation.

The drilling and sampling was carried out by specialist drilling contractors and was observed and recorded by Terraprobe on a full time basis. The boreholes were made using continuous flight power auger equipment and hollow stem augers. A Terraprobe technician logged the boreholes and examined the samples recovered from the boreholes. The samples obtained were sealed in clean, air-tight containers and transferred to the Terraprobe laboratory, where they were reviewed for consistency of description by a geotechnical engineer. Ground water observations were made in the boreholes as drilling proceeded. Ground water monitoring wells were constructed in selected boreholes and water levels measured on specific dates are reported. Fluctuations in the ground water levels are expected due to precipitation conditions and seasonal effects.

The samples of the strata penetrated were obtained using the Split-Barrel Method technique (ASTM D1586). The samples were taken at intervals. The conventional interval sampling procedure used for this investigation does not recover continuous samples of soil at any borehole location. There is consequently some interpolation of the borehole layering between samples and indications of changes in stratigraphy as shown on the borehole logs are approximate.

It must be recognized that there are special risks whenever engineering or related disciplines are applied to identify subsurface conditions. A comprehensive sampling and testing programme implemented in accordance with the most stringent level of care may fail to detect certain conditions. Terraprobe has assumed for the purposes of providing design parameters and advice, that the conditions that exist between sampling points are similar to those found at the sample locations.

It may not be possible to drill a sufficient number of boreholes, or sample and report them in a way that would provide all the subsurface information and geotechnical advice to completely identify all aspects of the site and works that could affect construction costs, techniques, equipment and scheduling. Contractors bidding on or undertaking work on the project must be

directed to draw their own conclusions as to how the subsurface conditions may affect them, based on their own investigations and their own interpretations of the factual investigation results, and their approach to the construction works, cognizant of the risks implicit in the subsurface investigation activities.

The analytical results contained in this report should not be considered a warranty with respect to the soil quality or the use of the soil for any specific purpose. This report provides the factual results of the chemical analysis only for the specific parameters analysed. The chemical analysis, while completed in general accordance with the requirements of Ontario Regulation 153/04 (as amended), do not constitute a Phase Two ESA under the Regulation. The chemical analyses were not conducted for the purposes of supporting a Record of Site Condition.

8.2 Changes in Site and Scope

The subsurface conditions may potentially be altered with passage of time, natural occurrences, and direct or indirect human intervention at or near the site. Caution should be exercised in the consideration of contractual responsibilities as they relate to control of seepage, disturbance of soils, and frost protection.

The design parameters provided and the engineering advice offered in this report are based on the factual data obtained from this investigation made at the site by Terraprobe and are intended for use by the owner and its retained design consultants in the design phase of the project. If there are changes to the project scope and development features, the interpretations made of the subsurface information, the geotechnical design parameters, advice and comments relating to constructability issues and quality control may not be relevant or complete for the project. Terraprobe should be retained to review the implications of such changes with respect to the contents of this report.

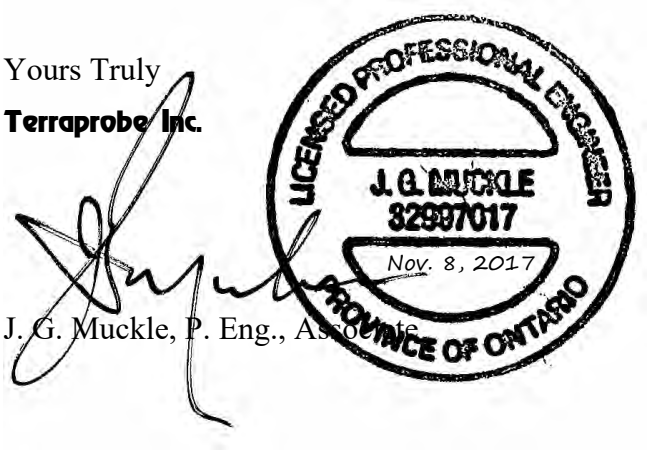
8.3 Use of Report

This report is prepared for the express use of Hatch, the County of Norfolk and other consultants retained to complete the design of the works described herein. The report is not intended for use by others or for other intents. This report is copyright of Terraprobe Inc., and no part of this report may be reproduced by any means, in any form, without the prior written permission of Terraprobe.

We trust that this report is satisfactory for your present requirements. If there is any point requiring further clarification, please contact the undersigned.

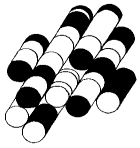
Yours Truly

Terraprobe Inc.

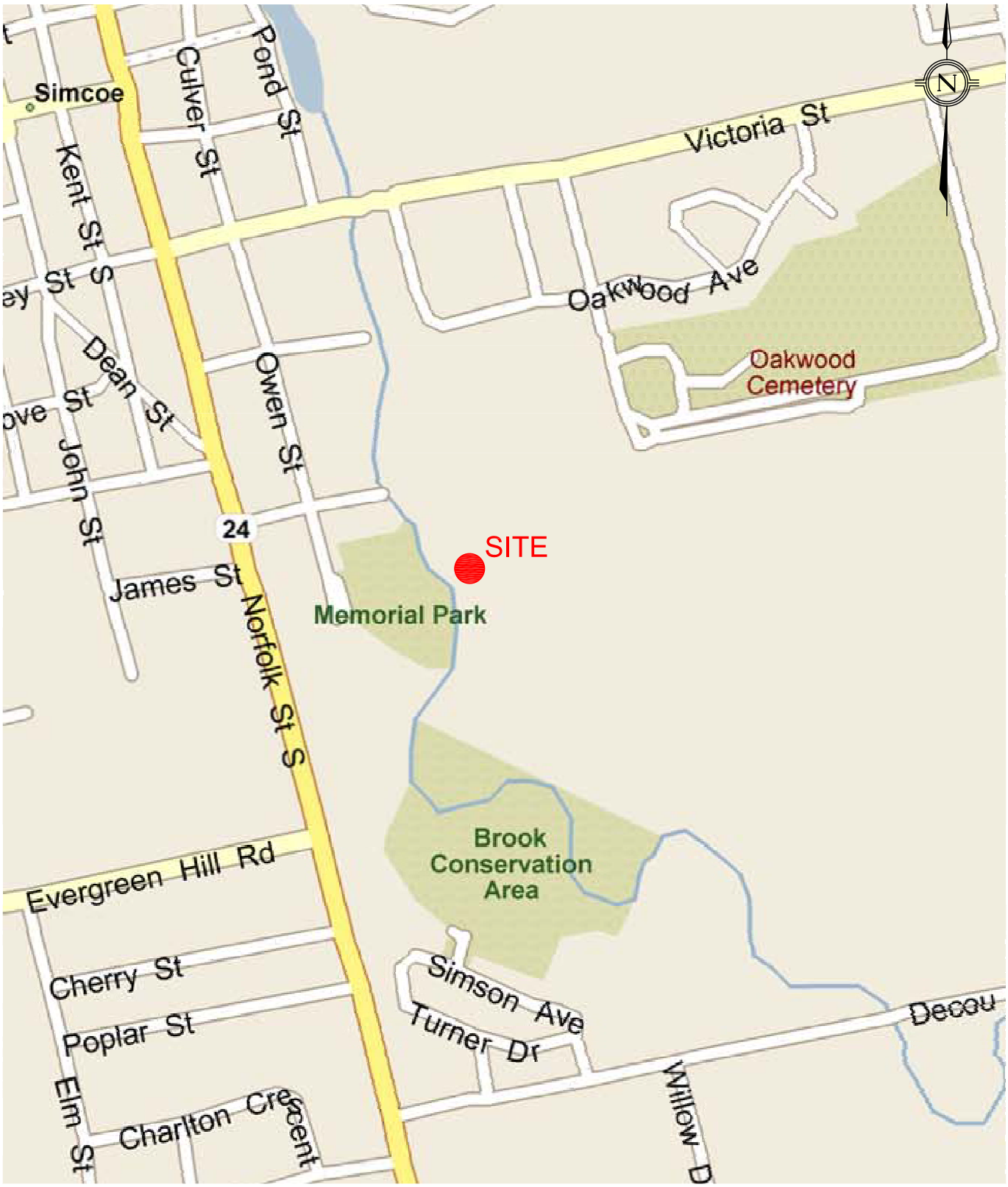


J. G. Muckle, P. Eng., Associate

FIGURES



Terraprobe Inc.

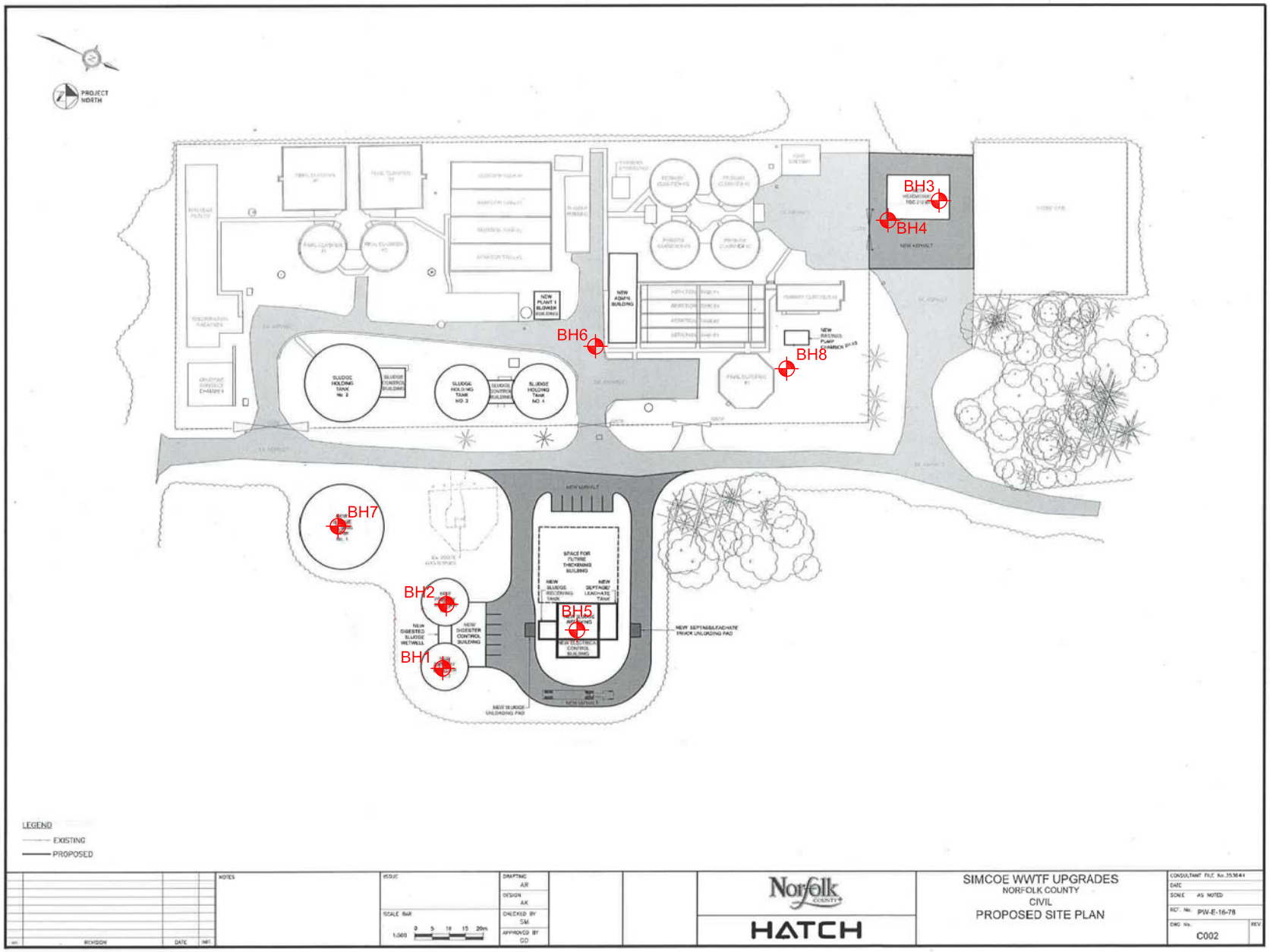


Terraprobe
903 Barton Street - Unit 22, Stoney Creek, Ontario, L8E 5R7
Tel: (905) 643-7560, Fax: (905) 643-7559

Title: SITE LOCATION PLAN

File No. 7-17-0120-01

FIGURE : 1



LEGEND

BH1 Borehole Location

Terraprobe
903 Barton Street - Unit 22, Stoney Creek, Ontario, L8E 5R7
Tel: (905) 643-7560, Fax: (905) 643-7559

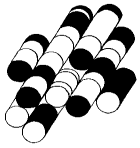
Title: BOREHOLE LOCATION PLAN

File No. 7-17-0120-01

FIGURE : 2

LOGS OF BOREHOLES

APPENDIX A



Terraprobe Inc.

Terraprobe

ABBREVIATIONS AND TERMINOLOGY

SAMPLING METHODS

AS	auger sample
CORE	cored sample
DP	direct push
FV	field vane
GS	grab sample
SS	split spoon
ST	shelby tube
WS	wash sample

PENETRATION RESISTANCE

Standard Penetration Test (SPT) resistance ('N' values) is defined as the number of blows by a hammer weighing 63.6 kg (140 lb.) falling freely for a distance of 0.76 m (30 in.) required to advance a standard 50 mm (2 in.) diameter split spoon sampler for a distance of 0.3 m (12 in.).

Dynamic Cone Test (DCT) resistance is defined as the number of blows by a hammer weighing 63.6 kg (140 lb.) falling freely for a distance of 0.76 m (30 in.) required to advance a conical steel point of 50 mm (2 in.) diameter and with 60° sides on 'A' size drill rods for a distance of 0.3 m (12 in.)."

COHESIONLESS SOILS

Compactness	'N' value
very loose	< 4
loose	4 – 10
compact	10 – 30
dense	30 – 50
very dense	> 50

COHESIVE SOILS

Consistency	'N' value	Undrained Shear Strength (kPa)
very soft	< 2	< 12
soft	2 – 4	12 – 25
firm	4 – 8	25 – 50
stiff	8 – 15	50 – 100
very stiff	15 – 30	100 – 200
hard	> 30	> 200

COMPOSITION

Term (e.g)	% by weight
trace silt	< 10
some silt	10 – 20
silty	20 – 35
sand *and* silt	> 35

TESTS AND SYMBOLS

MH	mechanical sieve and hydrometer analysis
w, w_c	water content
w_L, LL	liquid limit
w_P, PL	plastic limit
I_P, PI	plasticity index
k	coefficient of permeability
γ	soil unit weight, bulk
φ'	internal friction angle
c'	effective cohesion
c_u	undrained shear strength

▽	Unstabilized water level
▼	1st water level measurement
▼	2nd water level measurement
▼	Most recent water level measurement
3.0 +	Undrained shear strength from field vane (with sensitivity)
C_c	compression index
c_v	coefficient of consolidation
m_v	coefficient of compressibility
e	void ratio

FIELD MOISTURE DESCRIPTIONS

Damp	refers to a soil sample that does not exhibit any observable pore water from field/hand inspection.
Moist	refers to a soil sample that exhibits evidence of existing pore water (e.g. sample feels cool, cohesive soil is at plastic limit) but does not have visible pore water
Wet	refers to a soil sample that has visible pore water

Terraprobe Inc.

Greater Toronto
11 Indell Lane
Brampton, Ontario L6T 3Y3
(905) 796-2650 Fax: 796-2250

Hamilton – Niagara
903 Barton Street, Unit 22
Stoney Creek, Ontario L8E 5P5
(905) 643-7560 Fax: 643-7559

Central Ontario
220 Bayview Drive, Unit 25
Barrie, Ontario L4N 4Y8
(705) 739-8355 Fax: 739-8369

Northern Ontario
1012 Kelly Lake Rd., Unit 1
Sudbury, Ontario P3E 5P4
(705) 670-0460 Fax: 670-0558

www.terraprobe.ca

LOG OF BOREHOLE 1

Terraprobe

Project No. : 7-17-0120-01	Client : Hatch	Originated by : AF
Date started : August 29, 2017	Project : 16 Oakwood Avenue	Compiled by : KB
Sheet No. : 1 of 1	Location : Simcoe, Ontario	Checked by : KB

Position : E: 4742120, N: 557635 (UTM 17T) Elevation Datum : Geodetic (NAD83)

Rig type : Track-mounted Drilling Method :

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	211.7	**GROUND SURFACE**				
	211.5	150mm **TOPSOIL**				
	0.2	**SANDY SILT**, trace topsoil, trace rootlets, compact, brown		1	SS	11
1				2	SS	13
	210.5					
	1.2	**SILTY FINE SAND**, loose, brown		3	SS	6
2	209.3					
	2.4	**MEDIUM SAND**, occasional gravel, compact, brown		4	SS	10
3				5	SS	10
4						
				6	SS	12
5						
				7	SS	22
6	205.1					
	6.6	**END OF BOREHOLE**				

Elevation Scale (m): 211, 210, 209, 208, 207, 206

Penetration Test Values (Blows / 0.3m): Dynamic Cone 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane 40 80 120 160

Moisture / Plasticity: Plastic Limit (PL) Natural Water Content (MC) Liquid Limit (LL) 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL

Unstabilized water level measured at 4.9 m below ground surface; borehole was open upon completion of drilling.

50 mm dia. monitoring well installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Aug 31, 2017	5.1	206.7
Sep 13, 2017	5.2	206.5

file: 7-17-0120-01 - simcoe wwtf.gpj

LOG OF BOREHOLE 2

Terraprobe

Project No. : 7-17-0120-01 | Client : Hatch | Originated by : AF

Date started : August 29, 2017 | Project : 16 Oakwood Avenue | Compiled by : KB

Sheet No. : 1 of 1 | Location : Simcoe, Ontario | Checked by : KB

Position : E: 4742118, N: 557632 (UTM 17T) | Elevation Datum : Geodetic (NAD83)

Rig type : Track-mounted | Drilling Method :

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
	211.6	**GROUND SURFACE**				
0	211.4	150mm **TOPSOIL**				
	0.2	**SANDY SILT**, trace topsoil, trace rootlets, loose, brown		1	SS	8
	210.7					
1	0.9	**SILTY FINE SAND**, loose, brown		2	SS	6
				3	SS	6
2	209.5					
	2.1	**MEDIUM SAND**, occasional gravel, compact, brown		4	SS	20
3				5	SS	25
4						
				6	SS	18
5						
6				7	SS	20
	205.0					
	6.6	**END OF BOREHOLE**				

Elevation Scale (m): 211, 210, 209, 208, 207, 206

Penetration Test Values (Blows / 0.3m): Dynamic Cone 10 20 30 40

Undrained Shear Strength (kPa): ○ Unconfined ● Pocket Penetrometer + Field Vane ■ Lab Vane — 40 80 120 160

Moisture / Plasticity: Plastic Limit (PL) | Natural Water Content (MC) | Liquid Limit (LL) — 10 20 30

Headspace Vapour (ppm) | Instrument Details | Unstabilized Water Level | Lab Data and Comments | GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL

Borehole was dry and caved to 4.9 m below ground surface upon completion of drilling.

file: 7-17-0120-01 - simcoe wwtf.gpj

LOG OF BOREHOLE 3

Terraprobe

Project No. : 7-17-0120-01	Client : Hatch	Originated by : AF
Date started : October 11, 2017	Project : 16 Oakwood Avenue	Compiled by : KB
Sheet No. : 1 of 1	Location : Simcoe, Ontario	Checked by : KB

Position : E: 4742219, N: 557478 (UTM 17T) Elevation Datum : Geodetic (NAD83)

Rig type : Track-mounted Drilling Method :

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)
	212.3	**GROUND SURFACE**					
0	211.7	100mm **ASPHALTIC CONCRETE**					212
	0.6	**FILL**, Granular Base		1	SS	7	
1		**FILL**, sandy silt, trace topsoil, occasional gravel, loose, brown					211
	210.6			2	SS	8	
2	1.7	**SANDY SILT to SILTY SAND**, loose, brown					210
	209.7			3	SS	19	
3	2.6	**MEDIUM SAND**, occasional gravel, compact, brown		4	SS	30	209
4							208
5				5	SS	28	
							207
6				6	SS	14	
	205.3						206
7	7.0	**MEDIUM SAND**, occasional gravel, dense to very dense, brown					
				7	SS	33	205
8							204
9				8	SS	52	203
	202.5						
10	9.8	**SILT**, with seams and layers of silty clay and silty sand, dense to very dense, brown					202
				9	SS	32	
11							201
12							
				10	SS	38	200
13							
				11	SS	54	199
14							198
15							
				12	SS	20	197
16							196
17				13	SS	30	
							195
18	194.0						
	18.3	**SILTY CLAY**, hard, brown / grey		14	SS	32	194
19	192.8						
	19.5	**SILT**, trace clay, dense, grey					193
20				15	SS	65	
							192
21							
	190.5			16	SS	29	191
	21.8						

Penetration Test Values (Blows / 0.3m)
Dynamic Cone: 10 20 30 40
Undrained Shear Strength (kPa)
Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40 80 120 160

Moisture / Plasticity
Plastic Limit, Natural Water Content, Liquid Limit
PL MC LL
10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

0 23 63 14

0 3 62 35

END OF BOREHOLE

Combined Borehole from two separate Drill dates. Aug 31 & Oct. 11 2017.

Borehole was dry and open upon completion of drilling.

50 mm dia. monitoring well installed.

file: 7-17-0120-01 - simcoe wwtf.gpj

LOG OF BOREHOLE 4

Terraprobe

Project No. : 7-17-0120-01	Client : Hatch	Originated by : AF
Date started : August 30, 2017	Project : 16 Oakwood Avenue	Compiled by : KB
Sheet No. : 1 of 1	Location : Simcoe, Ontario	Checked by : KB

Position : E: 4742193, N: 557983 (UTM 17T) Elevation Datum : Geodetic (NAD83)

Rig type : Track-mounted Drilling Method :

Depth (m)	Elev Depth (m)	Description	Number	Type	SPT 'N' Value	Elevation (m)	Lab Data and Comments (GR SA SI CL)
0	212.4	**GROUND SURFACE**					
		100mm **ASPHALTIC CONCRETE**					
	211.8	**FILL**, Granular Base					
	0.6	**FILL**, sandy silt, trace topsoil, occasional rootlets, trace gravel, loose, brown	1	SS	4		
1	211.2					212	
	1.2	**SANDY SILT to SILTY SAND**, loose, brown	2	SS	7	211	
2	210.3						
	2.1	**MEDIUM SAND**, occasional gravel, compact, brown	3	SS	24	210	
3			4	SS	15	209	29 67 3 1
4						208	
5			5	SS	22	207	
6			6	SS	10	206	4 92 1 3
7	205.4					205	
	7.0	**MEDIUM SAND**, occasional gravel, dense to very dense, brown	7	SS	35		2 93 3 2
8						204	
9	203.0		8	SS	59	203	
	9.4	**SILT**, with seams and layers of silty clay, dense to very dense, brown					
10			9	SS	55	202	
11						201	
12			10	SS	74	200	
13						199	
14	198.2		11	SS	46		
	14.2	**END OF BOREHOLE**					

Penetration Test Values (Blows / 0.3m): Dynamic Cone 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane 40 80 120 160

Moisture / Plasticity: Plastic Limit, Natural Water Content, Liquid Limit — PL MC LL 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

GRAIN SIZE DISTRIBUTION (%) (MIT)

Unstabilized water level measured at 5.7 m below ground surface; borehole was open upon completion of drilling.

50 mm dia. monitoring well installed

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Aug 31, 2017	5.8	206.6
Sep 13, 2017	5.8	206.6

file: 7-17-0120-01 - simcoe wwtf.gpj

LOG OF BOREHOLE 5

Terraprobe

Project No. : 7-17-0120-01	Client : Hatch	Originated by : AF
Date started : August 28, 2017	Project : 16 Oakwood Avenue	Compiled by : KB
Sheet No. : 1 of 1	Location : Simcoe, Ontario	Checked by : KB

Position : E: 4742127, N: 557628 (UTM 17T) Elevation Datum : Geodetic (NAD83)

Rig type : Track-mounted Drilling Method :

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
	213.4	**GROUND SURFACE**				
0	213.2	150mm **TOPSOIL**				
	0.2	**SANDY SILT**, trace topsoil, trace rootlets, compact, brown		1	SS	10
	212.5					
1	0.9	**SILTY FINE SAND**, loose, brown		2	SS	14
				3	SS	7
2				4	SS	16
	210.5					
3	2.9	**MEDIUM SAND**, occasional gravel, occasional silty seams, compact, brown		5	SS	21
4						
				6	SS	21
5						
6				7	SS	18
	206.8					
	6.6	**END OF BOREHOLE**				

Elevation Scale (m): 213, 212, 211, 210, 209, 208, 207

Penetration Test Values (Blows / 0.3m)
× Dynamic Cone
10 20 30 40
Undrained Shear Strength (kPa)
○ Unconfined + Field Vane
● Pocket Penetrometer ■ Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit | Natural Water Content | Liquid Limit
PL MC LL
10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

Borehole was dry and caved to 4.9 m below ground surface upon completion of drilling.

file: 7-17-0120-01 - simcoe wwtf.gpj

LOG OF BOREHOLE 6

Terraprobe

Project No. : 7-17-0120-01	Client : Hatch	Originated by : AF
Date started : August 29, 2017	Project : 16 Oakwood Avenue	Compiled by : KB
Sheet No. : 1 of 1	Location : Simcoe, Ontario	Checked by : KB

Position : E: 4742124, N: 557553 (UTM 17T) Elevation Datum : Geodetic (NAD83)

Rig type : Track-mounted Drilling Method :

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	211.5	**GROUND SURFACE**				
	211.3	150mm **ASPHALTIC CONCRETE**				
	0.2	**FILL**, Granular Base				
	210.9					
	0.6	**FILL**, clayey silt, trace sand, occasional gravel, firm, brown		1	SS	7
1				2	SS	4
2	209.4					
	2.1	**MEDIUM SAND**, occasional gravel, compact, brown		3	SS	18
3				4	SS	22
	208.0					
	3.5	**END OF BOREHOLE**				

Elevation Scale (m): 211, 210, 209, 208

Penetration Test Values (Blows / 0.3m): Dynamic Cone 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane — 40 80 120 160

Moisture / Plasticity: Plastic Limit (PL) Natural Water Content (MC) Liquid Limit (LL) — 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL

Borehole was dry and open upon completion of drilling.

file: 7-17-0120-01 - simcoe wwtf.gpj

LOG OF BOREHOLE 7

Terraprobe

Project No. : 7-17-0120-01	Client : Hatch	Originated by : AF
Date started : August 29, 2017	Project : 16 Oakwood Avenue	Compiled by : KB
Sheet No. : 1 of 1	Location : Simcoe, Ontario	Checked by : KB

Position : E: 4742073, N: 557633 (UTM 17T) Elevation Datum : Geodetic (NAD83)

Rig type : Track-mounted Drilling Method :

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	210.4	**GROUND SURFACE**				
	210.2	150mm **TOPSOIL**				
	0.2	**SANDY SILT**, trace topsoil, trace rootlets, loose, brown		1	SS	10
	209.8					
1	0.6	**SILTY FINE SAND**, loose, brown		2	SS	4
	208.9					
2	1.5	**MEDIUM SAND**, occasional gravel, compact, brown		3	SS	18
				4	SS	13
3				5	SS	12
4				6	SS	15
5				7	SS	22
6				8	SS	12
7						
8	202.3					
	8.1	**END OF BOREHOLE**				

Elevation Scale (m): 210, 209, 208, 207, 206, 205, 204, 203

Penetration Test Values (Blows / 0.3m): Dynamic Cone 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane — 40 80 120 160

Moisture / Plasticity: Plastic Limit (PL) Natural Water Content (MC) Liquid Limit (LL) — 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL

Unstabilized water level measured at 4.5 m below ground surface; borehole caved to 4.3 m below ground surface upon completion of drilling.

50 mm dia. monitoring well installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Aug 31, 2017	4.1	206.4
Sep 13, 2017	4.0	206.4

file: 7-17-0120-01 - simcoe wwtf.gpj

LOG OF BOREHOLE 8

Terraprobe

Project No. : 7-17-0120-01	Client : Hatch	Originated by : AF
Date started : August 30, 2017	Project : 16 Oakwood Avenue	Compiled by : KB
Sheet No. : 1 of 1	Location : Simcoe, Ontario	Checked by : KB

Position : E: 4742187, N: 557540 (UTM 17T) Elevation Datum : Geodetic (NAD83)

Rig type : Track-mounted Drilling Method :

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	212.0	**GROUND SURFACE**				
		100mm **TOPSOIL**				
		FILL, sandy silt, trace topsoil, trace rootlets, loose to compact, brown		1	SS	12
1				2	SS	8
	210.8					
	1.2	**SANDY SILT to SILTY SAND**, loose to compact, brown		3	SS	9
2				4	SS	6
	209.2					
	2.8	**MEDIUM SAND**, occasional gravel, compact, brown		5	SS	21
3						
4				6	SS	27
5						
6				7	SS	21
7						
8				8	SS	17

Elevation Scale (m): 211, 210, 209, 208, 207, 206, 205, 204

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10, 20, 30, 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40, 80, 120, 160

Moisture / Plasticity — Plastic Limit, Natural Water Content, Liquid Limit: PL, MC, LL; 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL

END OF BOREHOLE

Unstabilized water level measured at 6.1 m below ground surface; borehole was open upon completion of drilling.

50 mm dia. monitoring well installed.

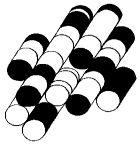
WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Aug 31, 2017	5.7	206.3
Sep 13, 2017	5.7	206.3

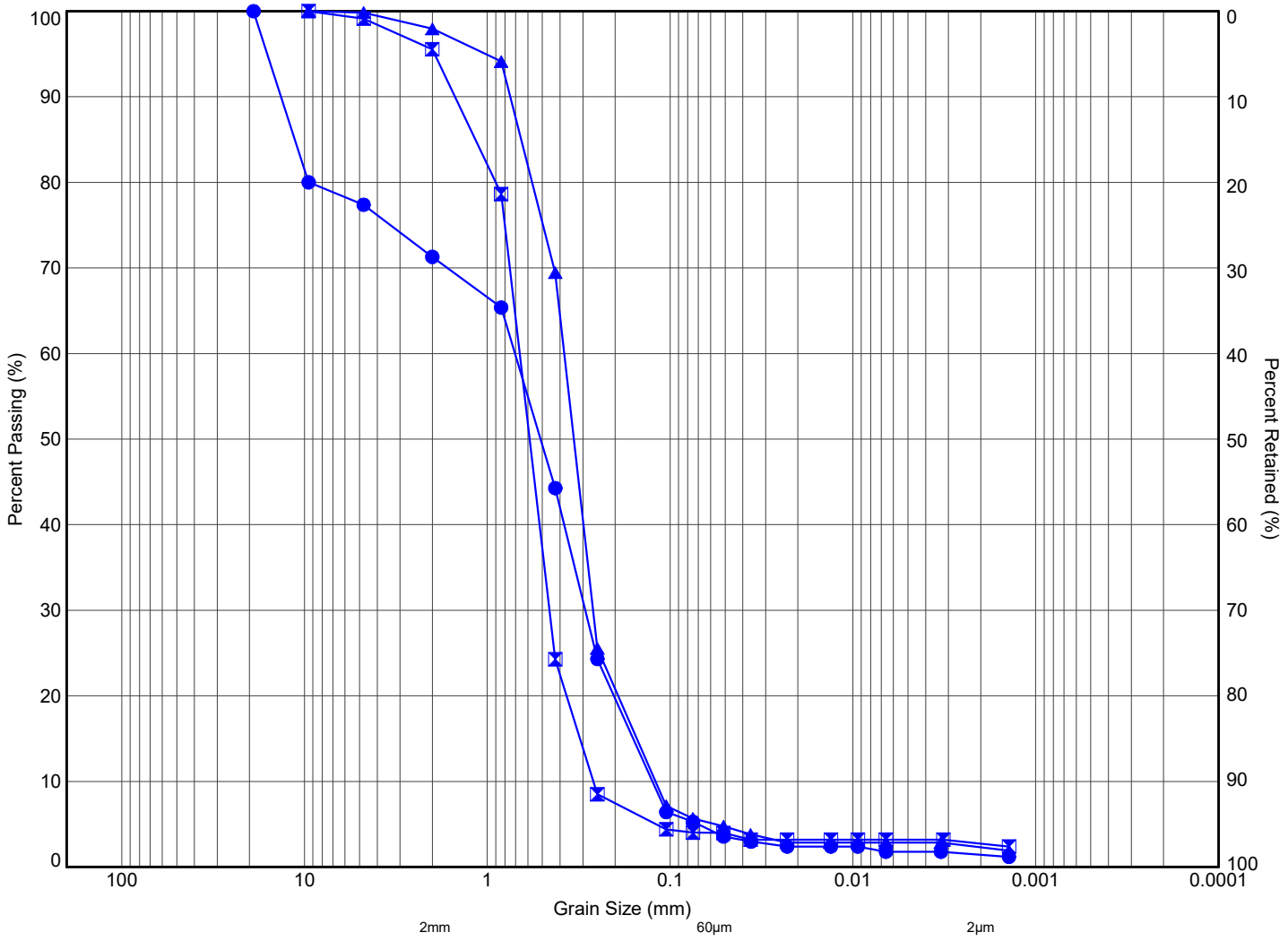
file: 7-17-0120-01 - simcoe wwtf.gpj

GEOTECHNICAL LABORATORY RESULTS

APPENDIX B



Terraprobe Inc.



MIT SYSTEM	COBBLES	GRAVEL			SAND			SILT	CLAY
		COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE		

MIT SYSTEM

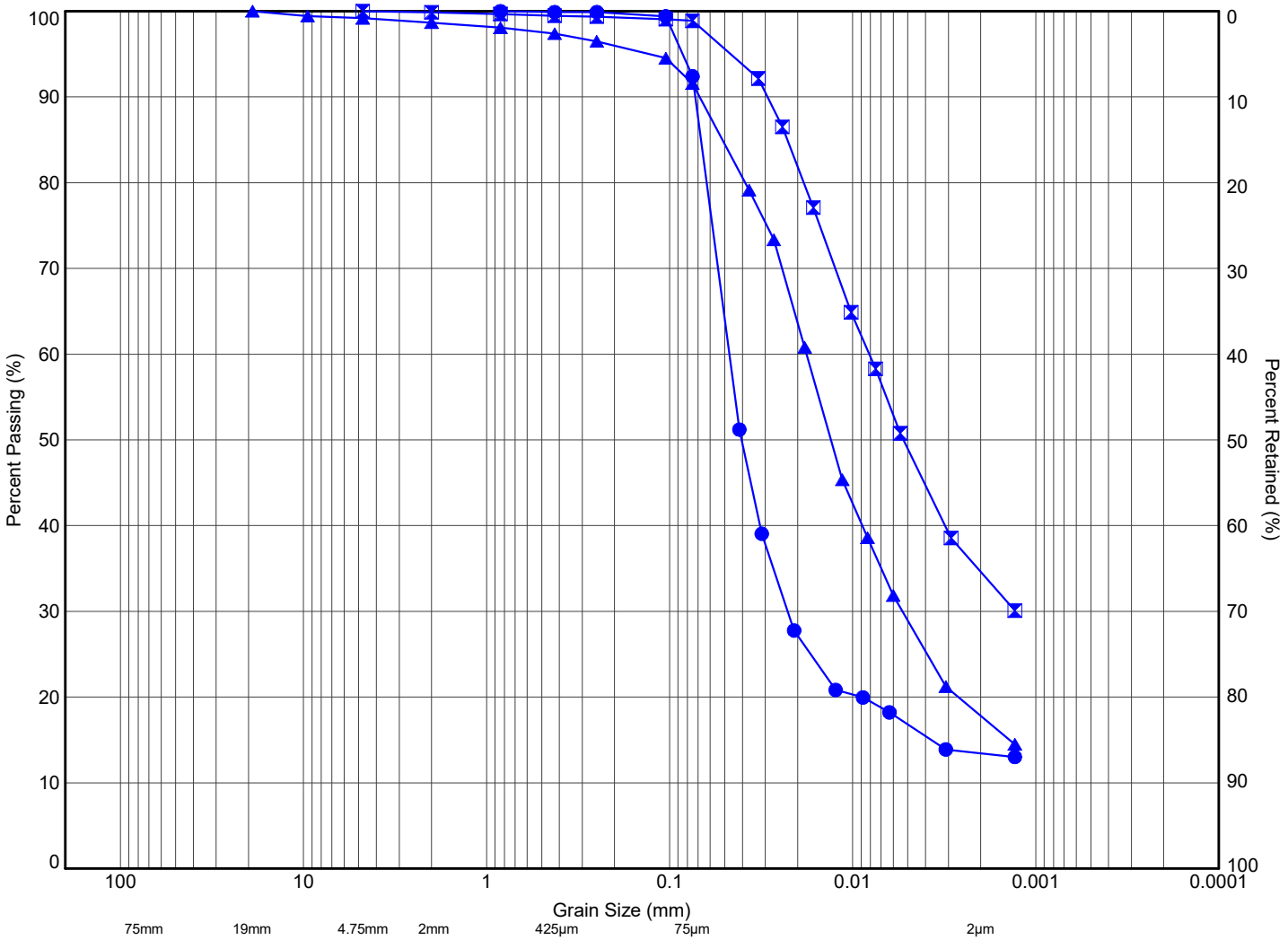
	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**4**	SS4	3.3	209.1	29	67	3	1	
⊠	**4**	SS6	6.3	206.1	4	92	1	3	
▲	**4**	SS7	7.8	204.6	2	93	3	2	

Sand

Terraprobe
903 Barton Street, Unit 22, Stoney Creek ON L8E 5P5
(905) 643-7560

Title: **GRAIN SIZE DISTRIBUTION** **Figure B-1**

File No.: **7-17-0120-01**



	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**3**	SS13	17.0	195.3	0	7	79	14	
⊠	**3**	SS14	18.5	193.8	0	1	64	35	
▲	**3**	SS10	12.4	199.9	1	7	74	18	

Silt with Silty Clay Layers

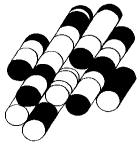
Terraprobe
11 Indell Lane, Brampton Ontario L6T 3Y3
(905) 796-2650

Title: **GRAIN SIZE DISTRIBUTION** **Figure B2**

File No.: **7-17-0120-01**

CERTIFICATES OF ANALYSES AND QUALITY ASSURANCE REPORT - SOIL

APPENDIX C



Terraprobe Inc.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: TERRAPROBE INC
903 Barton Street
Stoney Creek, ON L8E5P5
(905) 643-7560

ATTENTION TO: Kyle Byckalo

PROJECT: 7-17-0120-01

AGAT WORK ORDER: 17H255265

SOIL ANALYSIS REVIEWED BY: Parvathi Malemath, Data Reviewer

TRACE ORGANICS REVIEWED BY: Gyulhan Yalamova, Report Reviewer

DATE REPORTED: Sep 08, 2017

PAGES (INCLUDING COVER): 13

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

Member of: Association of Professional Engineers and Geoscientists of Alberta (APEGA)
Western Enviro-Agricultural Laboratory Association (WEALA)
Environmental Services Association of Alberta (ESAA)

AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation.

Results relate only to the items tested and to all the items tested
All reportable information as specified by ISO 17025:2005 is available from AGAT Laboratories upon request

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 17H255265

PROJECT: 7-17-0120-01

CLIENT NAME: TERRAPROBE INC

ATTENTION TO: Kyle Byckalo

SAMPLING SITE:

SAMPLED BY:

Corrosivity Package

DATE RECEIVED: 2017-09-01

DATE REPORTED: 2017-09-08

Parameter	Unit	G / S	RDL	BH3 SA3 Corrosivity Soil 2017-08-31 8682231	BH6 SA3 Corrosivity Soil 2017-08-31 8682244	BH1 SA6 Corrosivity Soil 2017-08-31 8682253
Chloride (2:1)	µg/g		2	31	5	2
Electrical Conductivity (2:1)	mS/cm		0.005	0.152	0.073	0.065
Redox Potential (2:1)	mV		5	203	193	188
Resistivity (2:1)	ohm.cm		1	6580	13700	15400
Sulfide (S2-)	%		0.05	<0.05	<0.05	<0.05
Sulphate (2:1)	µg/g		2	39	10	10
pH (2:1)	pH Units		NA	8.64	9.11	9.13

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

8682231-8682253 EC, pH, Chloride, Sulphate and Redox Potential were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil).

*Sulphide analyzed at AGAT 5623 McAdam

Certified By:



Results relate only to the items tested and to all the items tested

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 17H255265

PROJECT: 7-17-0120-01

CLIENT NAME: TERRAPROBE INC

ATTENTION TO: Kyle Byckalo

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2017-09-01

DATE REPORTED: 2017-09-08

		SAMPLE DESCRIPTION:		BH1 SA2	BH1 SA5	BH2 SA2	BH2 SA5	BH3 SA2	BH3 SA4	BH4 SA2	BH4 SA4
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2017-08-31	2017-08-31	2017-08-31	2017-08-31	2017-08-31	2017-08-31	2017-08-31	2017-08-31
Parameter	Unit	G / S	RDL	8682222	8682227	8682228	8682229	8682230	8682237	8682238	8682239
Antimony	µg/g		0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Arsenic	µg/g		1	5	3	4	3	4	2	4	2
Barium	µg/g		2	37	10	33	11	39	11	29	12
Beryllium	µg/g		0.5	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Boron	µg/g		5	<5	10	<5	7	<5	<5	6	<5
Boron (Hot Water Soluble)	µg/g		0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Cadmium	µg/g		0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	µg/g		2	17	8	15	7	16	7	12	11
Chromium VI	µg/g		0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cobalt	µg/g		0.5	8.2	3.5	7.1	3.2	7.5	2.3	6.2	2.9
Copper	µg/g		1	23	16	21	15	16	7	17	8
Cyanide	µg/g		0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
Electrical Conductivity	mS/cm		0.005	0.067	0.066	0.078	0.063	0.198	0.070	0.373	0.088
Lead	µg/g		1	9	7	9	6	11	4	6	4
Mercury	µg/g		0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Molybdenum	µg/g		0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Nickel	µg/g		1	17	8	15	7	13	4	13	5
Selenium	µg/g		0.4	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Silver	µg/g		0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Sodium Adsorption Ratio	NA		NA	0.077	0.051	0.075	0.073	0.595	0.320	2.40	0.599
Thallium	µg/g		0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Uranium	µg/g		0.5	0.5	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Vanadium	µg/g		1	31	12	26	11	26	13	21	36
Zinc	µg/g		5	45	29	46	27	43	27	35	23
pH, 2:1 CaCl2 Extraction	pH Units		NA	7.25	8.02	6.79	8.03	7.55	8.14	7.68	8.12

Certified By:



Results relate only to the items tested and to all the items tested

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 17H255265

PROJECT: 7-17-0120-01

CLIENT NAME: TERRAPROBE INC

ATTENTION TO: Kyle Byckalo

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2017-09-01

DATE REPORTED: 2017-09-08

		SAMPLE DESCRIPTION:		BH5 SA2	BH5 SA5	BH6 SA1	BH6 SA4	BH7 SA3	BH7 SA6	BH8 SA2	BH8 SA5
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2017-08-31	2017-08-31	2017-08-31	2017-08-31	2017-08-31	2017-08-31	2017-08-31	2017-08-31
Parameter	Unit	G / S	RDL	8682240	8682241	8682242	8682243	8682246	8682250	8682251	8682252
Antimony	µg/g		0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Arsenic	µg/g		1	4	3	7	3	3	2	3	3
Barium	µg/g		2	28	14	60	16	10	11	17	10
Beryllium	µg/g		0.5	<0.5	<0.5	0.8	<0.5	<0.5	<0.5	<0.5	<0.5
Boron	µg/g		5	<5	6	6	7	<5	6	<5	<5
Boron (Hot Water Soluble)	µg/g		0.10	<0.10	<0.10	0.23	<0.10	<0.10	<0.10	<0.10	<0.10
Cadmium	µg/g		0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	µg/g		2	14	6	23	8	7	7	9	6
Chromium VI	µg/g		0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cobalt	µg/g		0.5	6.4	3.1	10.0	4.9	2.4	3.2	4.3	3.0
Copper	µg/g		1	15	14	32	17	10	13	11	10
Cyanide	µg/g		0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
Electrical Conductivity	mS/cm		0.005	0.100	0.057	0.186	0.084	0.073	0.098	0.086	0.055
Lead	µg/g		1	8	7	12	6	5	6	5	4
Mercury	µg/g		0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Molybdenum	µg/g		0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Nickel	µg/g		1	13	6	22	9	5	7	8	5
Selenium	µg/g		0.4	<0.4	<0.4	1.0	<0.4	<0.4	<0.4	<0.4	<0.4
Silver	µg/g		0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Sodium Adsorption Ratio	NA		NA	0.062	0.056	1.72	0.329	0.090	0.069	0.051	0.059
Thallium	µg/g		0.4	<0.4	<0.4	0.5	<0.4	<0.4	<0.4	<0.4	<0.4
Uranium	µg/g		0.5	<0.5	<0.5	0.7	<0.5	<0.5	<0.5	<0.5	<0.5
Vanadium	µg/g		1	26	10	38	13	17	12	18	12
Zinc	µg/g		5	33	34	59	30	24	24	25	20
pH, 2:1 CaCl2 Extraction	pH Units		NA	7.35	8.06	7.16	8.01	8.02	7.83	7.78	8.21

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

8682222-8682252 EC & SAR were determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl2 extract prepared at 2:1 ratio.

Certified By:



Results relate only to the items tested and to all the items tested

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 17H255265

PROJECT: 7-17-0120-01

CLIENT NAME: TERRAPROBE INC

ATTENTION TO: Kyle Byckalo

SAMPLING SITE:

SAMPLED BY:

O. Reg. 558 Metals and Inorganics

DATE RECEIVED: 2017-09-01

DATE REPORTED: 2017-09-08

		SAMPLE DESCRIPTION:		TCLP 1
		SAMPLE TYPE:		Soil
		DATE SAMPLED:		2017-08-31
Parameter	Unit	G / S	RDL	8682254
Arsenic Leachate	mg/L		0.010	<0.010
Barium Leachate	mg/L		0.100	0.177
Boron Leachate	mg/L		0.050	0.069
Cadmium Leachate	mg/L		0.010	<0.010
Chromium Leachate	mg/L		0.010	0.015
Cyanide Leachate	mg/L		0.05	<0.05
Fluoride Leachate	mg/L		0.05	0.20
Lead Leachate	mg/L		0.010	<0.010
Mercury Leachate	mg/L		0.01	<0.01
(Nitrate + Nitrite) as N Leachate	mg/L		0.70	<0.70
Selenium Leachate	mg/L		0.010	<0.010
Silver Leachate	mg/L		0.010	<0.010
Uranium Leachate	mg/L		0.050	<0.050

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:



Results relate only to the items tested and to all the items tested

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 17H255265

PROJECT: 7-17-0120-01

CLIENT NAME: TERRAPROBE INC

ATTENTION TO: Kyle Byckalo

SAMPLING SITE:

SAMPLED BY:

O. Reg. 558 - VOCs

DATE RECEIVED: 2017-09-01

DATE REPORTED: 2017-09-08

		SAMPLE DESCRIPTION:		TCLP 1
		SAMPLE TYPE:		Soil
		DATE SAMPLED:		2017-08-31
Parameter	**Unit**	**G / S**	**RDL**	**8682254**
Benzene	mg/L		0.020	<0.020
Carbon Tetrachloride	mg/L		0.020	<0.020
Chlorobenzene	mg/L		0.010	<0.010
Chloroform	mg/L		0.020	<0.020
1,4-Dichlorobenzene	mg/L		0.010	<0.010
1,2-Dichlorobenzene	mg/L		0.010	<0.010
1,2-Dichloroethane	mg/L		0.020	<0.020
1,1 Dichloroethene	mg/L		0.020	<0.020
Dichloromethane	mg/L		0.030	<0.030
Methyl Ethyl Ketone	mg/L		0.090	<0.090
Tetrachloroethene	mg/L		0.050	<0.050
Trichloroethene	mg/L		0.020	<0.020
Vinyl Chloride	mg/L		0.030	<0.030
Surrogate	**Unit**	**Acceptable Limits**		
Toluene-d8	% Recovery	60-130		93

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

8682254 Sample was prepared using Regulation 558 protocol and a zero headspace extractor.

Certified By:



Results relate only to the items tested and to all the items tested

AGAT Laboratories
5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: TERRAPROBE INC

AGAT WORK ORDER: 17H255265

PROJECT: 7-17-0120-01

ATTENTION TO: Kyle Byckalo

SAMPLING SITE:

SAMPLED BY:

Soil Analysis

RPT Date: Sep 08, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Corrosivity Package															
Chloride (2:1)	8682244	8682244	5	6	NA	< 2	95%	80%	120%	102%	80%	120%	96%	70%	130%
Electrical Conductivity (2:1)	8682227	8682227	0.066	0.067	1.5%	< 0.005	95%	90%	110%	NA			NA		
Redox Potential (2:1)	8682244	8682244	193	188	2.6%	< 5	105%	70%	130%	NA			NA		
Sulfide (S2-)	8682253	8682253	< 0.05	< 0.05	NA	< 0.05	99%	80%	120%						
Sulphate (2:1)	8682244	8682244	10	11	9.5%	< 2	93%	80%	120%	95%	80%	120%	82%	70%	130%
pH (2:1)	8682244	8682244	9.11	9.14	0.3%	NA	100%	90%	110%	NA			NA		
O. Reg. 558 Metals and Inorganics															
Arsenic Leachate	8684649		< 0.010	< 0.010	NA	< 0.010	100%	90%	110%	110%	80%	120%	109%	70%	130%
Barium Leachate	8684649		0.293	0.295	NA	< 0.100	95%	90%	110%	103%	80%	120%	106%	70%	130%
Boron Leachate	8684649		0.067	0.066	NA	< 0.050	96%	90%	110%	99%	80%	120%	103%	70%	130%
Cadmium Leachate	8684649		< 0.010	< 0.010	NA	< 0.010	93%	90%	110%	101%	80%	120%	107%	70%	130%
Chromium Leachate	8684649		0.020	0.020	NA	< 0.010	103%	90%	110%	115%	80%	120%	105%	70%	130%
Cyanide Leachate	8684649		< 0.05	< 0.05	NA	< 0.05	90%	90%	110%	101%	90%	110%	101%	70%	130%
Fluoride Leachate	8684649		0.34	0.34	0.0%	< 0.05	104%	90%	110%	108%	90%	110%	98%	70%	130%
Lead Leachate	8684649		< 0.010	< 0.010	NA	< 0.010	103%	90%	110%	108%	80%	120%	111%	70%	130%
Mercury Leachate	8684649		< 0.01	< 0.01	NA	< 0.01	104%	90%	110%	100%	80%	120%	108%	70%	130%
(Nitrate + Nitrite) as N Leachate	8684649		<0.70	<0.70	NA	< 0.70	100%	80%	120%	100%	80%	120%	98%	70%	130%
Selenium Leachate	8684649		< 0.010	< 0.010	NA	< 0.010	94%	90%	110%	107%	80%	120%	110%	70%	130%
Silver Leachate	8684649		< 0.010	< 0.010	NA	< 0.010	96%	90%	110%	100%	80%	120%	105%	70%	130%
Uranium Leachate	8684649		< 0.050	< 0.050	NA	< 0.050	100%	90%	110%	106%	80%	120%	111%	70%	130%
O. Reg. 153(511) - Metals & Inorganics (Soil)															
Antimony	8682227	8682227	<0.8	<0.8	NA	< 0.8	101%	70%	130%	95%	80%	120%	84%	70%	130%
Arsenic	8682227	8682227	3	3	NA	< 1	108%	70%	130%	94%	80%	120%	98%	70%	130%
Barium	8682227	8682227	10	10	0.0%	< 2	100%	70%	130%	99%	80%	120%	101%	70%	130%
Beryllium	8682227	8682227	<0.5	<0.5	NA	< 0.5	108%	70%	130%	120%	80%	120%	104%	70%	130%
Boron	8682227	8682227	10	11	NA	< 5	81%	70%	130%	115%	80%	120%	102%	70%	130%
Boron (Hot Water Soluble)	8682227	8682227	<0.10	<0.10	NA	< 0.10	80%	60%	140%	95%	70%	130%	96%	60%	140%
Cadmium	8682227	8682227	<0.5	<0.5	NA	< 0.5	100%	70%	130%	101%	80%	120%	110%	70%	130%
Chromium	8682227	8682227	8	9	NA	< 2	101%	70%	130%	108%	80%	120%	117%	70%	130%
Chromium VI	8682242	8682242	<0.2	<0.2	NA	< 0.2	97%	70%	130%	100%	80%	120%	103%	70%	130%
Cobalt	8682227	8682227	3.5	3.7	5.6%	< 0.5	104%	70%	130%	109%	80%	120%	112%	70%	130%
Copper	8682227	8682227	16	17	6.1%	< 1	94%	70%	130%	113%	80%	120%	103%	70%	130%
Cyanide	8682222	8682222	<0.040	<0.040	NA	< 0.040	90%	70%	130%	103%	80%	120%	102%	70%	130%
Electrical Conductivity	8682227	8682227	0.066	0.067	1.5%	< 0.005	95%	90%	110%	NA			NA		
Lead	8682227	8682227	7	8	13.3%	< 1	103%	70%	130%	112%	80%	120%	101%	70%	130%
Mercury	8682227	8682227	<0.10	<0.10	NA	< 0.10	104%	70%	130%	111%	80%	120%	107%	70%	130%
Molybdenum	8682227	8682227	<0.5	<0.5	NA	< 0.5	99%	70%	130%	103%	80%	120%	114%	70%	130%
Nickel	8682227	8682227	8	8	0.0%	< 1	107%	70%	130%	112%	80%	120%	108%	70%	130%

AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation.

Results relate only to the items tested and to all the items tested

AGAT Laboratories
5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: TERRAPROBE INC

AGAT WORK ORDER: 17H255265

PROJECT: 7-17-0120-01

ATTENTION TO: Kyle Byckalo

SAMPLING SITE:

SAMPLED BY:

Soil Analysis (Continued)

RPT Date: Sep 08, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Selenium	8682227	8682227	<0.4	<0.4	NA	< 0.4	106%	70%	130%	105%	80%	120%	106%	70%	130%
Silver	8682227	8682227	<0.2	<0.2	NA	< 0.2	85%	70%	130%	100%	80%	120%	93%	70%	130%
Sodium Adsorption Ratio	8682227	8682227	0.051	0.050	2.0%	NA	NA			NA			NA		
Thallium	8682227	8682227	<0.4	<0.4	NA	< 0.4	103%	70%	130%	107%	80%	120%	100%	70%	130%
Uranium	8682227	8682227	0.6	0.6	NA	< 0.5	103%	70%	130%	114%	80%	120%	106%	70%	130%
Vanadium	8682227	8682227	12	12	0.0%	< 1	106%	70%	130%	104%	80%	120%	111%	70%	130%
Zinc	8682227	8682227	29	30	3.4%	< 5	98%	70%	130%	118%	80%	120%	116%	70%	130%
pH, 2:1 CaCl2 Extraction	8682222	8682222	7.25	7.19	0.8%	NA	100%	80%	120%	NA			NA		

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By:



AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation.

Results relate only to the items tested and to all the items tested

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: TERRAPROBE INC

AGAT WORK ORDER: 17H255265

PROJECT: 7-17-0120-01

ATTENTION TO: Kyle Byckalo

SAMPLING SITE:

SAMPLED BY:

Trace Organics Analysis

RPT Date: Sep 08, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 558 - VOCs															
Benzene	8678642		< 0.020	< 0.020	NA	< 0.020	77%	70%	130%	101%	70%	130%	NA	60%	140%
Carbon Tetrachloride	8678642		< 0.020	< 0.020	NA	< 0.020	77%	70%	130%	100%	70%	130%	NA	60%	140%
Chlorobenzene	8678642		< 0.010	< 0.010	NA	< 0.010	100%	70%	130%	102%	70%	130%	NA	60%	140%
Chloroform	8678642		< 0.020	< 0.020	NA	< 0.020	85%	70%	130%	106%	70%	130%	NA	60%	140%
1,4-Dichlorobenzene	8678642		< 0.010	< 0.010	NA	< 0.010	118%	70%	130%	103%	70%	130%	NA	60%	140%
1,2-Dichlorobenzene	8678642		< 0.010	< 0.010	NA	< 0.010	110%	70%	130%	100%	70%	130%	NA	60%	140%
1,2-Dichloroethane	8678642		< 0.020	< 0.020	NA	< 0.020	90%	70%	130%	93%	70%	130%	NA	60%	140%
1,1 Dichloroethene	8678642		< 0.020	< 0.020	NA	< 0.020	77%	70%	130%	118%	70%	130%	NA	60%	140%
Dichloromethane	8678642		< 0.030	< 0.030	NA	< 0.030	93%	70%	130%	113%	70%	130%	NA	60%	140%
Methyl Ethyl Ketone	8678642		< 0.090	< 0.090	NA	< 0.090	105%	70%	130%	122%	70%	130%	NA	60%	140%
Tetrachloroethene	8678642		< 0.050	< 0.050	NA	< 0.050	89%	70%	130%	103%	70%	130%	NA	60%	140%
Trichloroethene	8678642		< 0.020	< 0.020	NA	< 0.020	72%	70%	130%	96%	70%	130%	NA	60%	140%
Vinyl Chloride	8678642		< 0.030	< 0.030	NA	< 0.030	78%	60%	140%	105%	60%	140%	NA	60%	140%

Comments:
When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

Certified By:

AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation.

Results relate only to the items tested and to all the items tested

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: TERRAPROBE INC

AGAT WORK ORDER: 17H255265

PROJECT: 7-17-0120-01

ATTENTION TO: Kyle Byckalo

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Chloride (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
Electrical Conductivity (2:1)	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Redox Potential (2:1)		McKeague 4.12 & SM 2510 B	REDOX POTENTIAL ELECTRODE
Resistivity (2:1)	INOR-93-6036	McKeague 4.12, SM 2510 B,SSA #5 Part 3	CALCULATION
Sulfide (S2-)	MIN-200-12025	ASTM E1915-09	GRAVIMETRIC
Sulphate (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
pH (2:1)	INOR 93-6031	MSA part 3 & SM 4500-H+ B	PH METER
Antimony	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Arsenic	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Barium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Beryllium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron (Hot Water Soluble)	MET-93-6104	EPA SW 846 6010C; MSA, Part 3, Ch.21	ICP/OES
Cadmium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium VI	INOR-93-6029	SM 3500 B; MSA Part 3, Ch. 25	SPECTROPHOTOMETER
Cobalt	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Copper	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cyanide	INOR-93-6052	MOE CN-3015 & E 3009 A;SM 4500 CN	TECHNICON AUTO ANALYZER
Electrical Conductivity	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Lead	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Mercury	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Molybdenum	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Nickel	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Selenium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Silver	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Sodium Adsorption Ratio	INOR-93-6007	McKeague 4.12 & 3.26 & EPA SW-846 6010B	ICP/OES
Thallium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Uranium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Vanadium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Zinc	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
pH, 2:1 CaCl2 Extraction	INOR-93-6031	MSA part 3 & SM 4500-H+ B	PH METER
Arsenic Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Barium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Boron Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Cadmium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Chromium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Cyanide Leachate	INOR-93-6052	EPA SW-846-1311 & MOE 3015 & SM 4500 CN- I	TECHNICON AUTO ANALYZER
Fluoride Leachate	INOR-93-6018	EPA SW-846-1311 & SM4500-F- C	ION SELECTIVE ELECTRODE
Lead Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Mercury Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
(Nitrate + Nitrite) as N Leachate	INOR-93-6053	EPA SW 846-1311 & SM 4500 - NO3- I	LACHAT FIA
Selenium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Silver Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS

Results relate only to the items tested and to all the items tested

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: TERRAPROBE INC

AGAT WORK ORDER: 17H255265

PROJECT: 7-17-0120-01

ATTENTION TO: Kyle Byckalo

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Uranium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Trace Organics Analysis			
Benzene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Carbon Tetrachloride	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Chlorobenzene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Chloroform	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
1,4-Dichlorobenzene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
1,2-Dichlorobenzene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
1,2-Dichloroethane	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
1,1 Dichloroethene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Dichloromethane	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Methyl Ethyl Ketone	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Tetrachloroethene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Toluene-d8	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Trichloroethene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Vinyl Chloride	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS

Results relate only to the items tested and to all the items tested

AGAT Laboratories
5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only

Work Order #: 17H255265

Cooler Quantity: LG cooler

Arrival Temperatures: 7.8 | 7.9 | 8.0 | 7F | 73 | 69

Custody Seal Intact: ☐Yes ☐No ☐N/A

Notes: ON ICE

Report Information:

Company: Terraprobe Inc.
Contact: Kyle Bychkalo
Address: 903 Barton Street, Unit #22, Stoney Creek, ON L8E 5P5
Phone: (905) 643-7560 Fax: (905) 643-7559
Reports to be sent to:
1. Email: kbychkalo@terraprobe.ca
2. Email: afelice@terraprobe.ca

Regulatory Requirements:

☐ No Regulatory Requirement
(Please check all applicable boxes)

☒ Regulation 153/04
Table 1 (Indicate One)
☒ Ind/Com
☐ Res/Park
☐ Agriculture

Soil Texture *(Check One)*
☒ Coarse
☒ Fine

☐ Sewer Use
☐ Sanitary
☐ Storm
Region _____ (Indicate One)
☐ MISA

☐ Regulation 558
☐ CCME
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
(Indicate One)

Is this submission for a **Record of Site Condition?** ☐ Yes ☒ No

Report Guideline on *Certificate of Analysis* ☐ Yes ☒ No

Turnaround Time (TAT) Required:

Regular TAT ☒ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply): _____

Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

For 'Same Day' analysis, please contact your AGAT CPM

Project Information:

Project: 7-17-0120-01
Site Location: Simcoe
Sampled By:
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☒ No ☐

Company:
Contact:
Address:
Email:

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI (Y/N)	O. Reg 153: Metals and Inorganics	All Metals ☐ 153 Metals (excl. Hydrides)	Hydride Metals ☐ 153 Metals (Incl. Hydrides)	ORPs: ☐ B-HWS ☐ Cl ☐ CN ☐ Cr^{6+} ☐ EC ☐ FDC ☐ Hg ☐ pH ☐ SAR	Full Metals Scan	Regulation/Custom Metals	Nutrients: ☐ TP ☐ NH_3 ☐ TKN ☐ NO_3 ☐ NO_2 ☐ NO_3+NO_2	Volatiles: ☐ VOC ☐ BTEX ☐ THM	CCME Fractions 1 to 4	ABNs	PAHs	PCBs: ☐ Total ☐ Aroclors	Organochlorine Pesticides	TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	Sewer Use	Corrosivity Package
~~BH1 SA1~~																						
BH1SA2	Aug 31/17	AM	1	soil	1 x 250mL water jar		X															
BH1SA5							X															
BH2SA2							X															
BH2SA5							X															
BH3SA2							X															
BH3SA3 Corrosivity																						X
BH3SA4							X															
BH4SA2							X															
BH4SA4							X															
BH5SA2							X															
BH5SA5							X															

Samples Relinquished By (Print Name and Sign)	Date	Time	Samples Received By (Print Name and Sign)	Date	Time
Anthony Felice	Aug 31/17	3:30pm	Daniella Tajic	8/31/17	3:30pm
			Simon	9/1/17	9:14

Page 1 of 2

N°: T 052862

Pink Copy - Client | Yellow Copy - AGAT | White Copy- AGAT

Date Issued: February 22, 2017

AGAT Laboratories

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only

Work Order #: 17H255265
Cooler Quantity: 1 Gr cooler
Arrival Temperatures: 7.8 | 7.9 | 8.0
Custody Seal Intact: ☐ Yes ☐ No ☐ N/A
Notes: ON ICE

Report Information:

Company: Terraprobe Inc.
Contact: Kyle Bychala
Address: 903 Barton Street, Unit #22, Stoney Creek, ON, L8E 5P5
Phone: (905) 643-7560 Fax: (905) 643-7559
Reports to be sent to:
1. Email: kbychala@terraprobe.ca
2. Email: afelice@terraprobe.ca

Regulatory Requirements:

☐ No Regulatory Requirement
(Please check all applicable boxes)

☒ Regulation 153/04 — Table: ☒ Ind/Com ☐ Res/Park ☐ Agriculture — Soil Texture (Check One): ☒ Coarse ☒ Fine
☐ Sewer Use — ☐ Sanitary ☐ Storm — Region: *Indicate One* — ☐ MISA
☒ Regulation 558 for TCLP — ☐ CCME — ☐ Prov. Water Quality Objectives (PWQO) — ☐ Other — *Indicate One*

Turnaround Time (TAT) Required:

Regular TAT ☒ 5 to 7 Business Days
Rush TAT (Rush Surcharges Apply)
☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day
OR Date Required (Rush Surcharges May Apply):
Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*
For 'Same Day' analysis, please contact your AGAT CPM

Project Information:

Project: 7-17-0120-01
Site Location: Simcoe
Sampled By:
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Is this submission for a **Record of Site Condition?** ☐ Yes ☐ No

Report Guideline on *Certificate of Analysis* ☐ Yes ☐ No

Invoice Information:

Bill To Same: Yes ☒ No ☐
Company:
Contact:
Address:
Email:

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI (Y/N)	O. Reg 153: Metals and Inorganics	All Metals ☐ 153 Metals (exc. Hydrides)	Hydride Metals ☐ 153 Metals (incl. Hydrides)	ORPs: ☐ B-HWS ☐ Cl ☐ CN	☐ Cr⁶⁺ ☐ EC ☐ FOC ☐ Hg	☐ pH ☐ SAR	Full Metals Scan	Regulation/Custom Metals	Nutrients: ☐ TP ☐ NH_3 ☐ TKN	☐ NO_3 ☐ NO_2 ☐ NO_2+NO_3	Volatiles: ☐ VOC ☐ BTEX ☐ THM	CCME Fractions 1 to 4	ABNs	PAHs	PCBs: ☐ Total ☐ Aroclors	Organochlorine Pesticides	TCLP: ☒ M&I ☒ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	Sewer Use	Corrosivity Package
BH6 SA1	Aug 31/17	AM	1	Soil	1 x 250mL amber jar		X																		
BH6 SA4							X																		
BH6 SA3	Corrosivity																							X	
BH7 SA3							X																		
BH7 SA6							X																		
BH8 SA2							X																		
BH8 SA5							X																		
BH1 SA6	Corrosivity																							X	
TCLP1																							X		

Samples Relinquished By (Print Name and Sign)	Date	Time	Samples Received By (Print Name and Sign)	Date	Time
Anthony Felice	Aug 31/17	3:30pm	Daniella Jail	8/31/17	3:30pm
			Sina	17/9/1	914

Page 2 of 2
N°: T 052861

Terraprobe
Consulting Geotechnical & Environmental Engineering
Construction Materials Inspection & Testing

HYDROGEOLOGIC INVESTIGATION
NORFOLK COUNTY
WASTEWATER TREATMENT PLANT UPGRADES
16 OAKWOOD AVENUE
SIMCOE, ONTARIO

Prepared For: **Hatch**
5035 South Service Road, 6th Floor
Burlington, Ontario
L7L 6M9

Attention: Mr. Glen Douglas, Project Manager

File No. 7-17-0120-46
January 18, 2018

© Terraprobe Inc.

TABLE OF CONTENTS

SECTION PAGE (S)

1.0 INTRODUCTION 1

2.0 SCOPE OF WORK 2

3.0 DESCRIPTION OF SITE CONDITIONS 3

3.1 SITE DESCRIPTION AND PHYSIOGRAPHY 3
3.2 SITE GEOLOGY AND HYDROGEOLOGY 3
3.3 SUMMARY OF GEOTECHNICAL INVESTIGATION 4
3.3.1 Fill 4
3.3.2 Sandy Silt and Silty Fine Sand 4
3.3.3 Sand 4
3.3.4 Silt 5
3.4 GROUND WATER CONDITIONS 5
3.5 SUMMARY OF PROPOSED WWTF INFRASTRUCTURE 7
3.6 DEWATERING REQUIREMENTS 7
3.7 SUMMARY OF GROUND WATER QUALITY 8

4.0 ASSESSMENT OF GROUND WATER CONTROL REQUIREMENTS 10

4.1 SUMMARY OF SITE CONDITIONS AND GROUND WATER FEATURES 10
4.2 ANTICIPATED RATES OF DEWATERING 10
4.3 DISCHARGE OF GROUND WATER 12
4.4 POTENTIAL ZONE OF INFLUENCE 12
4.5 IMPACT ON LOCAL FEATURES AND USES 12
4.6 GEOTECHNICAL CONSIDERATIONS 13
4.7 REQUIREMENTS FOR RECORD KEEPING 13

5.0 SUMMARY AND CONCLUSIONS 14

6.0 REFERENCES 16

TABLE OF CONTENTS (cont')

FIGURES:

Figure 1 – Site Location Plan
Figure 2 - Borehole Location Plan
Figure 3 – Shallow Ground Water Flow Direction
Figure 4 – Site Geology
Figure 5 – Dewatering Locations and MOECC Well Record Locations

TABLES:

Table 1 – Summary of Water Quality Sampling
Table 2 – Summary of MOECC Well Records

APPENDICES:

Appendix A – Borehole Logs and Grain Size Analysis
Appendix B – Results of In-Situ Hydraulic Conductivity Testing
Appendix C – Engineering Site Plans
Appendix D – Dewatering Analysis
Appendix E – Laboratory Certificates of Analysis

1.0 INTRODUCTION

Terraprobe was retained by Hatch to complete a hydrogeologic investigation for the proposed upgrades to the Wastewater Treatment Facility (WWTF) located at 16 Oakwood Avenue (the Site) in Simcoe Ontario. The Site consists of the existing County of Norfolk WWTF covering an area of approximately 2 hectares in size comprised of various infrastructure and buildings. The Site access consists of a paved road which extends south from Oakwood Avenue along the east side of the existing plant. The Lynn River is located to the west of the existing plant. The site location is shown on the attached Figure 1.

Upgrades to the existing plant and new works are proposed for the property on the east side of the access road. This property was tree covered and sloped upward toward the east. The following infrastructure is proposed as part of the Simcoe WWTF upgrading:

- New headworks;
- New RAS/WAS chamber and sludge receiving station;
- New digester and bio-solids holding tank;
- New administration building; and
- Underground piping and access roads.

The purpose of the hydrogeologic investigation was to assess shallow ground water levels in relation to the proposed works for the WWTF to provide for the estimation of ground water dewatering rates required for construction. An assessment was completed to evaluate the potential for impacts to surround ground water uses and natural features, and to provide recommendations regarding ground water monitoring, mitigation and contingency plans over the duration of active dewatering for the proposed upgrades.

2.0 SCOPE OF WORK

The following tasks were undertaken in order to address the requirements of the PTTW application:

- *Review of available background information*. A review of available geotechnical and hydrogeologic information for the site was conducted, including topographic mapping, geologic mapping, and results of the geotechnical investigation (Terraprobe) and subsurface investigations completed at the site.

- *Confirmation of Site Conditions*. Ground water levels were monitored on several occasions to confirm the shallow ground water level at the Site. Water quality sampling was completed from an installed monitoring well and was analyzed for the parameters contained within the County of Norfolk sewer-use bylaws. Water quality sampling was completed to assess ground water discharge options and treatment requirements during active dewatering.

- *Assessment for Construction Dewatering*. Engineering plans for proposed WWTF upgrades were reviewed to assess volumes of ground water taking for construction. Soil and ground water conditions were reviewed in relation to the proposed invert elevations for the proposed works.

3.0 DESCRIPTION OF SITE CONDITIONS

3.1 Site Description and Physiography

The site is located south of Oakwood Avenue immediately east of the Lynn River. Land uses in the vicinity of the site consist of municipally serviced residential homes to the north and west of the site, St. Joseph's Catholic School to the north, the Oakwood Cemetery situated to the east of the site and a woodlot and rail trail to the south. The Site is serviced with municipal water and sewer servicing.

The Site is situated in the physiographic region of Southern Ontario known as the Norfolk Sand Plain. The soil stratigraphy characteristic to this region generally consists of deltaic sand deposits overlying strata of silt and clay.

Topographical relief in this area gently slopes from the northeast to the southwest (OBM, 2002), with an overall grade change of about 6 metres across the site. A topographic high of approximately 216.0 masl exists to the northeast sloping to 210.0 masl to the southwest toward the Lynn River. The Lynn River is situated at an elevation of approximately 206.0 masl to the west of the Site.

3.2 Site Geology and Hydrogeology

Based upon geologic mapping for the area (Barnett, 1978) the Site is within an area characterized by glaciolacustrine deep water silt deposits. The Lynn River to the west of the site is characterized by medium to very coarse grained sands and pebbles, and lands to the east form a regionally extensive area of glaciolacustrine shallow water sand deposits. Geologic mapping for the vicinity of the site is provided in the attached Figure 4.

Drift thickness in the vicinity of the Site is reported at 30 to 38 metres, overlying limestone of the Onondaga Formation. Bedrock elevations are anticipated at elevations of approximately 177.0 masl. Bedrock is reported to slope to the south and west toward Lake Erie.

Ground water at the subject site will be largely influenced by the Lynn River, with shallow ground water discharging through shallow deposits of medium to coarse sands to the river. Ground water flow direction is expected to follow topography and flow to the southwest toward the Lynn River. Shallow ground water levels were measured between 4 to 6 metres below existing grades and are expected to fluctuate seasonally.

Hydraulic conductivity of soils were assessed based on in-situ hydraulic conductivity testing completed for the series of four monitoring wells established at the Site as part of the subsurface investigation completed for the geotechnical investigation for the proposed WWTF upgrades. Results of in-situ hydraulic conductivity testing are provided in Section 3.4 below.

3.3 Summary of Geotechnical Investigation

A geotechnical investigation was completed at the subject site by Terraprobe. A series of eight (8) boreholes were completed at the site in August 2017 to investigate the subsurface conditions present at the Site. Boreholes were completed to various depths between 3.5 and 14.2 metres below existing grades. The subsurface conditions encountered at the Site generally consisted of fill overlying near surface strata of loose silty sand and sandy silt. A stratum of sand was encountered beneath the fill and surficial soils. The deeper boreholes penetrated a layered silt and silty clay deposit beneath the sand.

An additional borehole was completed in October 2017 in close proximity to borehole 3 completed at a greater depth to penetrate into underlying silt deposits. This borehole was completed to a depth of 21.8 m. Borehole logs and laboratory results of grain size analysis are provided in the attached Appendix A. Borehole locations are indicated on the attached Figure 2.

The following is a general description of the major stratigraphic units and ground water conditions observed in the boreholes.

3.3.1 Fill

Fill was encountered below asphalt pavement in boreholes 3 (A and B), 4 and 6 and below topsoil in borehole 8. The fill in borehole 3, 4 and 8 generally consisted of sandy silt and the fill in borehole 6 consisted of clayey silt. The thickness of fill deposits ranged from 1.2 to 2.1 metres below existing grades.

3.3.2 Sandy Silt and Silty Fine Sand

Strata of loose sandy silt and silty fine sand were encountered beneath the fill and topsoil in all of the completed boreholes. These strata were fully penetrated at depths of about 1.5 to 2.9 metres below existing grades.

3.3.3 Sand

Each of the completed boreholes encountered a stratum of compact medium sand below the silty sand and sandy silt. The sand was fully penetrated at depths of 9.4 and 9.8 metres below existing grades in

boreholes 3 and 4 respectively. Grain size distribution curves completed from samples obtained within this stratum indicated about 5% fine grained soils (i.e. soil finer than 60 μm).

3.3.4 Silt

Boreholes 3 and 4 encountered a deposit of dense silt with layers and seams of silty clay beneath the sand and to the depths explored. Grain size distribution curves completed from samples obtained within this stratum indicated about 88% fine grained soils (i.e. soil finer than 60 μm).

Borehole 3B was extended to a greater depth to fully penetrate the silt stratum. This stratum was fully penetrated at a depth of 15.2 metres below existing grades followed by a compact to dense silty sand with silt seams to a depth of 18.3 m followed by a dense to very dense clayey silt to silt to the depth of completion at a depth of 21.8 m.

3.4 Ground Water Conditions

Monitoring wells were established in boreholes 1, 3B, 4, 7 and 8 to allow for the monitoring of long-term stabilized ground water levels at the Site. Numbering for monitoring well (MW) locations followed the assigned borehole numbers within the geotechnical investigation. Monitoring well locations consisted of 50 mm diameter PVC pipe with a 3.0 metre length slotted well screen. The following table summarizes the construction details and measured water levels from installed monitoring well locations:

Summary of Ground Water Elevations

Monitoring Well Location	Surface Elevation (masl)	Well Depth (m)		Water Level					
				31-Aug-17		13-Sep-17		16-Oct-17	
		mbgl	masl	mbgl	masl	mbgl	masl	mbgl	Masl
MW-1	211.7	5.4	206.3	5.1	206.7	5.2	206.5	5.3	206.4
MW-3B	212.3	21.4	190.9	Not Measured		Not Measured		5.8	206.5
MW-4	212.4	13.7	198.7	5.8	206.6	5.8	206.6	5.7	206.7
MW-7	210.4	6.8	203.6	4.1	206.3	4.0	206.4	4.1	206.3
MW-8	212.0	6.8	205.2	5.7	206.3	5.7	206.3	5.8	206.2

masl – metres below sea level

mbgl – metres below ground level

Monitoring well location 3-B was completed within deeper subsurface deposits underlying near surface sand deposits. Water levels observed within MW3-B were similar to shallow ground water elevations observed at other shallow monitoring installations. Head pressures within silt underlying sand deposits at

the site are expected to be similar to the near surface sand unit. Ground water flow direction is expected to the southwest toward the Lynn River and is indicated on the attached Figure 3.

In-situ hydraulic conductivity testing was completed on October 16, 2017 for the above monitoring well installations. The testing involved the removal of water from the well (i.e. bail test) and the recovery of ground water was observed over time. Water level data obtained from the in-situ testing was interpreted using the Hvorslev analysis method for a point piezometer. Methodology of the analysis of in-situ hydraulic conductivity is provided in the attached Appendix B. A summary of the calculated rates of hydraulic conductivity are summarized in the table below:

Summary of In-Situ Hydraulic Conductivity

Monitoring Location	Screened Formation	Hydraulic Conductivity (m/s)
MW-1	Sand	1×10^{-4} m/s*
MW-3B	Clayey Silt to Silt	1.5×10^{-7} m/s
MW-4	Silt	5.6×10^{-6} m/s
MW-7	Sand	1.7×10^{-4} m/s*
MW-8	Sand	1.7×10^{-4} m/s*

* hydraulic conductivity based on grain size analysis curve (Appendix A) and permeability coefficients within SG-9 Supplementary Guidelines to the Ontario Building Code (1997)

Rates of hydraulic conductivity within sand deposits could not be determined based on in-situ conductivity testing due to the rate of recovery for monitoring wells screened within the sand unit following the removal of ground water. The hydraulic conductivity of the sand unit was estimated based on the grain size analysis completed from representative samples obtained from the Site as detailed in the above table using the Hazen method (Hazen, 1911) as follows:

$$K = C(D_{10})^2$$

Where: K is the hydraulic conductivity (m/s)
C is Hazen's empercial coefficient (100 for medium sand).
D_{10} is the diameter of the 10th percentile grain size of the material (1.3×10^{-3} m)

D_{10} was estimated at 1.3 mm from grain size analysis completed for borehole 4, samples 6 and 7 as shown in the attached grain size analysis curves (Appendix A). These samples were obtained from depths below the anticipated shallow ground water level. The estimated hydraulic conductivity for the sand unit was calculated at 1.7×10^{-4} m/s.

3.5 Summary of Proposed WWTF Infrastructure

The following table summarizes the infrastructure proposed as part of the Simcoe WWTF upgrades:

Summary of Proposed WWTF Infrastructure

Infrastructure		Footing Depth (masl)	Area (m^2)	Ground Water Elevation (masl)	Dewatering Target (masl)
Headworks Facility	Wet Well (1)	199.074	76.5	206.6	198.1
	Wet Well (2)	200.824	123.5	206.6	199.8
	Valve Room	208.48	113.6	206.6	207.5
RAS/WAS Chamber		207.72	36.9	206.3	206.7
Sludge Receiving Station		209.00	272.2	206.7	208.0
Digester	Basement	209.3	299.0	206.7	208.3
	Tanks (x2)	207.7	347.8	206.7	206.7
Bio-Solids Holding Tank		204.4	527.7	206.3	203.4
Administration Building		209.5	296.0	206.1	208.5
Blower Building		209.5	90.7	206.1	208.5
Sanitary Sewer Lines		202.579	60*	206.6	201.6

*length of sewer line proposed to feed to proposed headworks facility assumed at 60 m length

The dewatering target is proposed at approximately 1.0 m below the proposed footing elevations for the above proposed infrastructure. Shallow ground water levels were based on observed water levels at the site from the site inspection completed on August 31, 2017. Water levels from August 31, 2017 were used as water levels observed on this date represented the observed seasonal high ground water conditions based on completed monitoring events completed at the site. It is recommended that additional water levels be obtained from the site to confirm seasonal fluctuations in shallow ground water at the site.

Based on the observed site conditions and the footing depths for proposed infrastructure it is anticipated that ground water dewatering will be required to facilitate the construction of the headworks facility (wet well structure) and the bio-solids holding tank. The remaining infrastructure is anticipated to have footprint depths above the level of shallow ground water at the Site. Engineering drawings for the proposed WWTF upgrades are provided in Appendix C.

3.6 Dewatering Requirements

Based on the attached proposed plan (Appendix C) the following drawdown of shallow ground water levels is anticipated for construction works requiring dewatering:

Summary of Dewatering Requirements

Location	Ground Water Elevation	Excavation Depth	Dewatering Target	Dewatering Thickness	Radius of Influence
Headworks Facility (Wet Well)	206.6 masl	199.1 masl	198.1 masl	12.2 m	86.6 m
	206.6 masl	200.8 masl	199.8 masl	10.5 m	74.5 m
Bio-Solids Holding Tank	206.3 masl	204.4 masl	203.4 masl	5.0 m	195.6 m
Sanitary Sewer	206.6 masl	202.6 mals	201.6 masl	8.6 m	336 m

The above assessment assumes a shallow ground water level as observed during the site inspection completed on August 31, 2017. The dewatering assessment was based upon the installation of sheet piling which would effectively cut lateral ground water flow from the upper sand unit for the wet well excavations. It is anticipated that dewatering for the wet well feature would be completed from within silt deposits encountered from depths of approximately 202.5 to 197.1 masl. Dewatering for the bio-solids holding tank is expected within the sand unit encountered from 208.9 to 202.5 masl.

The radius of influence was calculated at a maximum of 86.6 m surrounding the proposed wet well feature for the headworks facility, and 195.6 m surrounding the bio-solids holding tank. The Lynn River is located approximately 100 m west of the proposed headworks facility and approximately 180 m west of the bio-solids holding tank. A further analysis of rates of water taking and potential impacts of water taking activities is further discussed in Section 4.0 below. Locations of proposed water taking are shown on the attached Figure 5.

3.7 Summary of Ground Water Quality

Ground water quality sampling was completed on October 16, 2017 from MW-7 located in the area proposed for the bio-solids holding tank. Water quality sampling was completed for parameters contained within the County of Norfolk Sewer Use By-Law. Two sets of water quality samples were obtained. One set consisted of un-filtered ground water and a second set was filtered using a 20 micron filter to remove suspended solids.

The monitoring well was purged of three casing volumes prior to sampling to remove standing water from within the monitoring well. Samples were collected in laboratory supplied sample bottles required for the requested analysis. All collected samples were stored on ice and transported to the Stoney Creek office for courier to Agat Laboratories of Mississauga for analysis. Laboratory Certificates of Analysis are provided in the attached Appendix E. Results of analysis are provided in the attached Table 1.

Results of water quality sampling were compared to parameters within the Provincial Water Quality Objectives (PWQO) for discharge to the natural environment (i.e. Lynn River), and the County of Norfolk

Sewer Use By-Laws (both storm and sanitary). Based on the collected ground water sample the following treatment was determined to be required for discharge:

- For discharge to the Lynn River – exceedances of the PWQO were noted for cadmium, chromium, copper, lead, zinc, iron and E-coli. Treatment would be required for suspended solids, metals and microbiology. Treatment would include (but not limited to) greensand filters and UV disinfection;

- For discharge to the County of Norfolk storm sewer exceedances were noted for total suspended solids and E-coli. Treatment would be required consisting of UV disinfection and settling tanks; and

- For discharge to the County of Norfolk sanitary sewer exceedances were noted for total suspended solids and treatment via settling tanks or other filtration methodology would be required prior to discharge.

Given that the proposed Simcoe WWTF upgrades are being completed by the County of Norfolk and the proximity of the works to the sanitary sewer it is anticipated that discharge of ground water from dewatering would be directed to the sanitary sewer.

4.0 ASSESSMENT OF GROUND WATER CONTROL REQUIREMENTS

Based on the subsurface conditions observed as part of site investigations and a review of background information, the potential dewatering required for completion of Simcoe WWTF upgrades have been assessed.

4.1 Summary of Site Conditions and Ground Water Features

In summary, the results of the site investigation and information review indicate the following:

- Based on three completed boreholes completed at the Site subsurface materials consist of silty sand and sandy silt overlying sand followed by silt to clayey silt. Sand was encountered to a depth of approximately 202.5 masl. It is anticipated that excavations for the bio-solids holding tank and sanitary sewer lines will be completed within the sand subsurface materials. Underlying silt soils were encountered to a depth of 197.1 masl. It is expected that the wet well feature of the headworks facility will be completed within silt soils.

- The stabilized ground water levels are expected to be within approximately 4 to 6 m of the ground surface.

- The site is situated in an area which is serviced with municipal piped water and sewage services. Private potable water wells are not located in the vicinity of the site.

On the basis of the above, it is expected that excavations carried below the water table in the native soil materials will encounter ground water seepage. It is noted that these recommendations are provided for the purposes of assessing general requirements for design and obtaining a Permit to Take Water. They are not intended to provide direction to contractors with respect to appropriate methods of ground water control for the site.

4.2 Anticipated Rates of Dewatering

Excavations required for the proposed WWTF upgrades are expected to be up to approximately 14.2 m below existing ground level through sand deposits and into underlying silt soils. Seepage is expected for excavations carried out in this area for sewer lines, the headworks facility (wet well feature) and for the proposed bio-solids holding tank. It is anticipated that ground water control can generally be accomplished from pumping a series of well points constructed around the perimeter of proposed excavations. The total volume of ground water pumped from excavations for the proposed WWTF

upgrades are expected to stabilize in the range of 1,410,000 litres per day. A safety factor of approximately 50% was applied for calculated rates to account for higher initial rates of water taking to drawdown shallow ground water levels, uncertainties in estimated hydraulic conductivity rates of soils and the potential for higher rates of dewatering as a result of precipitation events during active dewatering. The anticipated maximum rate of dewatering was estimated at 2,114,000 L/day. The table below summarizes the calculated rates of dewatering:

Summary of Calculated Dewatering Rates

Infrastructure	Subsurface Materials	Average Dewatering Rates	Maximum Dewatering Rates	Conditions/Assumptions
Headworks Facility	Silt	11,000 L/d	17,000 L/d	Shoring precluding lateral ground water flow
	Silt	15,000 L/d	22,000 L/d	Shoring precluding lateral ground water flow
Bio-Solids Holding Tank	Sand	300,000 L/d	450,000 L/d	Shoring precluding lateral ground water flow
Sanitary Lines	Sand	1,084,000 L/d	1,625,000 L/d	Excavation staged and open in 10 m lengths

It is anticipated that dewatering for the Simcoe WWTF upgrades can be facilitated through a Category 3 Permit to Take Water (PTTW) application. The PTTW is applicable for construction dewatering projects requiring dewatering in excess of 400,000 L/day.

A review of the above dewatering assessment should be reviewed along with current site plans, construction staging and updated site water levels prior to finalization of the dewatering plan. The above assessment was based on site conditions observed at the time of site inspection at the locations of completed monitoring well installations. A summary of dewatering flow calculations are provided in the attached Appendix D.

It should be noted that the above values are representative of short term rates of dewatering for construction purposes. In the event that permanent drainage is required for footings (i.e. weeping tile underlying structure footings) it is anticipated that a PTTW will be required for the long term water taking at the site. Long term water taking for footing sub-drains would form a separate PTTW application with the MOECC if required.

4.3 Discharge of Ground Water

The results of ground water quality sampling are provided in Section 3.7 above. It is anticipated that ground water discharge will be directed to the County of Norfolk sanitary sewer given the close proximity of the site to sanitary servicing. It is recommended a ground water quality monitoring program is in place to verify compliance with discharge to the municipal sanitary sewer. Well points/eductors should be filtered to ensure that fines are not pumped in the ground water discharge system. The outlet should be checked frequently to ensure that the discharge water is not carrying fines. Appropriate methods to control transport of silt in discharge water, such as filter bags or settling tanks, should be fitted to the outlet of the discharge.

Potential sources of ground water contamination in the vicinity of the site were not identified. Land use surrounding the site consists of residential dwellings to the north of the site. The Oakwood cemetery is located to the northeast of the site. The cemetery is not expected to represent a source of potential source of ground water contamination, ground water levels are expected to be below the depth of burial (i.e. approximately 1.8 m below ground) and based on current burial practices (i.e. underground vaults) potential ground water contamination is not expected.

4.4 Potential Zone of Influence

The potential zone of influence arising from ground water taking activities was calculated based on the anticipated drawdown and hydraulic conductivity determined for the site. The calculated zone of influence will extend to an anticipated maximum distance of 196 m surrounding the proposed excavation areas. It is anticipated that the Lynn River will act as a boundary condition to the west of the site. The existing WWTF and surrounding residential dwellings are municipally serviced. Ground water supply wells, surface water features (i.e. Lynn River) and potential sources of ground water contamination were not identified within the anticipated radius of influence of dewatering work for the WWTF upgrades.

4.5 Impact on Local Features and Uses

Potable water wells are not expected within the anticipated radius of influence. Surrounding wells listed within the MOECC water well record database pertain to wells completed for monitoring and/or dewatering purposes. Potable water supply wells are expected to have been decommissioned with connection of local residents to municipal water servicing. Dewatering is not expected to have impacts for surrounding land uses in the vicinity of the subject site. Locations of well records on file with the

MOECC within 200 m of the Site are shown on the attached Figure 5. A summary of well records is provided on the attached Table 2.

Surrounding natural surface water features consist of the Lynn River located approximately 100 metres west of the Site. The Lynn River is not situated within the expected radius of influence of dewatering work for the Simcoe WWTF upgrades. Impacts to the river as a result of dewatering are not anticipated.

4.6 Geotechnical Considerations

Lowering of ground water levels during construction activities has the potential to create ground subsidence or settlement. Surrounding building foundations and pavements should be inspected frequently to assess potential settlement surrounding existing structures for the Simcoe WWTF. Dewatering discharge should be inspected frequently to ensure discharge is clear and free of sediment in order to prevent possible ground loss with active dewatering.

4.7 Requirements for Record Keeping

Based on the results of the hydrogeologic investigation, it is expected there will be no significant impacts created by the dewatering activities. Nonetheless, it is important to maintain records to ensure that any unforeseen impacts are properly identified and that appropriate contingency measures can be implemented. The following record keeping measures are recommended:

- The location and extent (depth and approximate dimensions) of all excavations on the site should be recorded on a daily basis.

- The requirements for ground water control including volumes and duration of pumping from each excavation should be recorded on a daily basis.

- Ground water discharge from ground water control systems should be inspected frequently to ensure they are not carrying fines.

5.0 SUMMARY AND CONCLUSIONS

Based on the results of the investigation, the following summary and conclusions are provided:

i. The results of the investigation indicate the site is generally underlain sand materials. Hydraulic conductivity was estimated based on grain size gradation curves for soil samples obtained as part of the geotechnical investigations completed at the site using the Hazen method. For the purposes of estimating rates of dewatering a hydraulic conductivity of 1.7×10^{-4} m/s was considered.

ii. Ground water levels in the vicinity of infrastructure proposed for the Simcoe WWTF upgrades are expected within 4 to 6 m below existing grades. Significant variations in water level between shallow (MW 1, 4, 7 and 8) and deep (MW 3-B) installations were not noted for completed monitoring wells at the site.

iii. Based on the sand material present at the site it is expected that dewatering will generally be accomplished through a series of well points or eductors completed around the perimeter of the proposed excavations.

iv. The total volume of ground water pumped from excavations for the proposed WWTF upgrades are expected to stabilize in the range of 1,410,000 L/day. The anticipated maximum rate of dewatering was estimated at 2,114,000 L/day. These rates are representative of the short term rates of dewatering required for construction. Long term rates for dewatering for footing sub-drains (if proposed) were not assessed.

v. Discharge of pumped ground water is recommended to the municipal sanitary sewer. Water quality samples obtained from the Site generally meet the requirements of the County of Norfolk sanitary sewer use by-law. Based on the close proximity of excavations to the existing sanitary system, and that the proposed works are being completed for the municipality it is anticipated that discharge to the sanitary system will be the most effective discharge option for dewatering discharge.

vi. Ground water control activities are not expected to cause any significant impacts to local water resources, surface water features or significant ground settlement. The anticipated zone of influence surrounding the site is expected at a maximum of 60 metres surrounding open excavations.

vii. Water quality concerns for discharge water are not anticipated. Measures should be taken to insure that fines are not pumped in the ground water discharge system, and that erosion at the point of discharge to the existing open channel west of the site is limited.

We trust this report meets with your requirements. Should you have any questions regarding the information presented, please do not hesitate to contact our office.

Yours truly,

Terraprobe Inc.







Paul L. Raepple, P. Geo.

R. Baker Wohayeb, M.A.Sc., P.Eng., QP_{RA}
Principal

Stoney Creek Office

6.0 REFERENCES

Barnett, P.J. 1978: Quaternary Geology of the Simcoe Area, Southern Ontario; Ontario Division of Mines, GR162, 74p. Accompanied by Maps 2369, 2370, and 2371, scale 1:50,000.

County of Norfolk By-Law 83-74, Sewer Use By-Law (as Amended by 173-86, 186-87, 208-89, 192-91 and 160-92), dated February 13, 1975.

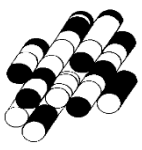
Ontario Base Mapping, Sheet 10 17 5550 47400. Ontario Ministry of Natural Resources, 2002; scale 1:10,000.

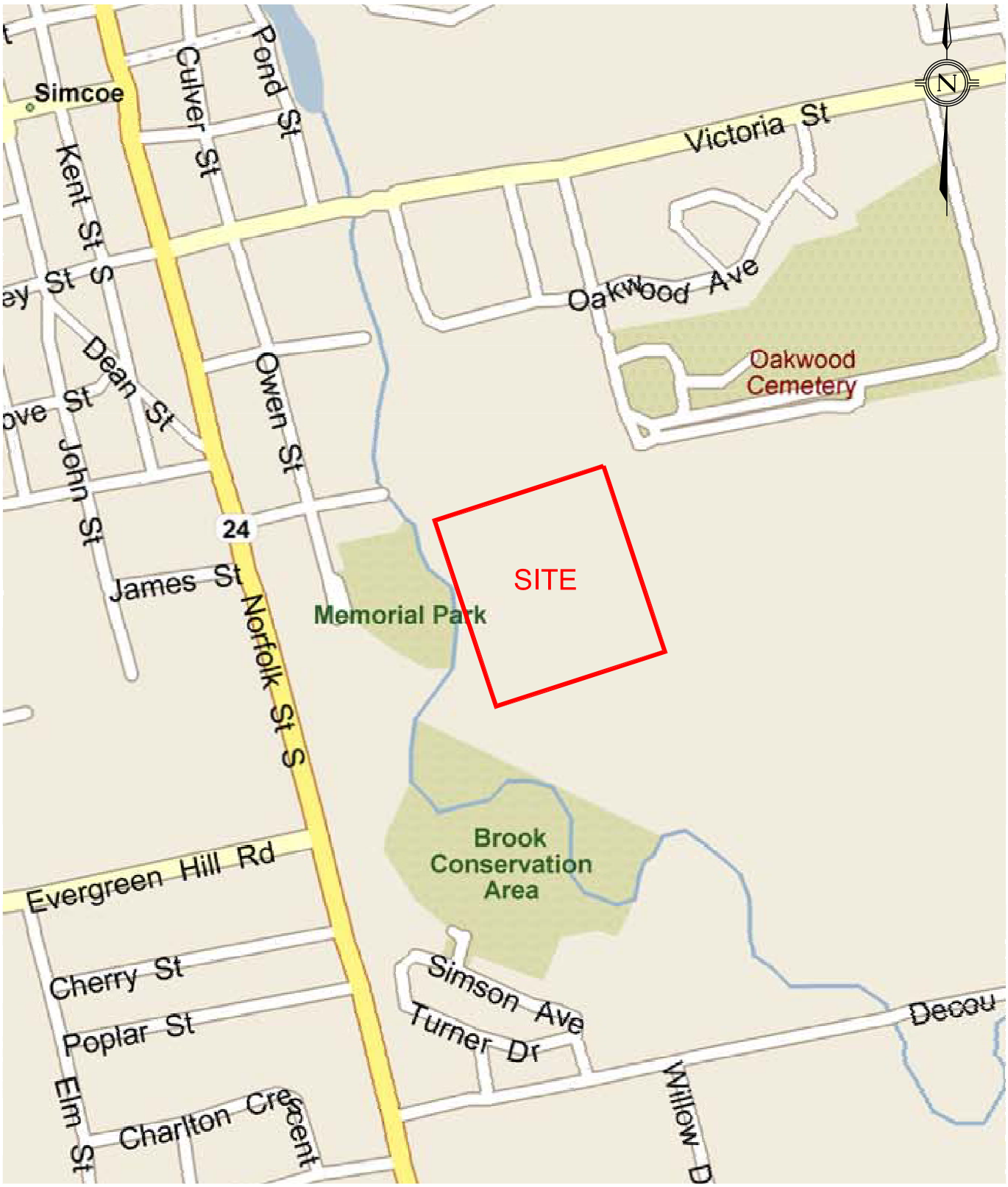
Terraprobe, (2017), *Geotechnical Investigation, Norfolk County, Wastewater Treatment Plant Upgrades, 16 Oakwood Avenue, Simcoe, Ontario.*

Water Management Policies Guidelines, Provincial Water Quality Objectives of the Ministry of Environment and Energy (1994). Queen's Printer for Ontario. PIBS 3303E.

FIGURES

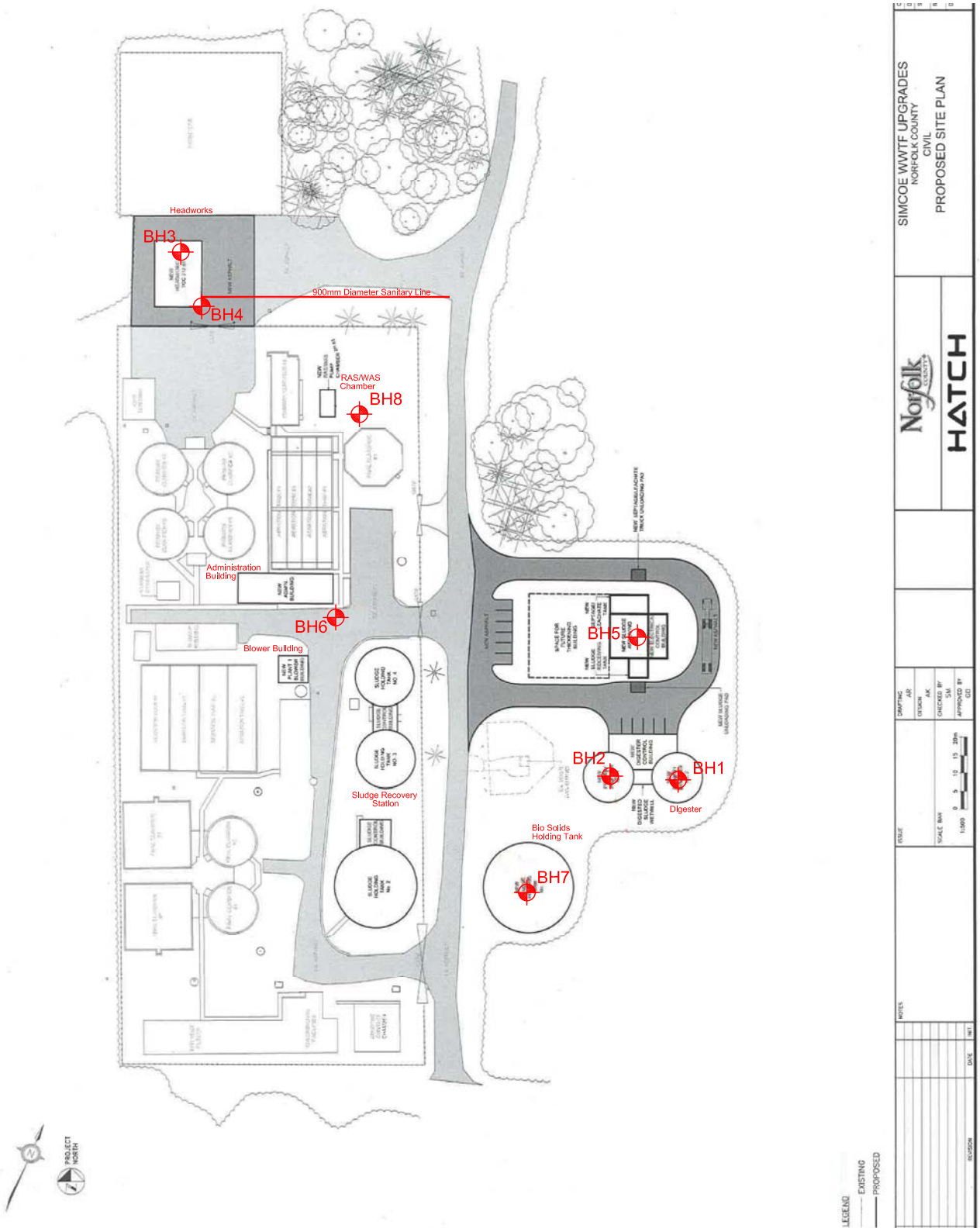
Terraprobe Inc.





Terraprobe
903 Barton Street - Unit 22, Stoney Creek, Ontario, L8E 5R7
Tel: (905) 643-7560, Fax: (905) 643-7559

Title:	FIGURE :
SITE LOCATION PLAN	1
File No. 7-17-0120-01	



LEGEND

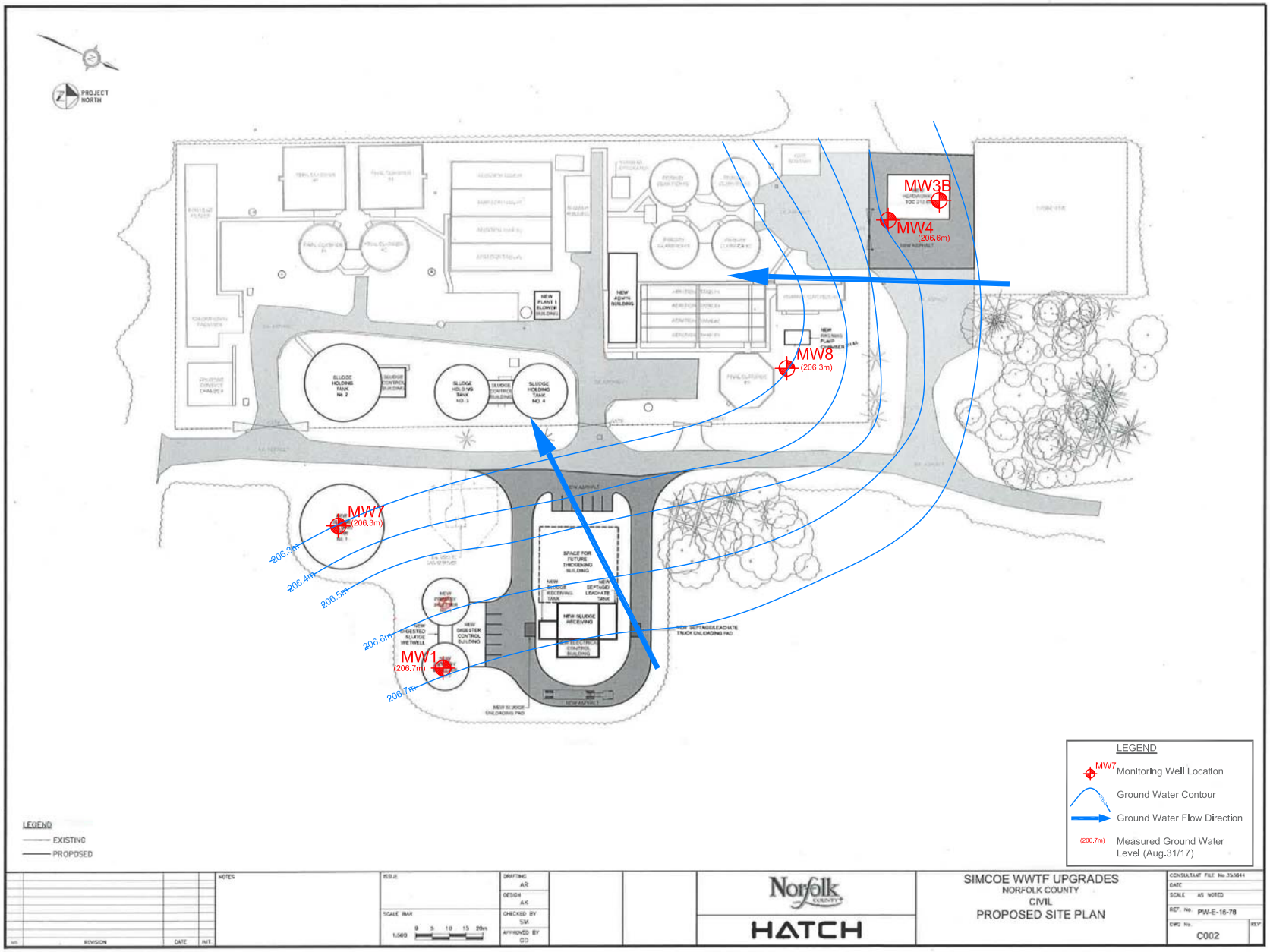
BH1 Borehole Location

Terraprobe
903 Barton Street - Unit 22, Stoney Creek, Ontario, L8E 5R7
Tel: (905) 643-7560, Fax: (905) 643-7559

Title: BOREHOLE LOCATION PLAN

File No. 7-17-0120-01

FIGURE : 2

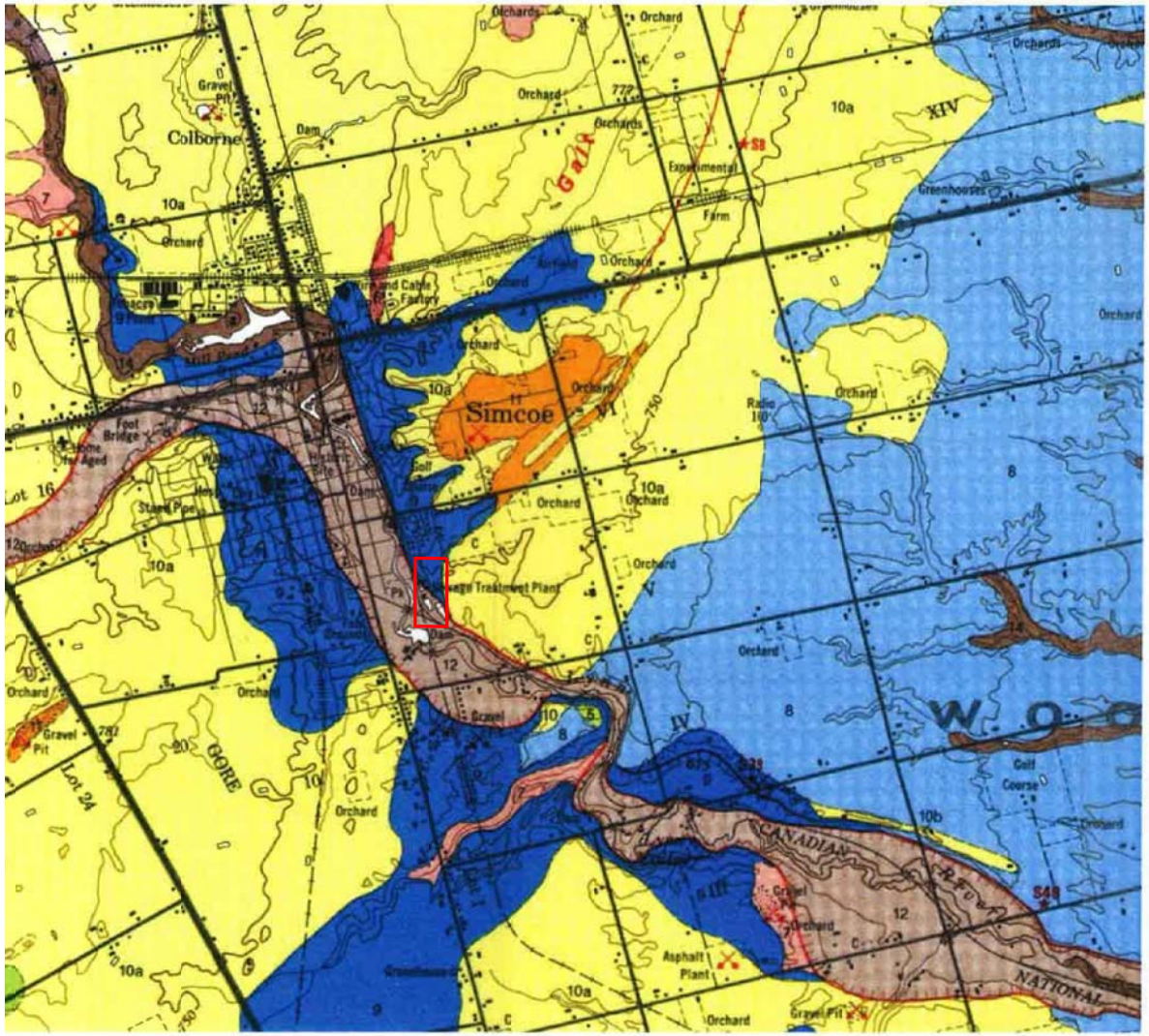


Terraprobe
903 Barton Street - Unit 22, Stoney Creek, Ontario, L8E 5R7
Tel: (905) 643-7560, Fax: (905) 643-7559

Title: SHALLOW GROUND WATER FLOW DIRECTION

File No. 7-17-0120-01

FIGURE : 3



HALDIMAND-NORFOLK (RM)

QUATERNARY

RECENT

16 *Fill.*

15 *Modern Lake Erie beach deposits: (sand, gravel and sand, shingle).*

14 *Modern alluvium: undifferentiated, (clay, silt, sand, muck).*

13 *Bog deposits: a, muck and peat; b, marl.*

PLEISTOCENE

LATE WISCONSINAN

12 *Older alluvium in terrace remnants, (medium to very coarse grained sand with occasional pebbles).*

11 *Glaciolacustrine beach, bar, or near shore deposits, (gravel to very coarse grained sand with pebbles).*

10 *Glaciolacustrine shallow water sand deposits: (very fine to coarse grained sand, massive to faintly laminated).*
10a *May be modified slightly by wind.*
10b *Large dunes.*
10c *Varved very fine to fine grained sand.*

9 *Glaciolacustrine deep water silt deposits, (massive to laminated and varved silt).*

8 *Glaciolacustrine deep water clay deposits, (massive to laminated and varved clay).*

7 *Glaciofluvial, outwash, deltaic deposits, (gravel to gravelly sand).*

6 *Ice-contact stratified drift, (moraine and kame gravel and sand).*

5 *WENTWORTH TILL (stony, fine, sandy silt to silty, fine, sand till).*
5a *In moraine or till plain.*
5b *In drumlin.*

4 *Glaciolacustrine sand related to Lake Maumee.*

3 *PORT STANLEY TILL, (gritty clayey silt to silty clay till).*

UNCONFORMITY

PALEOZOIC

Source: Quaternary Geology, Simcoe, Southern Ontario; Ontario Division of Mines, 1976 - Map2369

Terraprobe
903 Barton Street - Unit 22, Stoney Creek, Ontario, L8E 5R7
Tel: (905) 643-7560, Fax: (905) 643-7559

Title: Site Geology

File No. 7-17-0120-01

FIGURE : 4



LEGEND

(10) MOECC Well Record Location

Proposed Dewatering Location

Terraprobe
903 Barton Street - Unit 22, Stoney Creek, Ontario, L8E 5R7
Tel: (905) 643-7560, Fax: (905) 643-7559

Title: Dewatering Locations & MOECC Well Record Locations

File No. 7-17-0120-01

FIGURE : 5

TABLES

Terraprobe Inc.

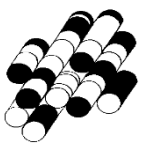


Table 1: Summary of Water Quality Sampling
Simcoe WWTF Expansion
16 Oakwood Avenue
Simcoe, Ontario

Sample Description	Unit	PWQO	Storm	Sanitary	BH 7a	BH 7b
Date Sampled					**16-Oct-17**	**16-Oct-17**
Inorganics						
pH	pH Units	6.5-8.5	6.5-9.5	6.5-8.5	7.89	7.86
BOD (5)	mg/L				<5	<5
Total Suspended Solids	mg/L		15	350	**4480**	**680**
Phenols	mg/L	0.005	0.020	0.10	<0.001	<0.001
Total Cyanide	mg/L	0.005	0.1	2	<0.002	<0.002
Sulphide	mg/L		1	2	<0.05	<0.05
Chloride	mg/L		1500	1500	6.21	6.21
Sulphate	mg/L		1500	1500	65.7	65.8
Cadmium	mg/L	0.0002	1	3	**<0.001**	**<0.001**
Chromium	mg/L	0.001	1	3	**0.014**	**0.004**
Copper	mg/L	0.005	1	3	**0.050**	**0.013**
Lead	mg/L	0.025			**0.073**	0.024
Nickel	mg/L	0.025	1	3	0.004	<0.003
Zinc	mg/L	0.03			**0.116**	0.030
Iron	mg/L	0.3			**10.6**	**5.10**
Organics						
Oil and Grease (animal/vegetable) in water	mg/L	[a]	15	100	0.6	0.8
Oil and Grease (mineral) in water	mg/L	[a]	15	15	<0.5	<0.5
Microbiological						
Total Coliforms	CFU/100mL	100	2400		NDOGT	**13000**

BH 7a indicates un-filtered sample
BH 7b indicates filtered sample (20 microns)
Storm and sanitary criteia obtained from the County of Norflok Sewer Use By-Laws (83-74)
(a) PWQO for oil and grease is set at no visible sheen, odour or discolouration of discharge water
PWQO - Provincial Water Quality Objetives
CFU - Colony Forming Units

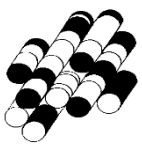
TABLE 2: Summary of MOECC Well Records
Simcoe WWTF Expansion
16 Oakwood Avenue
Simcoe, Ontario

Well ID	Well Number	Water Level (m)	Well Use	Stratigraphy (Depth Encountered in metres)
1	7044570	1.8	Observation Well	Fine Sand (1.8) Coarse Sand (4.6)
2	7243484	n/a	Monitoring Well	Sand Fill (0.9) Water Bearing Sand (3.7)
3	4401194	0.9	n/a	Coarse Sand (5.5)
4	4401186	n/a	Test Hole	Clay (3.0) Sand (8.2) Silt/Clay (42.4)
5	4402034	11.2	Domestic	Sand (6.0) Sand/Gravel (12.5)
6	4402032	10.8	Domestic	Silt (3.0) Gravel (9.1) Fine Gravel (12.2)
7	4401187	n/a	Municipal	Clay (1.5) Sand (4.6) Clay/Gravel (39.6) Gravel (40.1)
8	7280339	n/a	Monitoring Well	Sand (6.7) Clay/Silt (7.6)
9	7116488	n/a	Monitoring Well	Sand Fill (5.4) Sand/Silt (12.0)
10	7135497	n/a	Monitoring Well	Topsoil (0.3) Silt/Sand (6.0)
11	7101397	18.5	Domestic	Sand (4.2) Clay (9.7) Sand (22.9)
12	4404974	1.2	Domestic	Sand (1.2) Clay (18.3) Limestone (20.4)

Borehole Logs and Grain Size Analysis

APPENDIX A

Terraprobe Inc.



LOG OF BOREHOLE 1

Terraprobe

Project No. : 7-17-0120-01	Client : Hatch	Originated by : AF
Date started : August 29, 2017	Project : 16 Oakwood Avenue	Compiled by : KB
Sheet No. : 1 of 1	Location : Simcoe, Ontario	Checked by : KB

Position : E: 4742120, N: 557635 (UTM 17T) Elevation Datum : Geodetic (NAD83)

Rig type : Track-mounted Drilling Method :

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	211.7	**GROUND SURFACE**				
	211.5	150mm **TOPSOIL**				
	0.2	**SANDY SILT**, trace topsoil, trace rootlets, compact, brown		1	SS	11
1				2	SS	13
	210.5					
	1.2	**SILTY FINE SAND**, loose, brown		3	SS	6
2	209.3					
	2.4	**MEDIUM SAND**, occasional gravel, compact, brown		4	SS	10
3				5	SS	10
4						
				6	SS	12
5						
				7	SS	22
6	205.1					
	6.6	**END OF BOREHOLE**				

Elevation Scale (m): 211, 210, 209, 208, 207, 206

Penetration Test Values (Blows / 0.3m): Dynamic Cone 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane 40 80 120 160

Moisture / Plasticity: Plastic Limit (PL) Natural Water Content (MC) Liquid Limit (LL) 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL

Unstabilized water level measured at 4.9 m below ground surface; borehole was open upon completion of drilling.

50 mm dia. monitoring well installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Aug 31, 2017	5.1	206.7
Sep 13, 2017	5.2	206.5

file: 7-17-0120-01 - simcoe wwtf.gpj

LOG OF BOREHOLE 2

Terraprobe

Project No. : 7-17-0120-01 | Client : Hatch | Originated by : AF

Date started : August 29, 2017 | Project : 16 Oakwood Avenue | Compiled by : KB

Sheet No. : 1 of 1 | Location : Simcoe, Ontario | Checked by : KB

Position : E: 4742118, N: 557632 (UTM 17T) | Elevation Datum : Geodetic (NAD83)

Rig type : Track-mounted | Drilling Method :

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
	211.6	**GROUND SURFACE**				
0	211.4	150mm **TOPSOIL**				
	0.2	**SANDY SILT**, trace topsoil, trace rootlets, loose, brown		1	SS	8
	210.7					
1	0.9	**SILTY FINE SAND**, loose, brown		2	SS	6
				3	SS	6
2	209.5					
	2.1	**MEDIUM SAND**, occasional gravel, compact, brown		4	SS	20
3				5	SS	25
4						
				6	SS	18
5						
6				7	SS	20
	205.0					
	6.6	**END OF BOREHOLE**				

Elevation Scale (m): 211, 210, 209, 208, 207, 206

Penetration Test Values (Blows / 0.3m): Dynamic Cone 10 20 30 40

Undrained Shear Strength (kPa): ○ Unconfined ● Pocket Penetrometer + Field Vane ■ Lab Vane — 40 80 120 160

Moisture / Plasticity: Plastic Limit (PL) | Natural Water Content (MC) | Liquid Limit (LL) — 10 20 30

Headspace Vapour (ppm) | Instrument Details | Unstabilized Water Level | Lab Data and Comments | GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL

Borehole was dry and caved to 4.9 m below ground surface upon completion of drilling.

file: 7-17-0120-01 - simcoe wwtf.gpj

LOG OF BOREHOLE 3

Terraprobe

Project No. : 7-17-0120-01	Client : Hatch	Originated by : AF
Date started : October 11, 2017	Project : 16 Oakwood Avenue	Compiled by : KB
Sheet No. : 1 of 1	Location : Simcoe, Ontario	Checked by : KB

Position : E: 4742219, N: 557478 (UTM 17T) Elevation Datum : Geodetic (NAD83)

Rig type : Track-mounted Drilling Method :

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)
	212.3	**GROUND SURFACE**					
0	211.7	100mm **ASPHALTIC CONCRETE**					212
	0.6	**FILL**, Granular Base		1	SS	7	
1		**FILL**, sandy silt, trace topsoil, occasional gravel, loose, brown					211
	210.6			2	SS	8	
2	1.7	**SANDY SILT to SILTY SAND**, loose, brown					210
	209.7			3	SS	19	
3	2.6	**MEDIUM SAND**, occasional gravel, compact, brown		4	SS	30	209
4							208
5				5	SS	28	
							207
6				6	SS	14	
	205.3						206
7	7.0	**MEDIUM SAND**, occasional gravel, dense to very dense, brown					
				7	SS	33	205
8							204
9				8	SS	52	203
	202.5						
10	9.8	**SILT**, with seams and layers of silty clay and silty sand, dense to very dense, brown					202
				9	SS	32	
11							201
12							
				10	SS	38	200
13							
				11	SS	54	199
14							198
15							
				12	SS	20	197
16							196
17				13	SS	30	
							195
18	194.0						
	18.3	**SILTY CLAY**, hard, brown / grey		14	SS	32	194
19	192.8						
	19.5	**SILT**, trace clay, dense, grey					193
20				15	SS	65	
							192
21							
	190.5			16	SS	29	191
	21.8						

Penetration Test Values (Blows / 0.3m)
Dynamic Cone: 10 20 30 40
Undrained Shear Strength (kPa)
Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40 80 120 160

Moisture / Plasticity
Plastic Limit, Natural Water Content, Liquid Limit
PL MC LL
10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

0 23 63 14

0 3 62 35

END OF BOREHOLE

Combined Borehole from two separate Drill dates. Aug 31 & Oct. 11 2017.

Borehole was dry and open upon completion of drilling.

50 mm dia. monitoring well installed.

file: 7-17-0120-01 - simcoe wwtf.gpj

LOG OF BOREHOLE 3A

Terraprobe

Project No. : 7-17-0120-01	Client : Hatch	Originated by : AF
Date started : August 31, 2017	Project : 16 Oakwood Avenue	Compiled by : KB
Sheet No. : 1 of 1	Location : Simcoe, Ontario	Checked by : KB

Position : E: 4742210, N: 557485 (UTM 17T) Elevation Datum : Geodetic (NAD83)

Rig type : Track-mounted Drilling Method :

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
	212.3	**GROUND SURFACE**				
		100mm **ASPHALTIC CONCRETE**				
	211.7	**FILL**, Granular Base				
	0.6	**FILL**, sandy silt, trace topsoil, occasional gravel, loose, brown		1	SS	7
	210.6					
	1.7	**SANDY SILT to SILTY SAND**, loose, brown		2	SS	8
	209.7			3	SS	19
	2.6	**MEDIUM SAND**, occasional gravel, compact, brown		4	SS	30
				5	SS	28
				6	SS	14
	205.3					
	7.0	**MEDIUM SAND**, occasional gravel, dense to very dense, brown		7	SS	33
				8	SS	52
	202.5					
	9.8	**SILT**, with seams and layers of silty clay and silty sand, dense to very dense, brown		9	SS	32
				10	SS	38
				11	SS	52
	198.1					
	14.2	**END OF BOREHOLE**				

Penetration Test Values (Blows / 0.3m): Dynamic Cone 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane 40 80 120 160

Moisture / Plasticity: Plastic Limit, Natural Water Content, Liquid Limit; PL MC LL; 10 20 30

Elevation Scale (m): 212 211 210 209 208 207 206 205 204 203 202 201 200 199

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)

GR SA SI CL

1 11 70 18

Unstabilized water level measured at 6.1 m below ground surface; borehole caved to 6.1 m below ground surface upon completion of drilling.

file: 7-17-0120-01 - simcoe wwtf.gpj

LOG OF BOREHOLE 3B

Terraprobe

Project No. : 7-17-0120-01	Client : Hatch	Originated by : AF
Date started : October 11, 2017	Project : 16 Oakwood Avenue	Compiled by : KB
Sheet No. : 1 of 1	Location : Simcoe, Ontario	Checked by : KB

Position : E: 4742219, N: 557478 (UTM 17T) Elevation Datum : Geodetic (NAD83)

Rig type : Track-mounted Drilling Method :

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)
	212.3	**GROUND SURFACE**					
	211.7 / 0.6	100mm **ASPHALTIC CONCRETE**					
		FILL, Granular Base					
	210.6 / 1.7	**FILL**, sandy silt, trace topsoil, occasional gravel, loose, brown					
	209.7 / 2.6	**SANDY SILT to SILTY SAND**, loose, brown					
	205.3 / 7.0	**MEDIUM SAND**, occasional gravel, compact, brown					
	202.5 / 9.8	**MEDIUM SAND**, occasional gravel, dense to very dense, brown					
	197.1 / 15.2	**SILT**, with seams and layers of silty clay and silty sand, dense to very dense, brown		1	SS	30	
				2	SS	54	
	194.0 / 18.3	**SILTY SAND**, with seams and layers of silt, compact to dense, grey		3	SS	20	
				4	SS	30	
	190.5 / 21.8	**CLAYEY SILT to SILT**, with seams and layers of silty sand, dense to very dense, grey		5	SS	32	
				6	SS	65	
				7	SS	29	

Penetration Test Values (Blows / 0.3m)
Dynamic Cone: 10 20 30 40
Undrained Shear Strength (kPa)
Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40 80 120 160

Moisture / Plasticity
Plastic Limit (PL) Natural Water Content (MC) Liquid Limit (LL)
10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments
GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

50 mm dia. monitoring well installed.

file: 7-17-0120-01 - simcoe wwtf.gpj

LOG OF BOREHOLE 4

Terraprobe

Project No. : 7-17-0120-01	Client : Hatch	Originated by : AF
Date started : August 30, 2017	Project : 16 Oakwood Avenue	Compiled by : KB
Sheet No. : 1 of 1	Location : Simcoe, Ontario	Checked by : KB

Position : E: 4742193, N: 557983 (UTM 17T) Elevation Datum : Geodetic (NAD83)

Rig type : Track-mounted Drilling Method :

Depth (m)	Elev Depth (m)	Description	Number	Type	SPT 'N' Value	Elevation (m)	Lab Data and Comments (GR SA SI CL)
0	212.4	**GROUND SURFACE**					
		100mm **ASPHALTIC CONCRETE**					
	211.8	**FILL**, Granular Base					
	0.6	**FILL**, sandy silt, trace topsoil, occasional rootlets, trace gravel, loose, brown	1	SS	4		
1	211.2					212	
	1.2	**SANDY SILT to SILTY SAND**, loose, brown	2	SS	7	211	
2	210.3						
	2.1	**MEDIUM SAND**, occasional gravel, compact, brown	3	SS	24	210	
3			4	SS	15	209	29 67 3 1
4						208	
5			5	SS	22	207	
6			6	SS	10	206	4 92 1 3
7	205.4					205	
	7.0	**MEDIUM SAND**, occasional gravel, dense to very dense, brown	7	SS	35		2 93 3 2
8						204	
9	203.0		8	SS	59	203	
	9.4	**SILT**, with seams and layers of silty clay, dense to very dense, brown					
10			9	SS	55	202	
11						201	
12			10	SS	74	200	
13						199	
14	198.2		11	SS	46		
	14.2	**END OF BOREHOLE**					

Penetration Test Values (Blows / 0.3m): Dynamic Cone 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane 40 80 120 160

Moisture / Plasticity: Plastic Limit, Natural Water Content, Liquid Limit — PL MC LL 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

GRAIN SIZE DISTRIBUTION (%) (MIT)

Unstabilized water level measured at 5.7 m below ground surface; borehole was open upon completion of drilling.

50 mm dia. monitoring well installed

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Aug 31, 2017	5.8	206.6
Sep 13, 2017	5.8	206.6

file: 7-17-0120-01 - simcoe wwtf.gpj

LOG OF BOREHOLE 5

Terraprobe

Project No. : 7-17-0120-01	Client : Hatch	Originated by : AF
Date started : August 28, 2017	Project : 16 Oakwood Avenue	Compiled by : KB
Sheet No. : 1 of 1	Location : Simcoe, Ontario	Checked by : KB

Position : E: 4742127, N: 557628 (UTM 17T) Elevation Datum : Geodetic (NAD83)

Rig type : Track-mounted Drilling Method :

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
	213.4	**GROUND SURFACE**				
0	213.2	150mm **TOPSOIL**				
	0.2	**SANDY SILT**, trace topsoil, trace rootlets, compact, brown		1	SS	10
	212.5					
1	0.9	**SILTY FINE SAND**, loose, brown		2	SS	14
				3	SS	7
2				4	SS	16
	210.5					
3	2.9	**MEDIUM SAND**, occasional gravel, occasional silty seams, compact, brown		5	SS	21
4						
				6	SS	21
5						
6				7	SS	18
	206.8					
	6.6	**END OF BOREHOLE**				

Elevation Scale (m): 213, 212, 211, 210, 209, 208, 207

Penetration Test Values (Blows / 0.3m)
× Dynamic Cone
10 20 30 40
Undrained Shear Strength (kPa)
○ Unconfined + Field Vane
● Pocket Penetrometer ■ Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit | Natural Water Content | Liquid Limit
PL MC LL
10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

Borehole was dry and caved to 4.9 m below ground surface upon completion of drilling.

file: 7-17-0120-01 - simcoe wwtf.gpj

LOG OF BOREHOLE 6

Terraprobe

Project No. : 7-17-0120-01	Client : Hatch	Originated by : AF
Date started : August 29, 2017	Project : 16 Oakwood Avenue	Compiled by : KB
Sheet No. : 1 of 1	Location : Simcoe, Ontario	Checked by : KB

Position : E: 4742124, N: 557553 (UTM 17T) Elevation Datum : Geodetic (NAD83)

Rig type : Track-mounted Drilling Method :

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	211.5	**GROUND SURFACE**				
	211.3	150mm **ASPHALTIC CONCRETE**				
	0.2	**FILL**, Granular Base				
	210.9					
	0.6	**FILL**, clayey silt, trace sand, occasional gravel, firm, brown		1	SS	7
1				2	SS	4
2	209.4					
	2.1	**MEDIUM SAND**, occasional gravel, compact, brown		3	SS	18
3				4	SS	22
	208.0					
	3.5	**END OF BOREHOLE**				

Elevation Scale (m): 211, 210, 209, 208

Penetration Test Values (Blows / 0.3m): Dynamic Cone 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane — 40 80 120 160

Moisture / Plasticity: Plastic Limit (PL) Natural Water Content (MC) Liquid Limit (LL) — 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL

Borehole was dry and open upon completion of drilling.

file: 7-17-0120-01 - simcoe wwtf.gpj

LOG OF BOREHOLE 7

Terraprobe

Project No. : 7-17-0120-01	Client : Hatch	Originated by : AF
Date started : August 29, 2017	Project : 16 Oakwood Avenue	Compiled by : KB
Sheet No. : 1 of 1	Location : Simcoe, Ontario	Checked by : KB

Position : E: 4742073, N: 557633 (UTM 17T) Elevation Datum : Geodetic (NAD83)

Rig type : Track-mounted Drilling Method :

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	210.4	**GROUND SURFACE**				
	210.2	150mm **TOPSOIL**				
	0.2	**SANDY SILT**, trace topsoil, trace rootlets, loose, brown		1	SS	10
	209.8					
1	0.6	**SILTY FINE SAND**, loose, brown		2	SS	4
	208.9					
2	1.5	**MEDIUM SAND**, occasional gravel, compact, brown		3	SS	18
				4	SS	13
3				5	SS	12
4				6	SS	15
5				7	SS	22
6				8	SS	12
7						
8	202.3					
	8.1	**END OF BOREHOLE**				

Elevation Scale (m): 210, 209, 208, 207, 206, 205, 204, 203

Penetration Test Values (Blows / 0.3m): Dynamic Cone 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane — 40 80 120 160

Moisture / Plasticity: Plastic Limit (PL) Natural Water Content (MC) Liquid Limit (LL) — 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL

Unstabilized water level measured at 4.5 m below ground surface; borehole caved to 4.3 m below ground surface upon completion of drilling.

50 mm dia. monitoring well installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Aug 31, 2017	4.1	206.4
Sep 13, 2017	4.0	206.4

file: 7-17-0120-01 - simcoe wwtf.gpj

LOG OF BOREHOLE 8

Terraprobe

Project No. : 7-17-0120-01	Client : Hatch	Originated by : AF
Date started : August 30, 2017	Project : 16 Oakwood Avenue	Compiled by : KB
Sheet No. : 1 of 1	Location : Simcoe, Ontario	Checked by : KB

Position : E: 4742187, N: 557540 (UTM 17T) Elevation Datum : Geodetic (NAD83)

Rig type : Track-mounted Drilling Method :

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	212.0	**GROUND SURFACE**				
		100mm **TOPSOIL**				
		FILL, sandy silt, trace topsoil, trace rootlets, loose to compact, brown		1	SS	12
1				2	SS	8
	210.8					
	1.2	**SANDY SILT to SILTY SAND**, loose to compact, brown		3	SS	9
2				4	SS	6
	209.2					
	2.8	**MEDIUM SAND**, occasional gravel, compact, brown		5	SS	21
3						
4				6	SS	27
5						
6				7	SS	21
7						
8				8	SS	17

Elevation Scale (m): 211, 210, 209, 208, 207, 206, 205, 204

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10, 20, 30, 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40, 80, 120, 160

Moisture / Plasticity — Plastic Limit, Natural Water Content, Liquid Limit: PL, MC, LL; 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL

END OF BOREHOLE

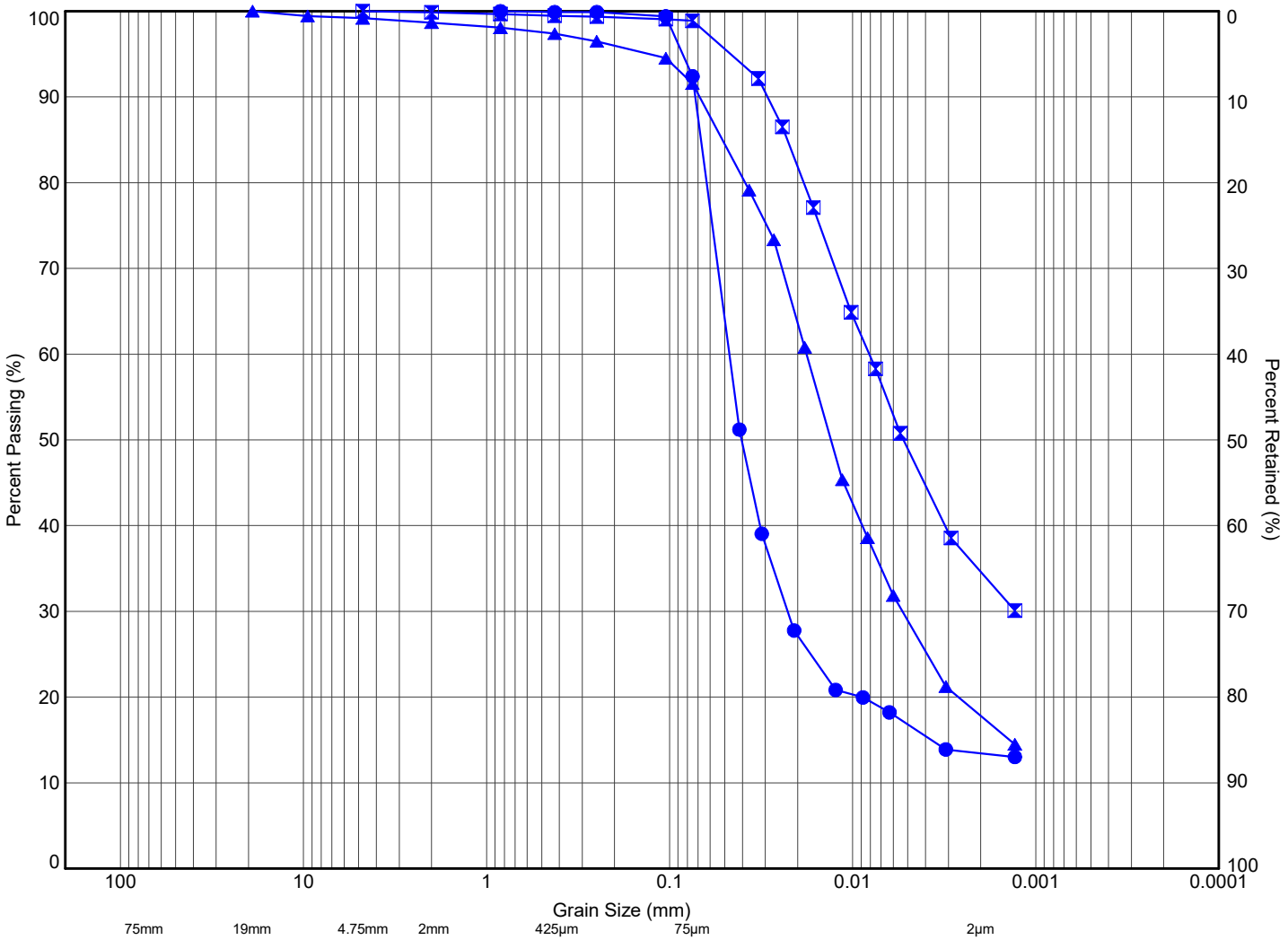
Unstabilized water level measured at 6.1 m below ground surface; borehole was open upon completion of drilling.

50 mm dia. monitoring well installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Aug 31, 2017	5.7	206.3
Sep 13, 2017	5.7	206.3

file: 7-17-0120-01 - simcoe wwtf.gpj

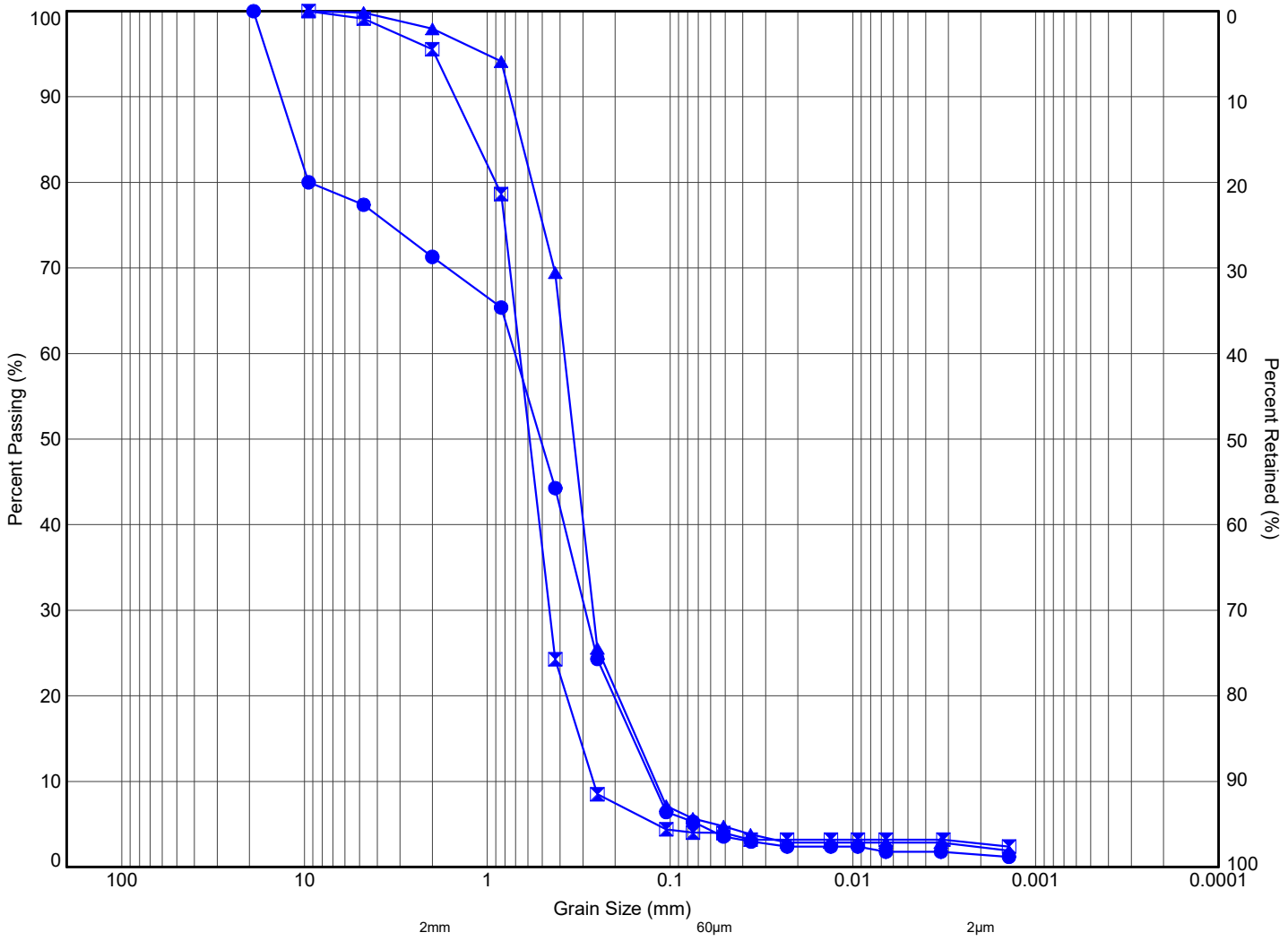


	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**3**	SS13	17.0	195.3	0	7	79	14	
⊠	**3**	SS14	18.5	193.8	0	1	64	35	
▲	**3A**	SS10	12.4	199.9	1	7	74	18	

Terraprobe
11 Indell Lane, Brampton Ontario L6T 3Y3
(905) 796-2650

Title: **GRAIN SIZE DISTRIBUTION**

File No.: **7-17-0120-01**



MIT SYSTEM	COBBLES	GRAVEL			SAND			SILT	CLAY
		COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE		

MIT SYSTEM

	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**4**	SS4	3.3	209.1	29	67	3	1	
⊠	**4**	SS6	6.3	206.1	4	92	1	3	
▲	**4**	SS7	7.8	204.6	2	93	3	2	

Terraprobe
903 Barton Street, Unit 22, Stoney Creek ON L8E 5P5
(905) 643-7560

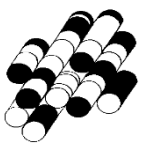
Title: **GRAIN SIZE DISTRIBUTION**

File No.: **7-17-0120-01**

Results of In-Situ Hydraulic Conductivity Testing

APPENDIX B

Terraprobe Inc.



Appendix B: Aquifer Response Test Results
Monitoring Well MW 3B
Simcoe WWTF Expansion
16 Oakwood Avenue
Simcoe, Ontario

Test Completed on	16-Oct-17	
well depth	190.90	m
r (casing radius)	0.025	m
L (length of screen)	3.2	m
R (filter pack [borehole] radius)	0.03	m
To (time lag*)	2972	sec
H (initial water level before slug)	206.53	m
Ho (water level at t=0)	199.22	m
h (recorded water level at time t)	See Column F	

* To = t when (H-h)/(H-Ho) = 0.37 and ln(H-h)/H-Ho)=-1

Hydraulic Conductivity (K) =(r^2 ln(L/R))/(2LTo)

1.53E-07 m/sec

Time lag is defined as the time required for the complete equalization of the head difference if the original rate of inflow were maintained.

Water Level (masl)	(H-h)/(H-Ho)	Elapsed Time (s)
199.25	1.00	15
199.33	0.98	30
199.52	0.96	45
199.60	0.95	60
199.65	0.94	75
199.72	0.93	90
199.76	0.93	105
199.80	0.92	120
199.90	0.91	150
199.99	0.89	180
200.10	0.88	210
200.21	0.86	240
200.32	0.85	270
200.38	0.84	300
200.52	0.82	360
200.68	0.80	420
200.76	0.79	480
200.87	0.77	540
200.94	0.76	600
201.09	0.74	720
201.23	0.73	840
201.37	0.71	960
201.45	0.69	1080
201.57	0.68	1200
201.82	0.64	1500
202.02	0.62	1800

Appendix B: Aquifer Response Test Results
Monitoring Well MW 4
Simcoe WWTF Expansion
16 Oakwood Avenue
Simcoe, Ontario

Test Completed on	16-Oct-17	
well depth	198.70	m
r (casing radius)	0.025	m
L (length of screen)	3	m
R (filter pack [borehole] radius)	0.03	m
To (time lag*)	86	sec
H (initial water level before slug)	206.67	m
Ho (water level at t=0)	206	m
h (recorded water level at time t)	See Column F	

* To = t when (H-h)/(H-Ho) = 0.37 and ln(H-h)/H-Ho)=-1

Hydraulic Conductivity (K) =(r^2 ln(L/R))/(2LTo)

5.58E-06 m/sec

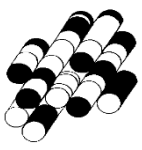
Time lag is defined as the time required for the complete equalization of the head difference if the original rate of inflow were maintained.

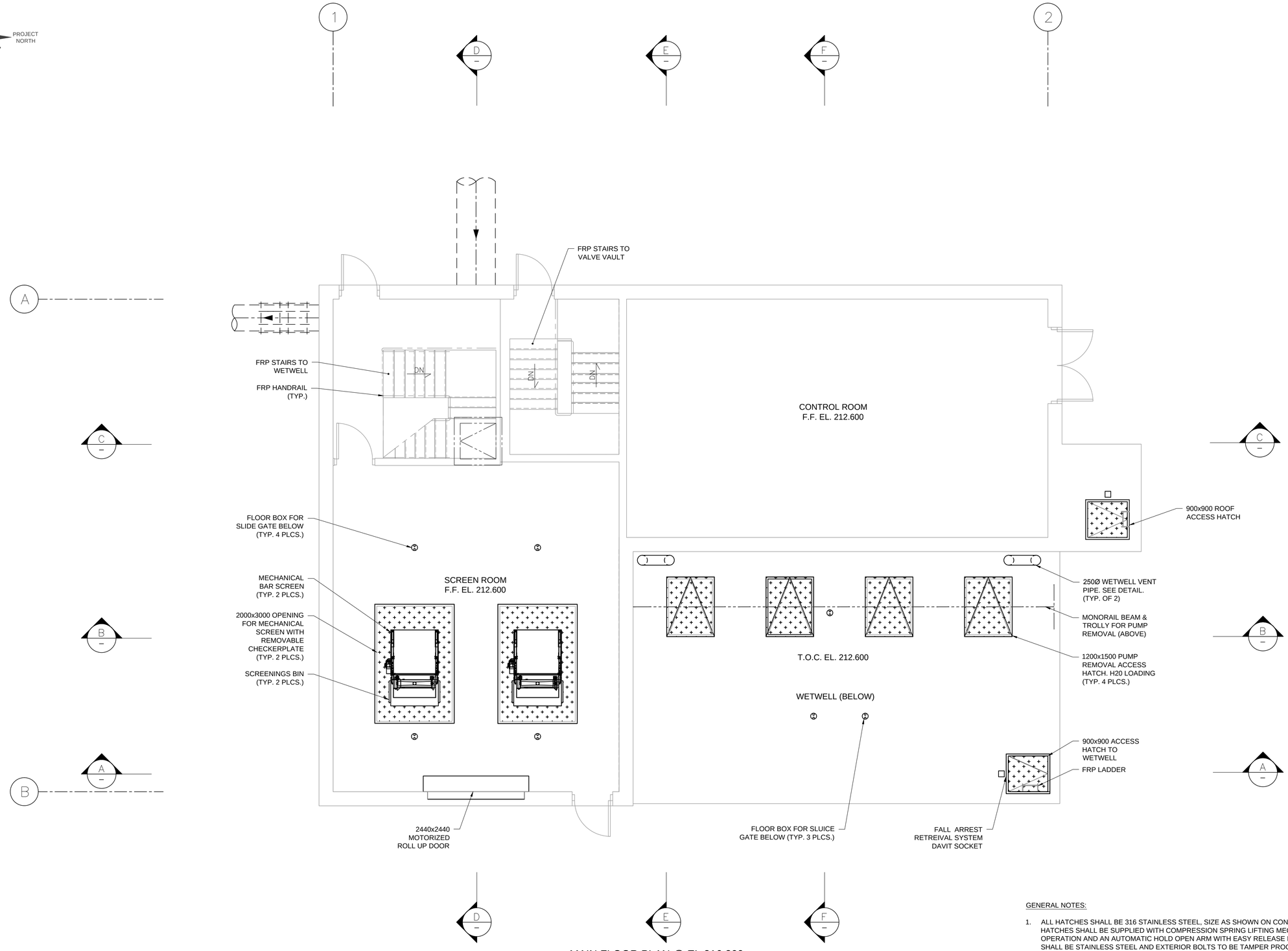
Water Level (masl)	(H-h)/(H-Ho)	Elapsed Time (s)
206.08	0.88	15
206.18	0.73	30
206.30	0.55	45
206.32	0.52	60
206.40	0.40	75
206.45	0.33	90
206.47	0.30	105
206.50	0.25	120
206.53	0.21	150
206.56	0.16	180
206.58	0.13	210
206.60	0.10	240
206.61	0.09	270
206.62	0.07	300
206.62	0.07	360
206.63	0.06	420
206.63	0.06	480
206.64	0.04	540
206.64	0.04	600
206.64	0.04	720
206.64	0.04	840
206.64	0.04	960
206.64	0.04	1080
206.64	0.04	1200
206.64	0.04	1500
206.64	0.04	1800

Engineering Site Plans

APPENDIX C

Terraprobe Inc.





MAIN FLOOR PLAN @ EL 216.200

GENERAL NOTES:

1. ALL HATCHES SHALL BE 316 STAINLESS STEEL, SIZE AS SHOWN ON CONTRACT DRAWINGS. ALL HATCHES SHALL BE SUPPLIED WITH COMPRESSION SPRING LIFTING MECHANISM FOR EASY OPERATION AND AN AUTOMATIC HOLD OPEN ARM WITH EASY RELEASE HANDLE. ALL HARDWARE SHALL BE STAINLESS STEEL AND EXTERIOR BOLTS TO BE TAMPER PROOF. HATCHES SHALL BE AS MANUFACTURED BY BILCO OR AN APPROVED EQUAL.
2. ALL INTERIOR PIPING AND FITTINGS SHALL BE 316 STAINLESS STEEL UNLESS OTHERWISE NOTED.
3. ALL PROCESS PIPING TO BE RATED FOR 150 PSI COLD WATER WORKING PRESSURE.

NO.	REVISION	DATE	INIT.

NOTES

ISSUE: PRELIMINARY

SCALE BAR: 1:50 (0, 1, 2m)

DRAFTING: AR
DESIGN: SM
CHECKED BY: GD
APPROVED BY: GD

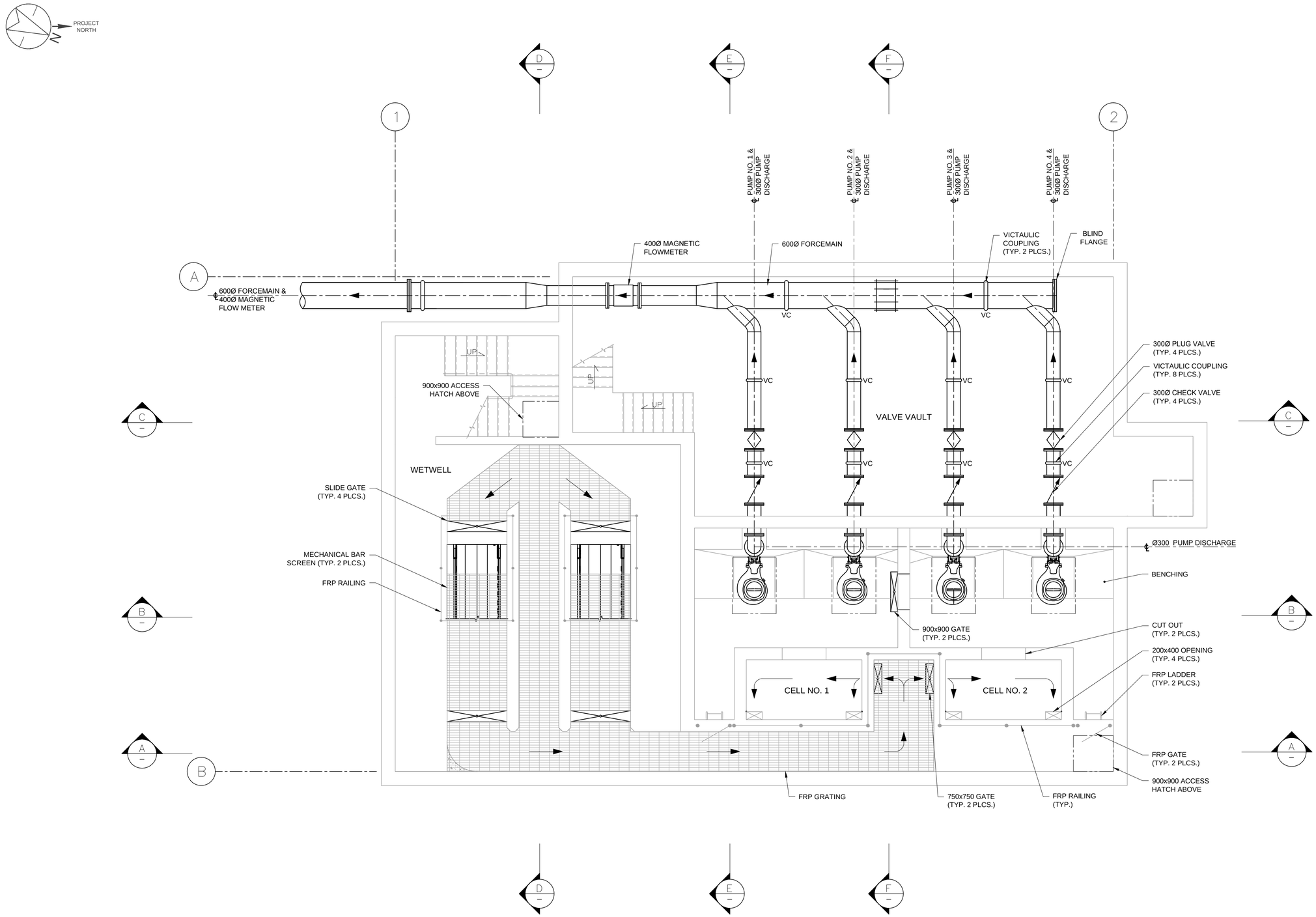
Norfolk County

HATCH

SIMCOE WWTF UPGRADES
NORFOLK COUNTY
PROCESS
HEADWORKS FACILITY
MAIN FLOOR PLAN

CONSULTANT FILE No.353644
DATE 2017/03/21
SCALE AS NOTED
REF. No. PW-E-16-78
DWG No. P201
REV.

8/21/2017 353644-Process Headworks.dwg



INTERMEDIATE PLAN @ EL 210.000

NOTE:

1. ——► REPRESENTS DIRECTION OF FLOW

NO.	REVISION	DATE	INIT.

NOTES

ISSUE: PRELIMINARY

SCALE BAR: 1:50 (0, 1, 2m)

DRAFTING: AR
DESIGN: SM
CHECKED BY: GD
APPROVED BY: GD

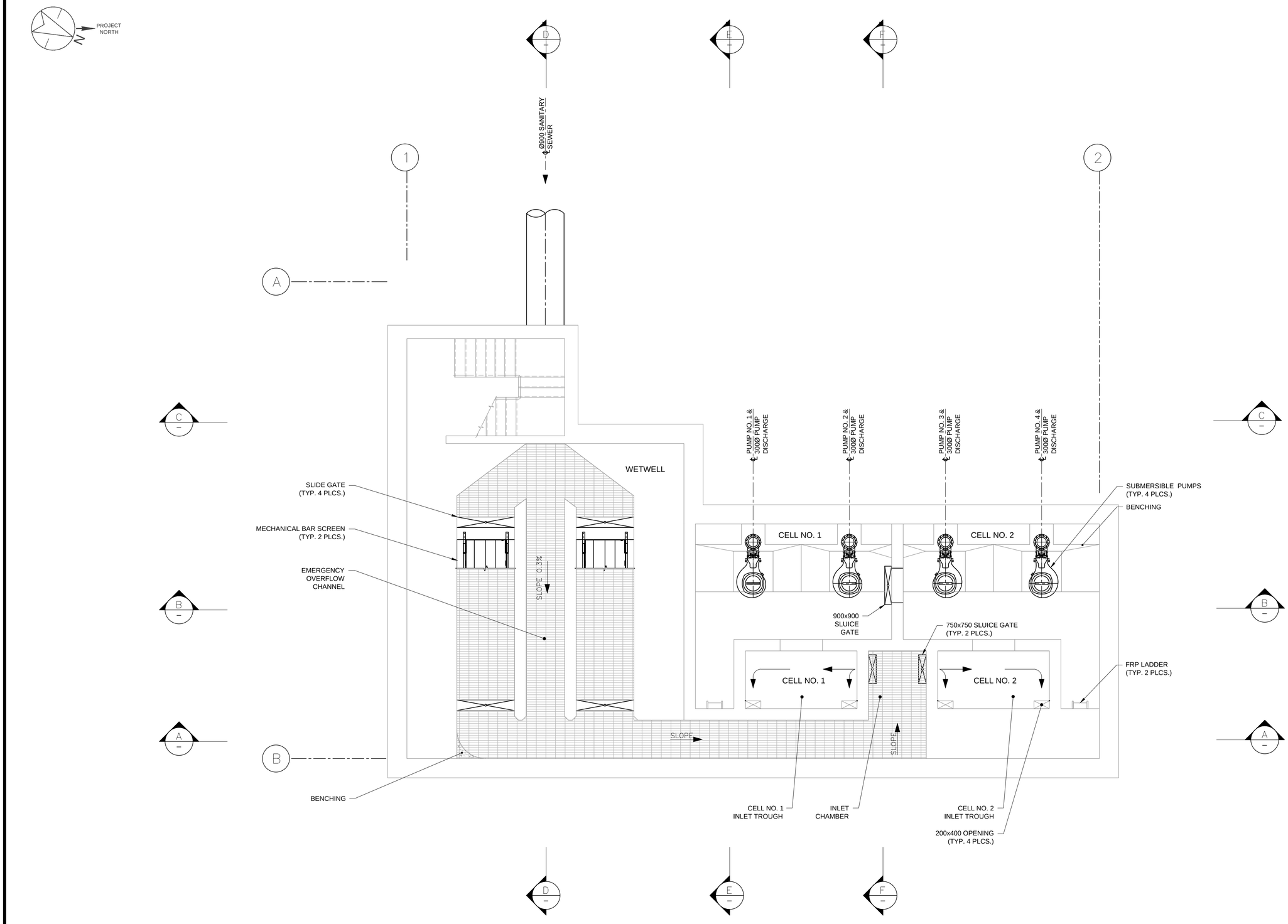
Norfolk County

HATCH

SIMCOE WWTF UPGRADES
NORFOLK COUNTY
PROCESS
HEADWORKS FACILITY
INTERMEDIATE PLAN

CONSULTANT FILE No.353644
DATE 2017/03/21
SCALE AS NOTED
REF. No. PW-E-16-78
DWG No. P202
REV.

8/21/2017 353644-Process Headworks.dwg



LOWER PLAN @ EL 204.000

NO.	REVISION	DATE	INIT.

NOTES

ISSUE: PRELIMINARY

SCALE BAR: 1:50 (0, 1, 2m)

DRAFTING: AR
DESIGN: SM
CHECKED BY: GD
APPROVED BY: GD

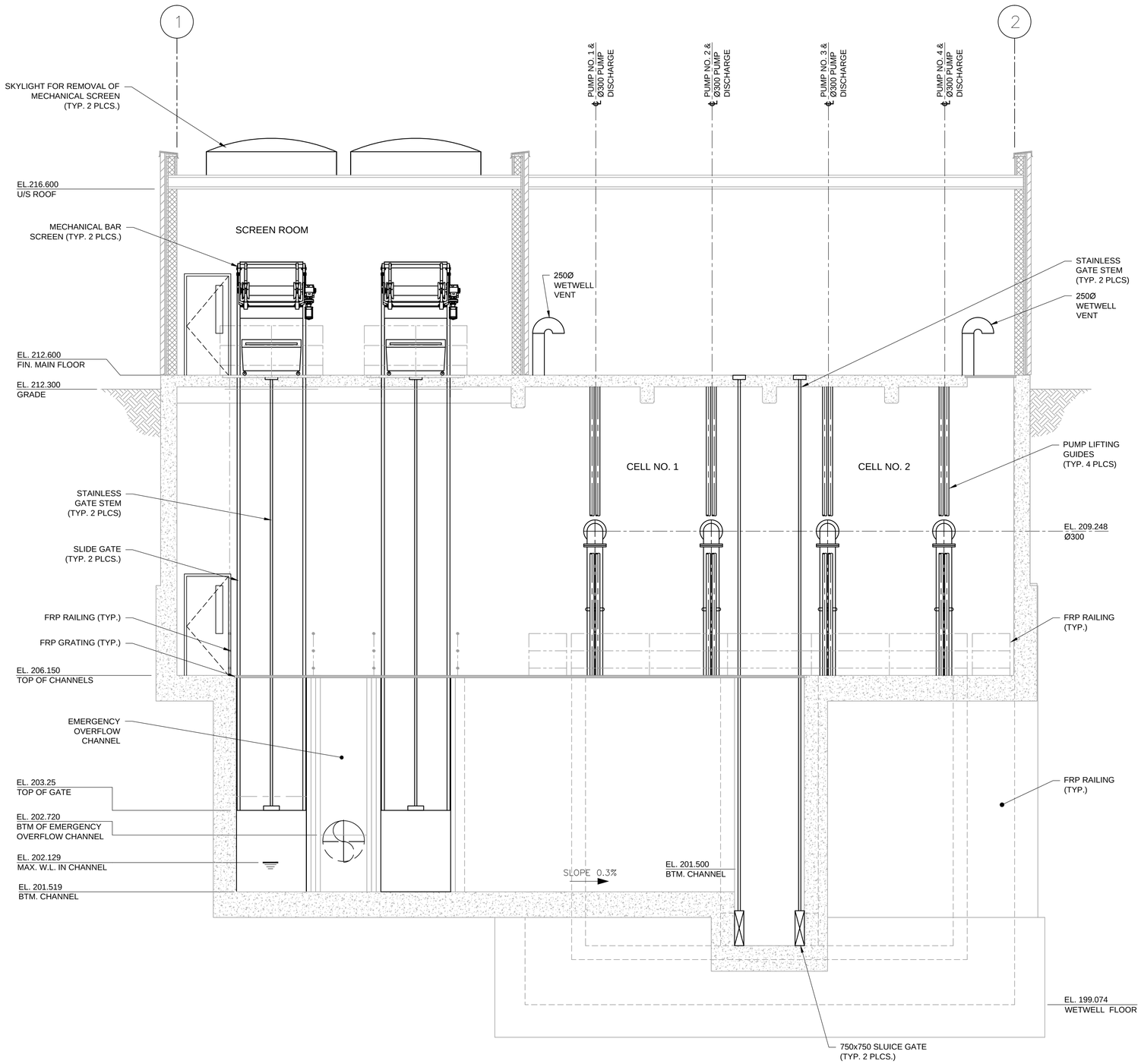
Norfolk County

HATCH

SIMCOE WWTF UPGRADES
NORFOLK COUNTY
PROCESS
HEADWORKS FACILITY
LOWER PLAN

CONSULTANT FILE No.353644
DATE 2017/03/21
SCALE AS NOTED
REF. No. PW-E-16-78
DWG No. P203
REV.

353644-Process Headworks.dwg
8/21/2017



SECTION A – 1:50

NO.	REVISION	DATE	INIT.

NOTES

ISSUE: PRELIMINARY

SCALE BAR: 1:50 (0, 1, 2m)

DRAFTING: AR
DESIGN: SM
CHECKED BY: GD
APPROVED BY: GD

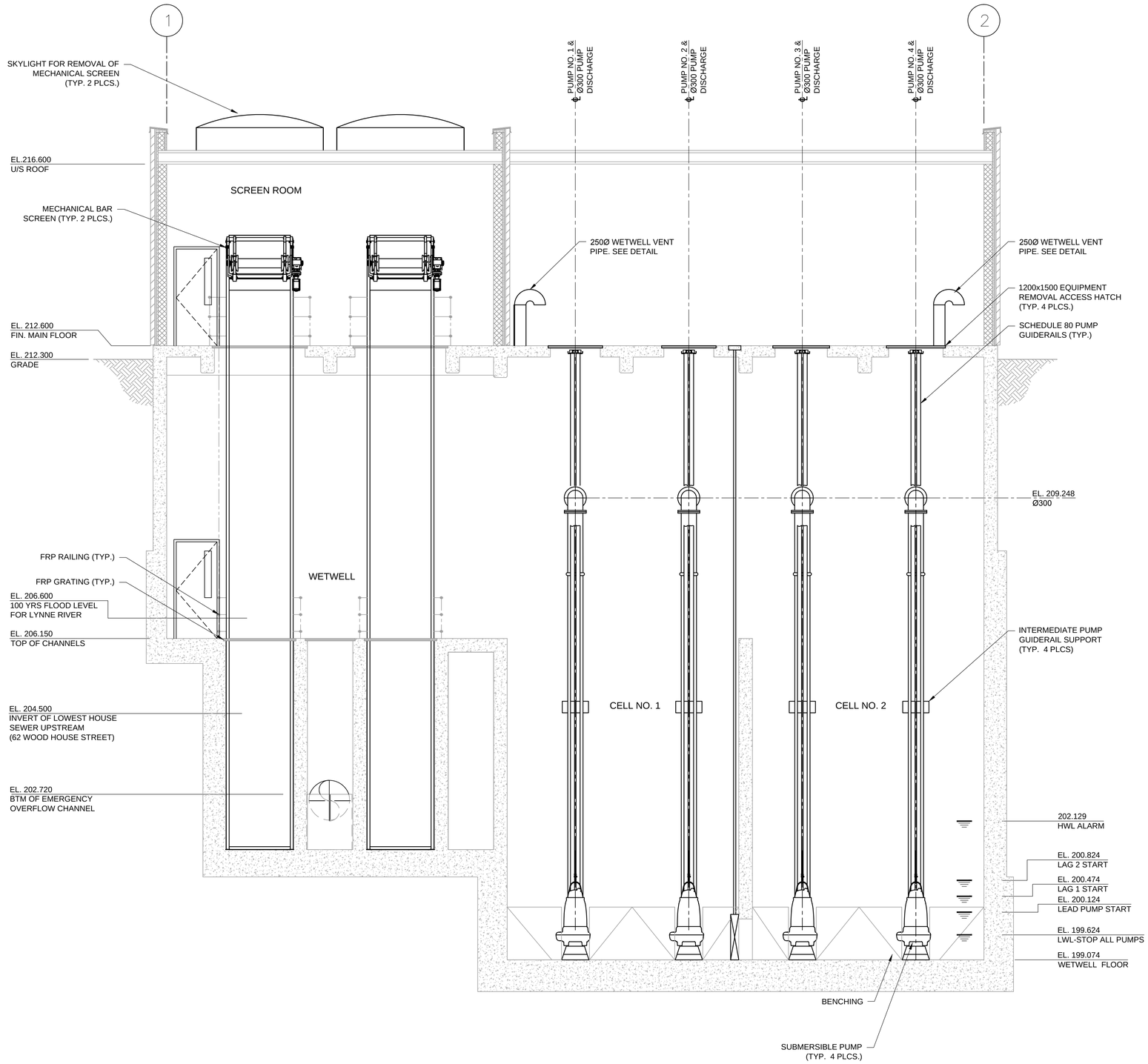
Norfolk County

HATCH

SIMCOE WWTF UPGRADES
NORFOLK COUNTY
PROCESS
HEADWORKS FACILITY
SECTION A-A

CONSULTANT FILE No.353644
DATE 2017/03/21
SCALE AS NOTED
REF. No. PW-E-16-78
DWG No. P204
REV.

8/21/2017 353644-Process Headworks.dwg



SECTION B
1:50

no.	REVISION	DATE	INIT.

NOTES

ISSUE: PRELIMINARY

SCALE BAR 1:50 (0, 1, 2m)

DRAFTING: AR
DESIGN: SM
CHECKED BY: GD
APPROVED BY: GD

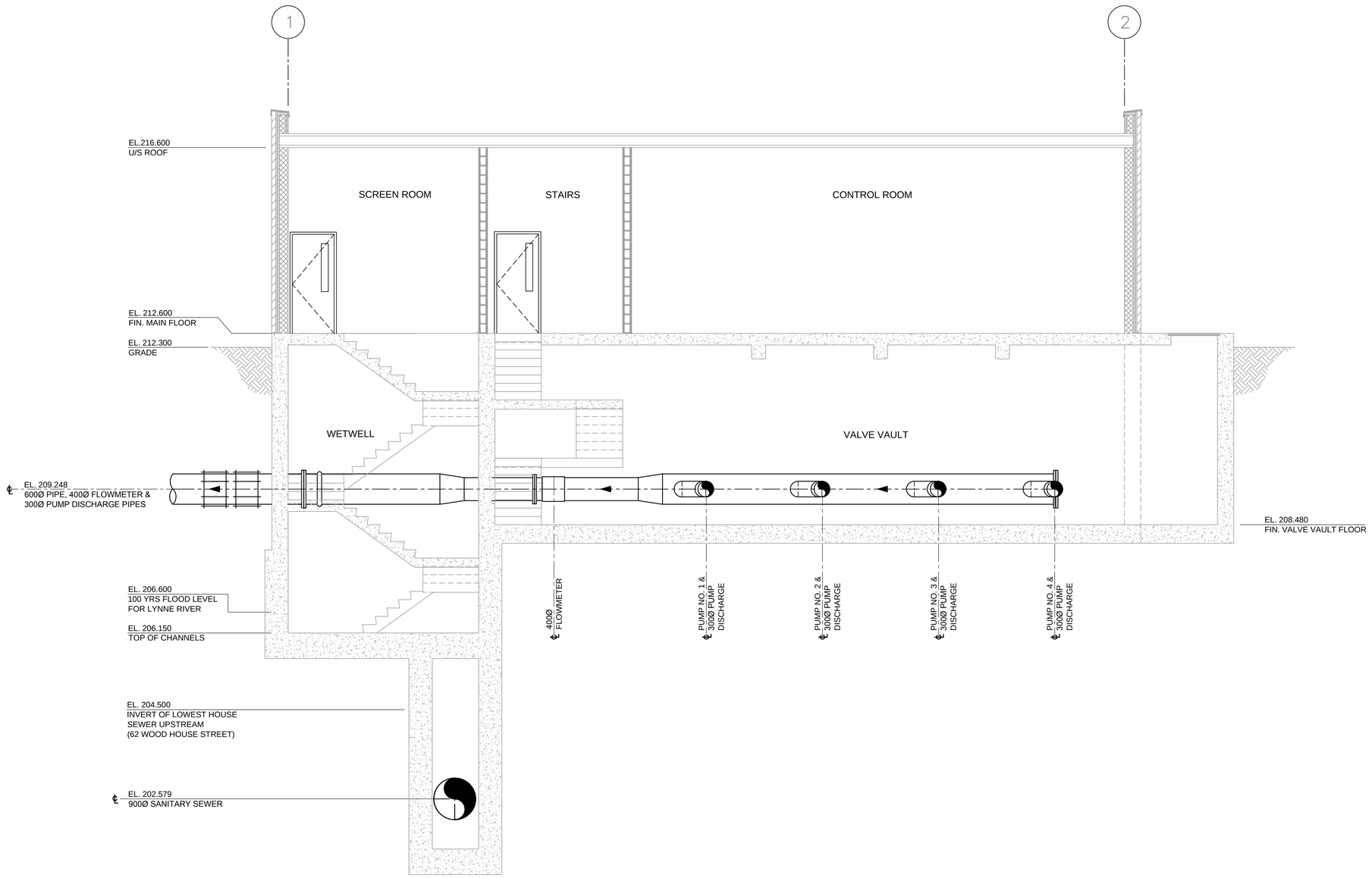
Norfolk County

HATCH

SIMCOE WWTF UPGRADES
NORFOLK COUNTY
PROCESS
HEADWORKS FACILITY
SECTION B-B

CONSULTANT FILE No.353644
DATE 2017/03/21
SCALE AS NOTED
REF. No. PW-E-16-78
DWG No. P205
REV.

8/21/2017 353644-Process Headworks.dwg



SECTION C
1:50

NO.	REVISION	DATE	INIT.

NOTES

ISSUE: PRELIMINARY

SCALE BAR: 0 1 2m, 1:50

DRAFTING: AR
DESIGN: SM
CHECKED BY: GD
APPROVED BY: GD

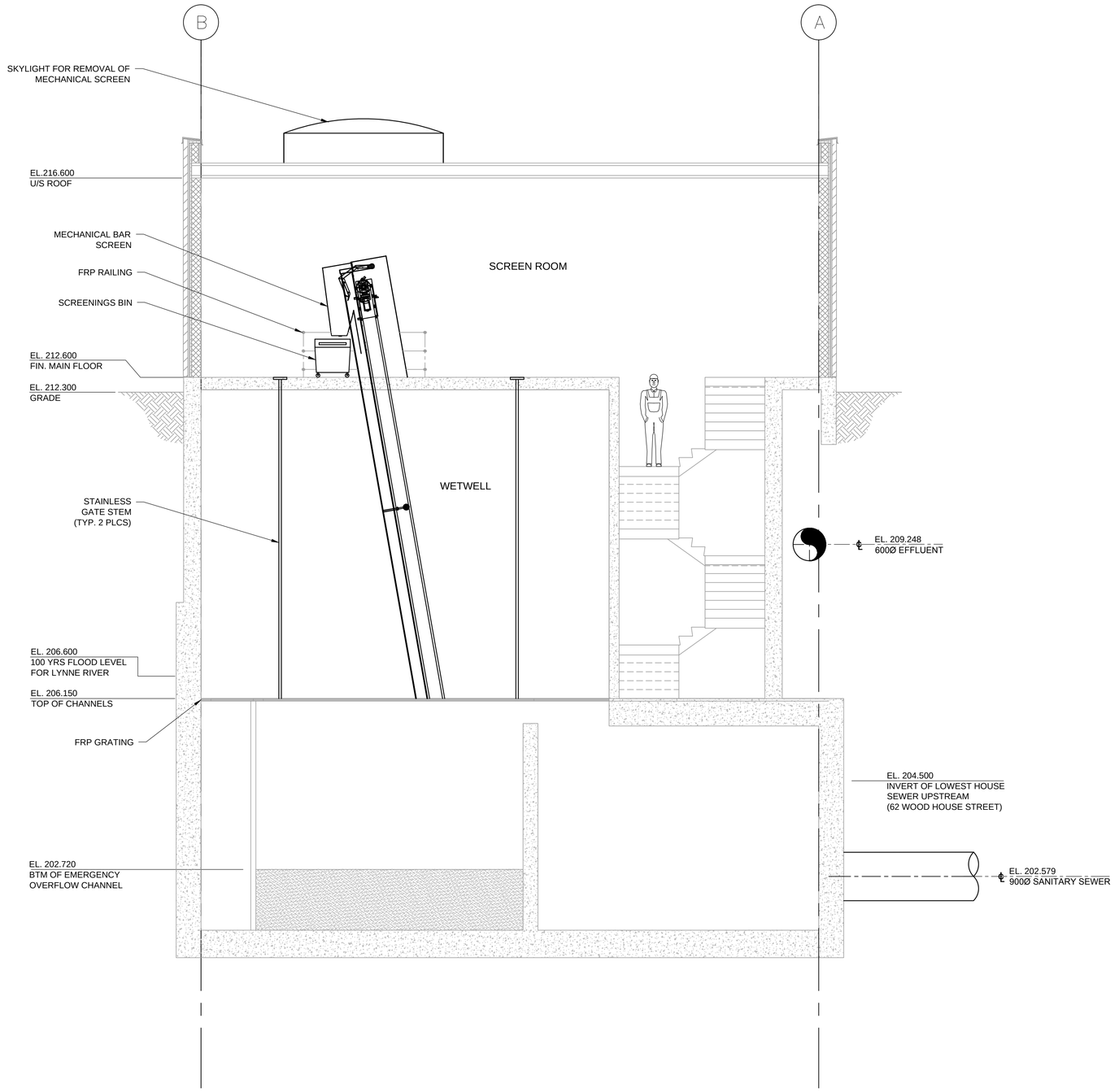
Norfolk COUNTY

HATCH

SIMCOE WWTF UPGRADES
NORFOLK COUNTY
PROCESS
HEADWORKS FACILITY
SECTION C-C

CONSULTANT FILE No.353644
DATE 2017/03/21
SCALE AS NOTED
REF. No. PW-E-16-78
DWG No. P206
REV.

8/21/2017 353644-Process Headworks.dwg



SECTION D
1:50

NO.	REVISION	DATE	INIT.

NOTES

ISSUE: PRELIMINARY

SCALE BAR 1:50 (0, 1, 2m)

DRAFTING: AR
DESIGN: SM
CHECKED BY: GD
APPROVED BY: GD

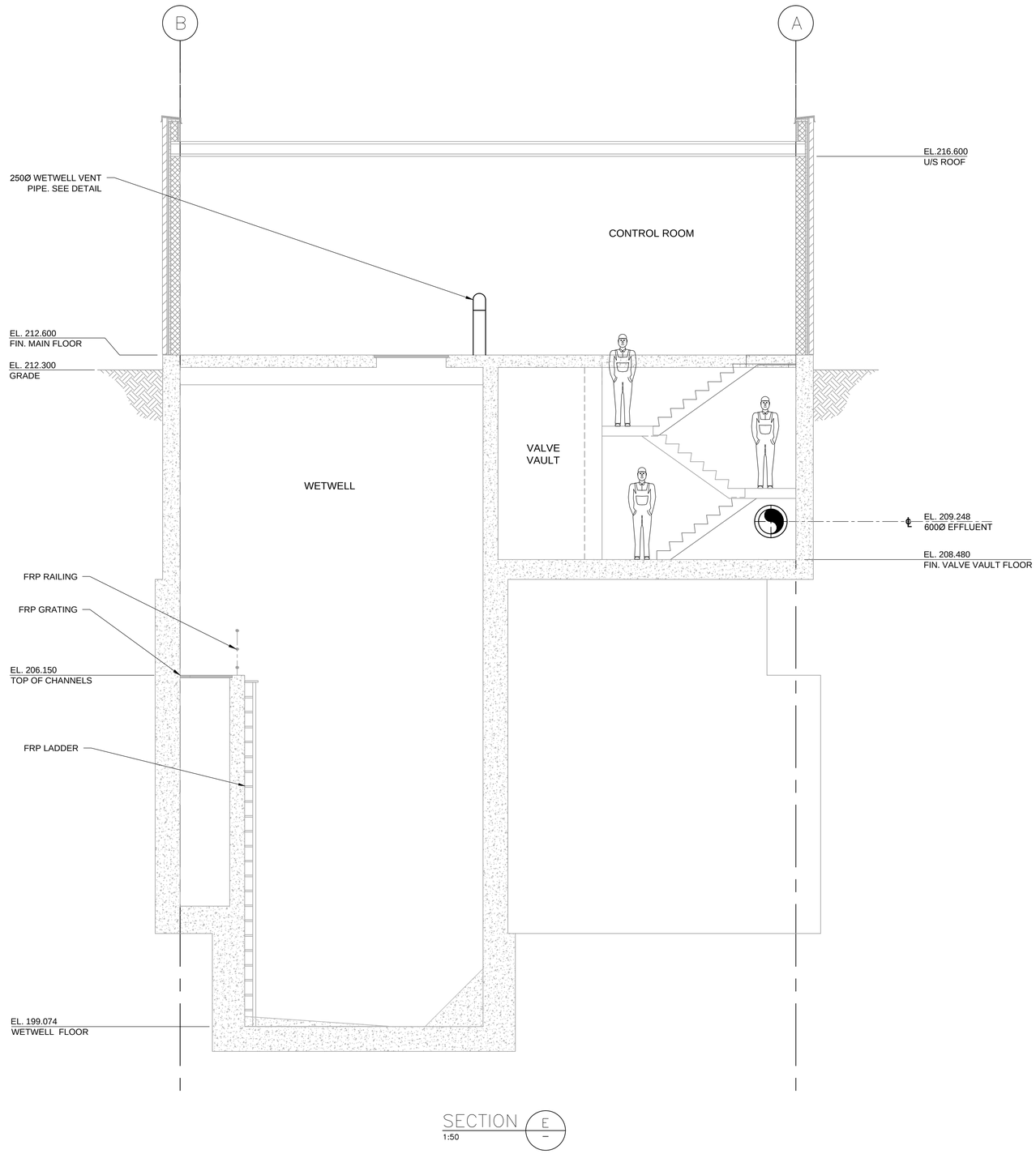
Norfolk County

HATCH

SIMCOE WWTF UPGRADES
NORFOLK COUNTY
PROCESS
HEADWORKS FACILITY
SECTION D-D

CONSULTANT FILE No.353644
DATE 2017/03/21
SCALE AS NOTED
REF. No. PW-E-16-78
DWG No. P207
REV.

8/21/2017 353644-Process Headworks.dwg



SECTION E
1:50

NO.	REVISION	DATE	INIT.

NOTES

ISSUE: PRELIMINARY

SCALE BAR: 1:50 (0, 1, 2m)

DRAFTING: AR
DESIGN: SM
CHECKED BY: GD
APPROVED BY: GD

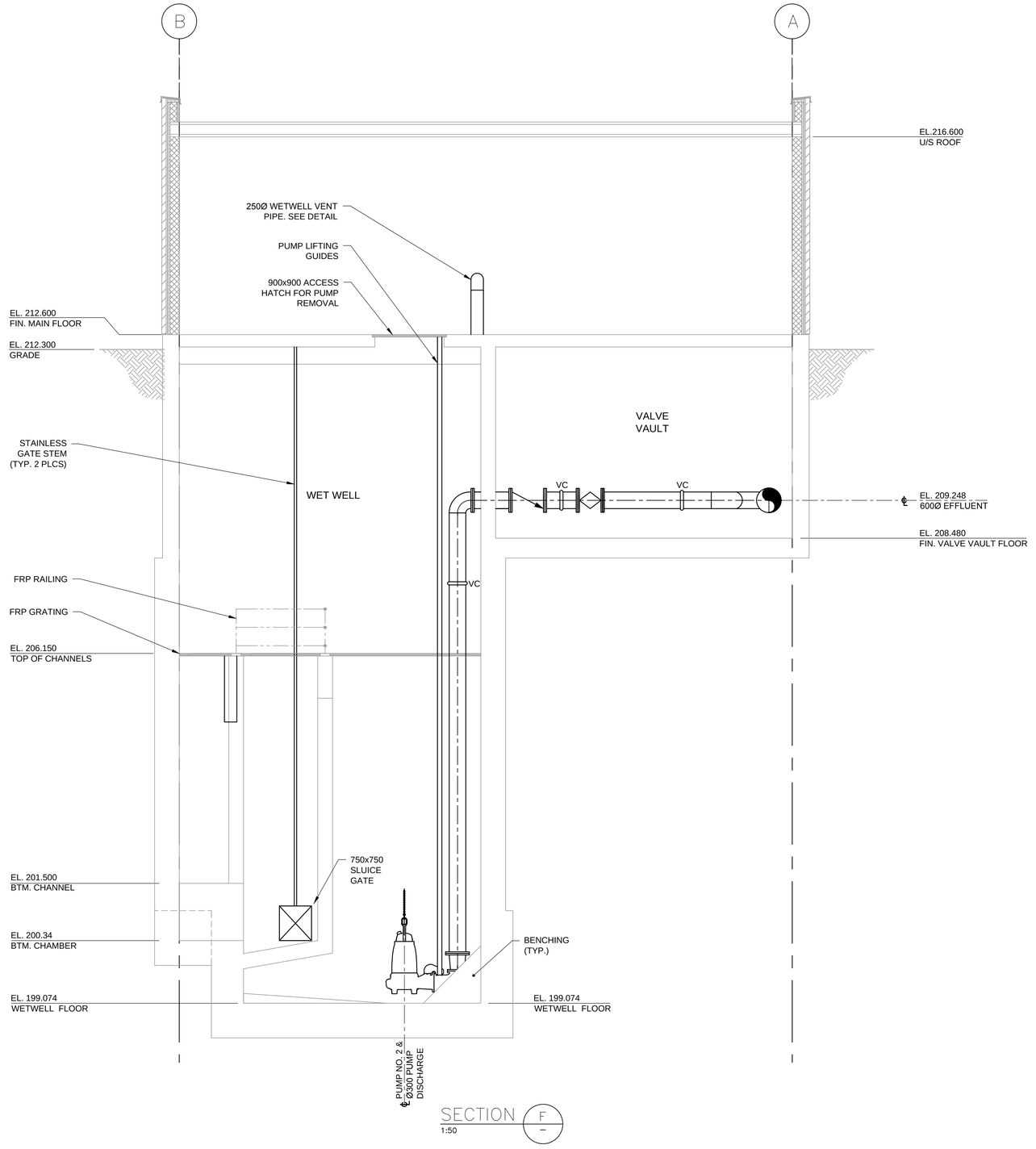
Norfolk County

HATCH

SIMCOE WWTF UPGRADES
NORFOLK COUNTY
PROCESS
HEADWORKS FACILITY
SECTION E-E

CONSULTANT FILE No.353644
DATE 2017/03/21
SCALE AS NOTED
REF. No. PW-E-16-78
DWG No. P208
REV.

8/21/2017 353644-Process Headworks.dwg



NO.	REVISION	DATE	INIT.

NOTES

ISSUE: PRELIMINARY

SCALE BAR 1:50 (0, 1, 2m)

DRAFTING: AR
DESIGN: SM
CHECKED BY: GD
APPROVED BY: GD

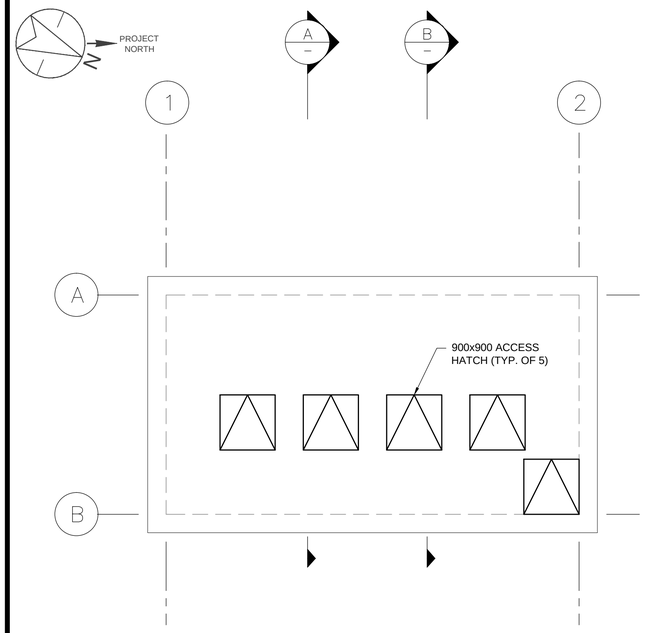
Norfolk County

HATCH

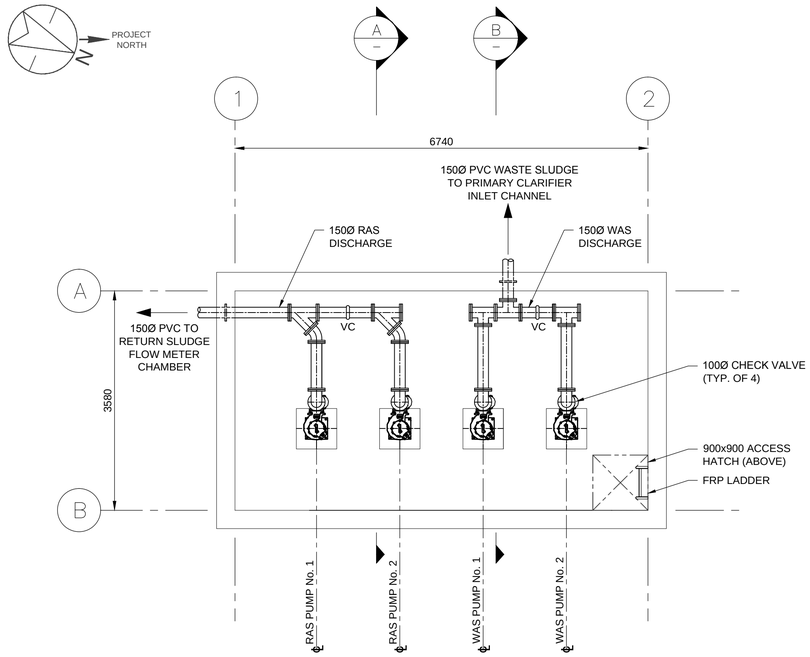
SIMCOE WWTF UPGRADES
NORFOLK COUNTY
PROCESS
HEADWORKS FACILITY
SECTION F-F

CONSULTANT FILE No.353644
DATE 2017/03/21
SCALE AS NOTED
REF. No. PW-E-16-78
DWG No. P209
REV.

8/21/2017 353644-Process Headworks.dwg

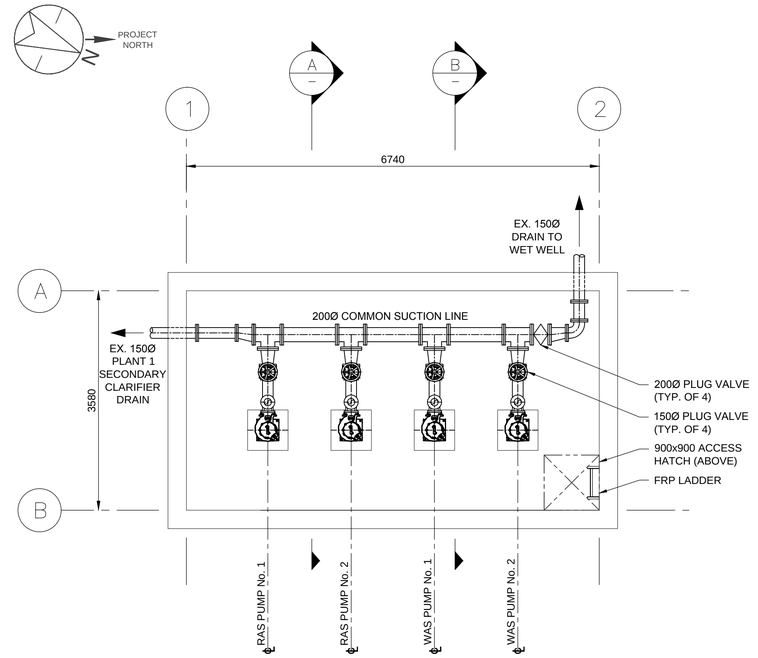


ROOF PLAN
1:50



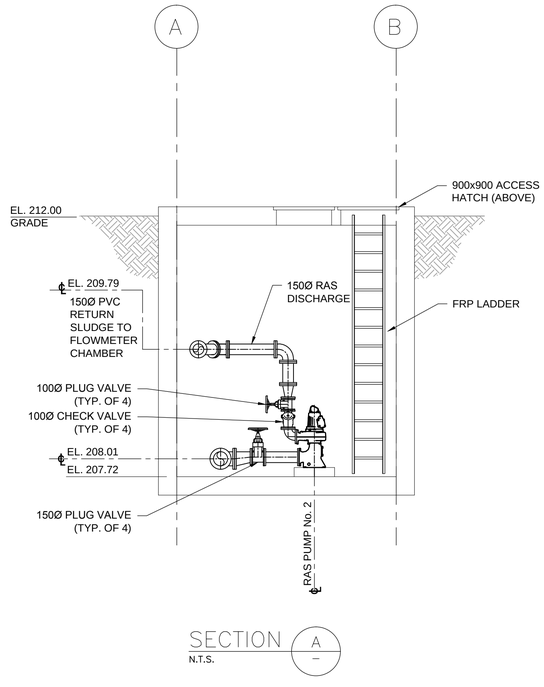
PLAN@EL.210.00
1:50

*NOTE: LOWER PIPING NOT SHOWN FOR CLARITY

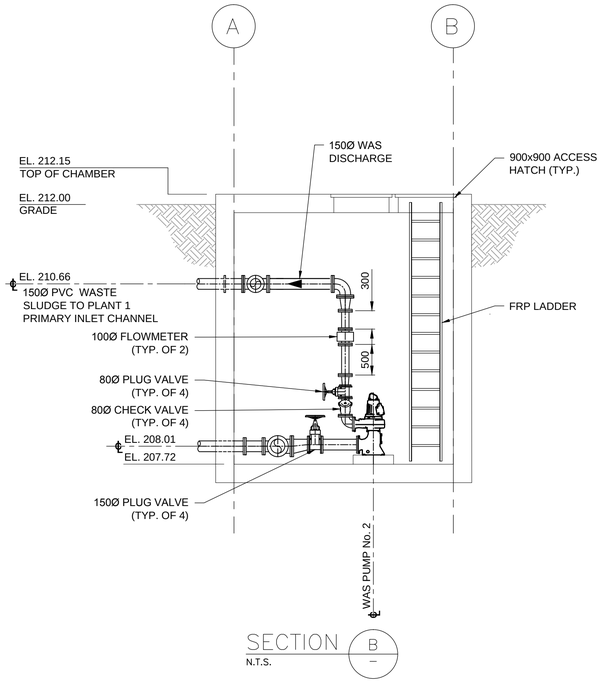


PLAN@EL.209.00
1:50

*NOTE: UPPER PIPING NOT SHOWN FOR CLARITY



SECTION A
N.T.S.



SECTION B
N.T.S.

NO.	REVISION	DATE	INIT.

NOTES

ISSUE: PRELIMINARY

SCALE BAR: 1:50 (0, 1, 2m)

DRAFTING: AR
DESIGN: SM
CHECKED BY: GD
APPROVED BY: GD

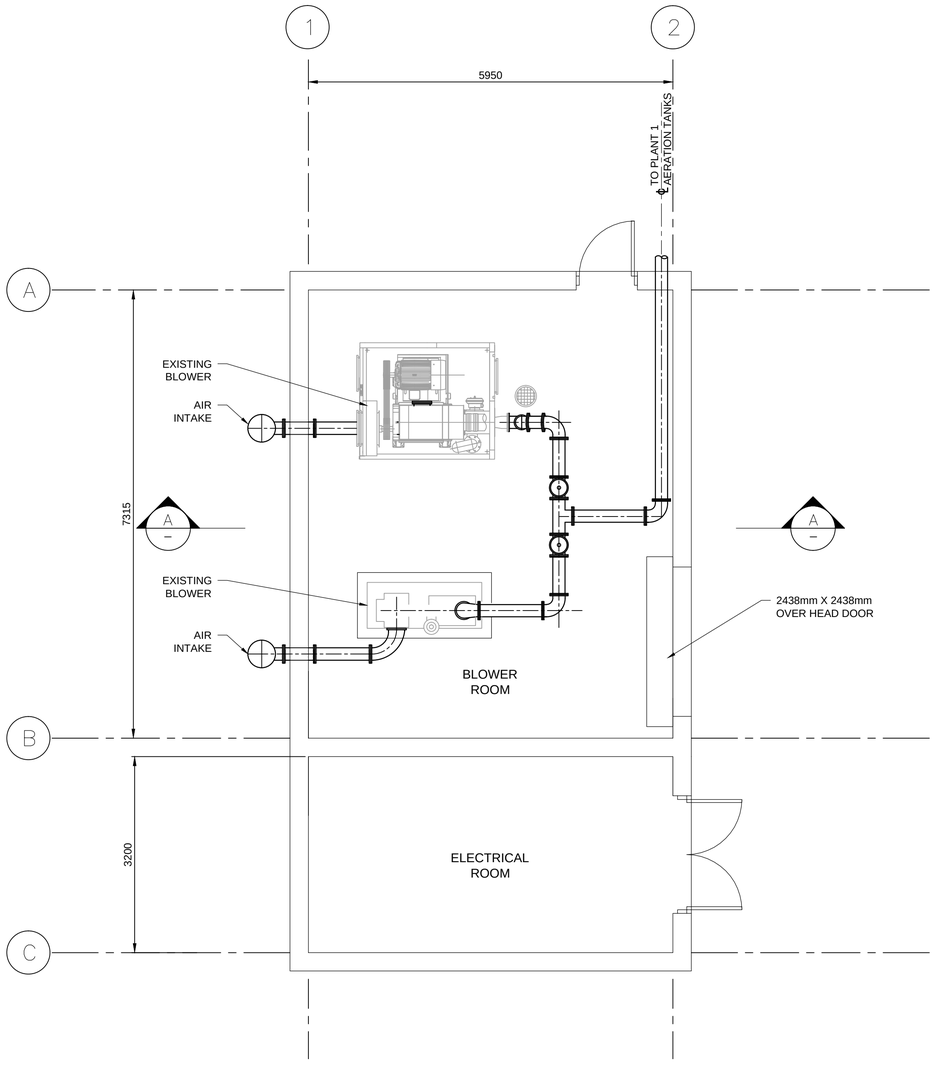
Norfolk County

HATCH

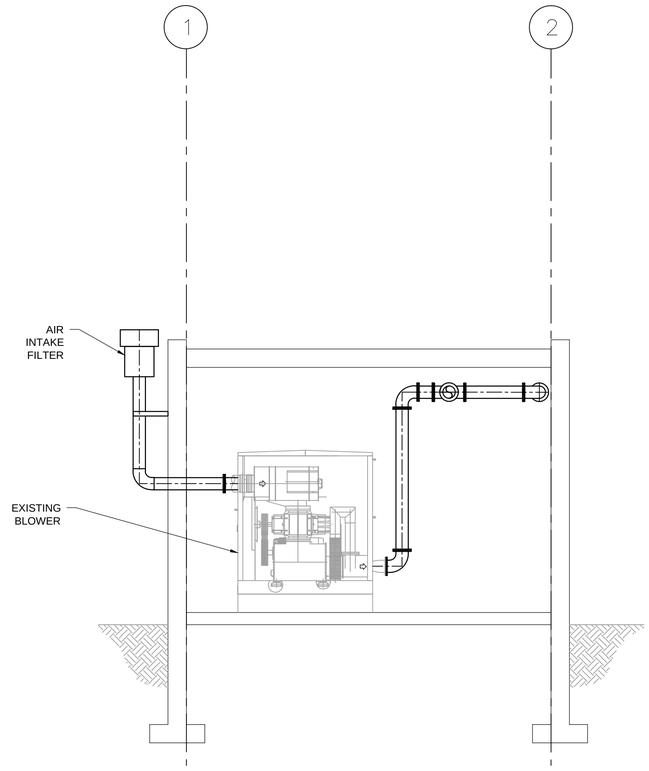
SIMCOE WWTF UPGRADES
NORFOLK COUNTY
PROCESS
RAS/WAS
PLANS AND SECTIONS

CONSULTANT FILE No.353644
DATE 2017/06/07
SCALE AS NOTED
REF. No. PW-E-16-78
DWG No. P301
REV.

PROJECT NORTH



PLAN
1:50



SECTION A
1:50

NOTES:

1. EXISTING BLOWERS TO BE RELOCATED FROM THE EXISTING PLANT 1 BLOWER BUILDING TO THE NEW PLANT 1 BLOWER BUILDING.

NO.	REVISION	DATE	INIT.

NOTES

ISSUE: PRELIMINARY

SCALE BAR: 1:50 (0, 1, 2m)

DRAFTING: AR
DESIGN: AK
CHECKED BY: SM
APPROVED BY: GD

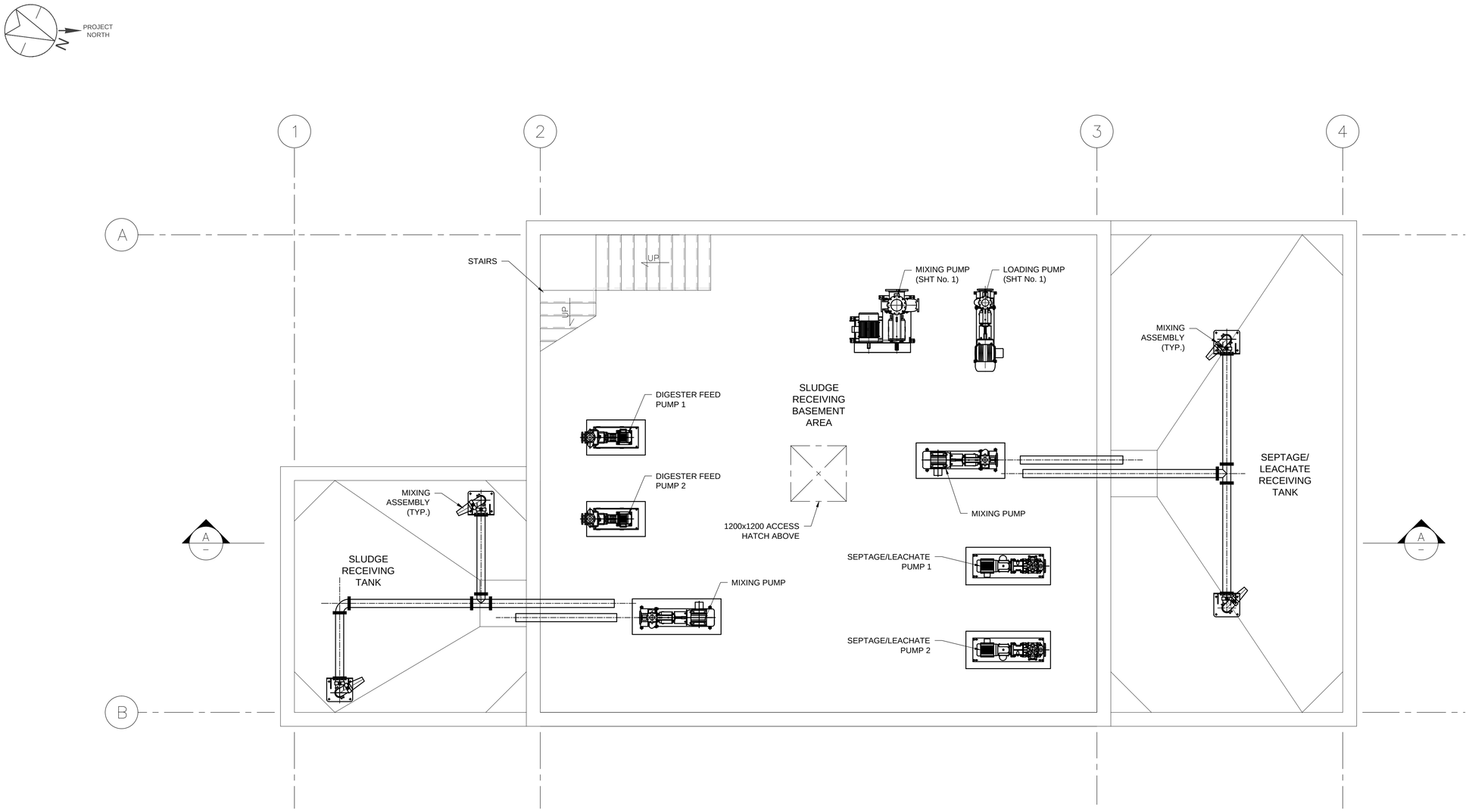
Norfolk County

HATCH

SIMCOE WWTF UPGRADES
NORFOLK COUNTY
PROCESS
PLANT 1 BLOWER BUILDING
PLAN AND SECTION

CONSULTANT FILE No.353644
DATE 2017/07/31
SCALE AS NOTED
REF. No. PW-E-16-78
DWG No. P401
REV.

8/21/2017 353644-Process Blower Building.dwg



PLAN@EL. 212.00

1:50

NO.	REVISION	DATE	INIT.

NOTES

ISSUE: PRELIMINARY

SCALE BAR: 1:50 (0, 1, 2m)

DRAFTING: AR

DESIGN: AK

CHECKED BY: SM

APPROVED BY: GD

Norfolk County

HATCH

SIMCOE WWTF UPGRADES
NORFOLK COUNTY
PROCESS
SLUDGE RECEIVING FACILITY
BASEMENT PLAN

CONSULTANT FILE No.353644

DATE 2017/06/07

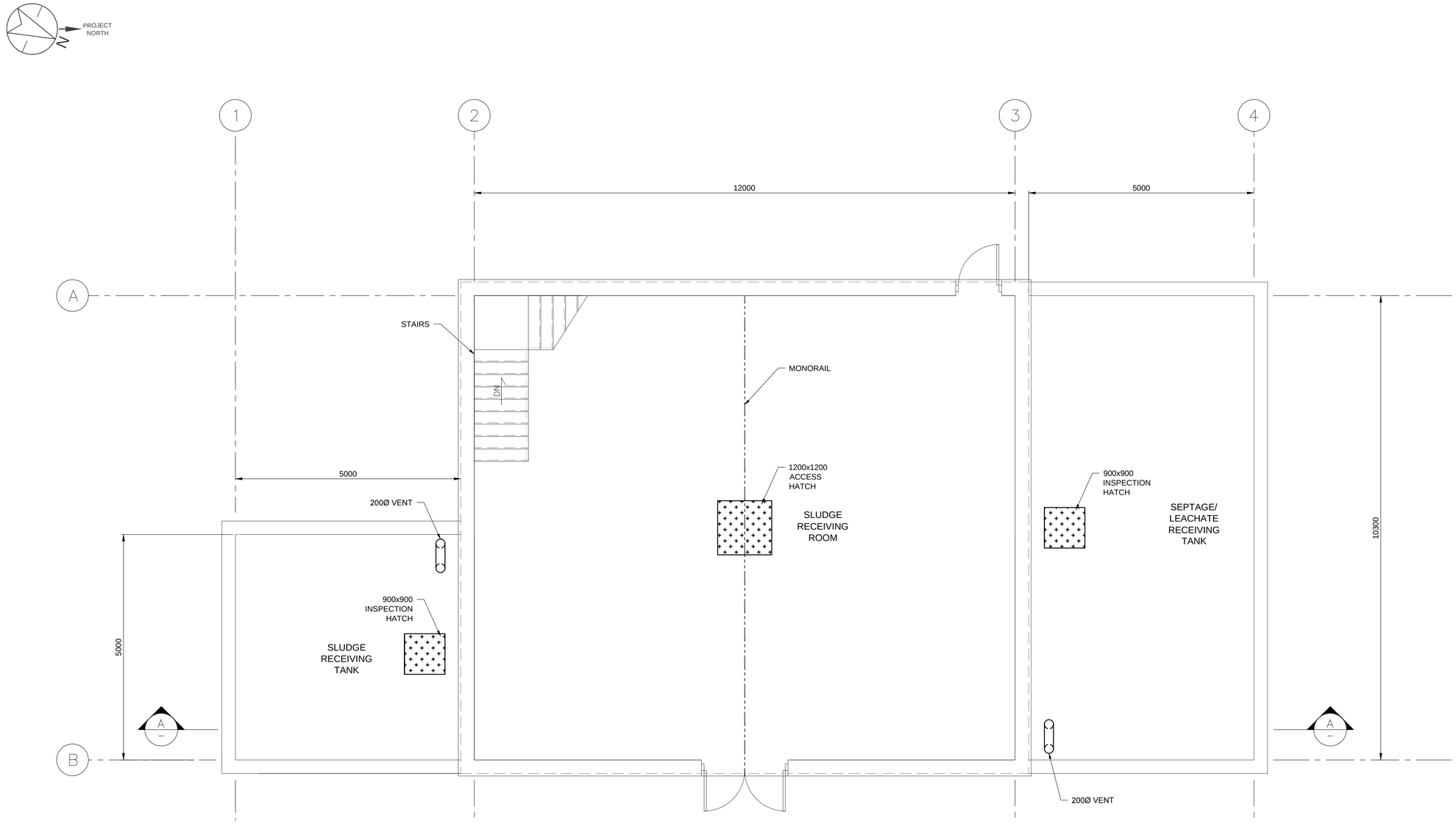
SCALE AS NOTED

REF. No. PW-E-16-78

DWG No. P501

REV.

8/22/2017 353644-Process Sludge Receiving Facility.dwg



PLAN@EL. 217.00

1:50

NO.	REVISION	DATE	INIT.

NOTES

ISSUE: PRELIMINARY

SCALE BAR: 1:50 (0, 1, 2m)

DRAFTING: AR

DESIGN: AK

CHECKED BY: SM

APPROVED BY: GD

Norfolk County

HATCH

SIMCOE WWTF UPGRADES
NORFOLK COUNTY
PROCESS
SLUDGE RECEIVING FACILITY
MAIN FLOOR PLAN

CONSULTANT FILE No.353644

DATE 2017/06/07

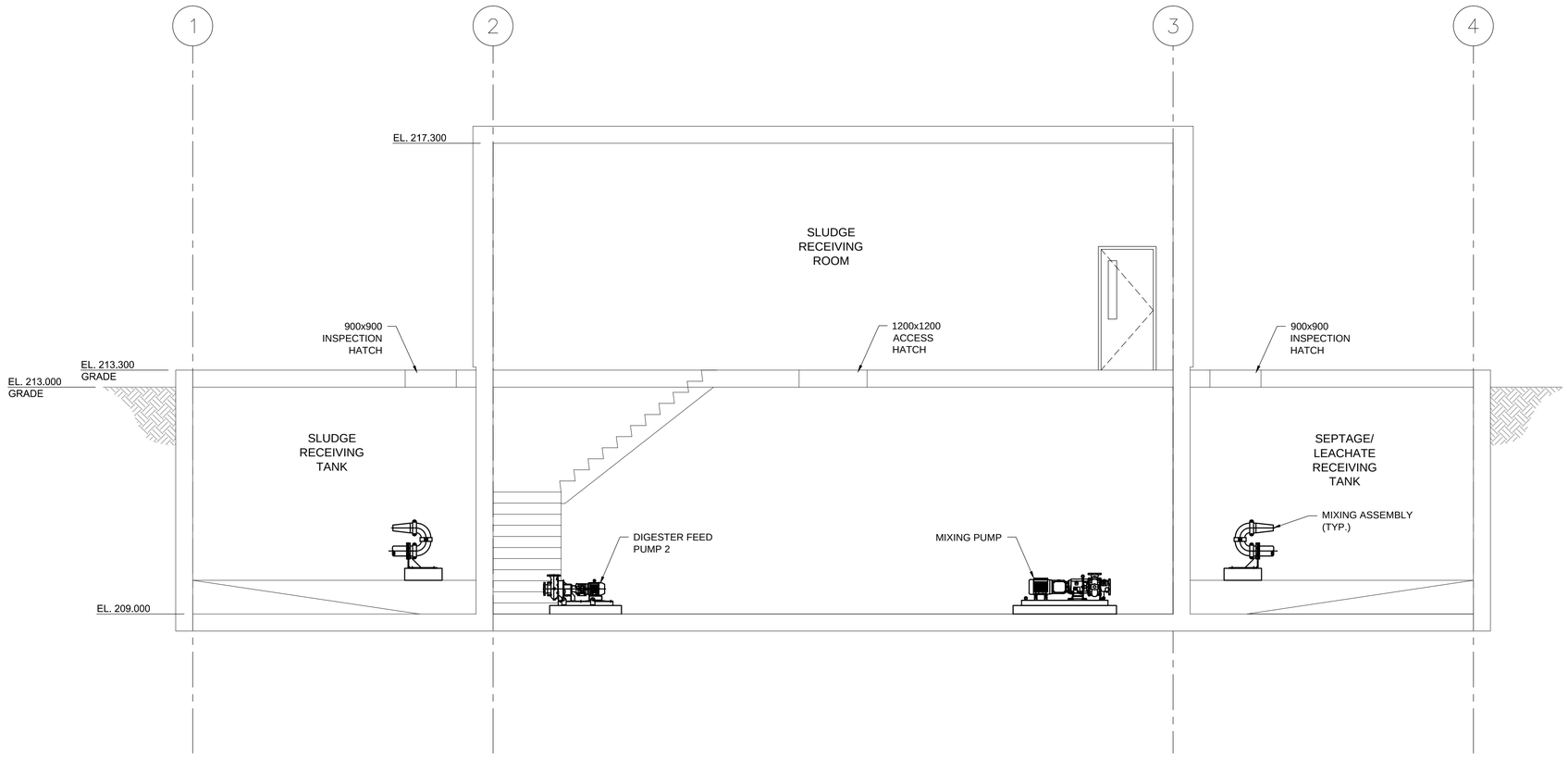
SCALE AS NOTED

REF. No. PW-E-16-78

DWG No. P502

REV.

8/22/2017 353644-Process Sludge Receiving Facility.dwg



SECTION A
1:50

NO.	REVISION	DATE	INIT.

NOTES

ISSUE: PRELIMINARY

SCALE BAR: 1:50 (0, 1, 2m)

DRAFTING: AR
DESIGN: AK
CHECKED BY: SM
APPROVED BY: GD

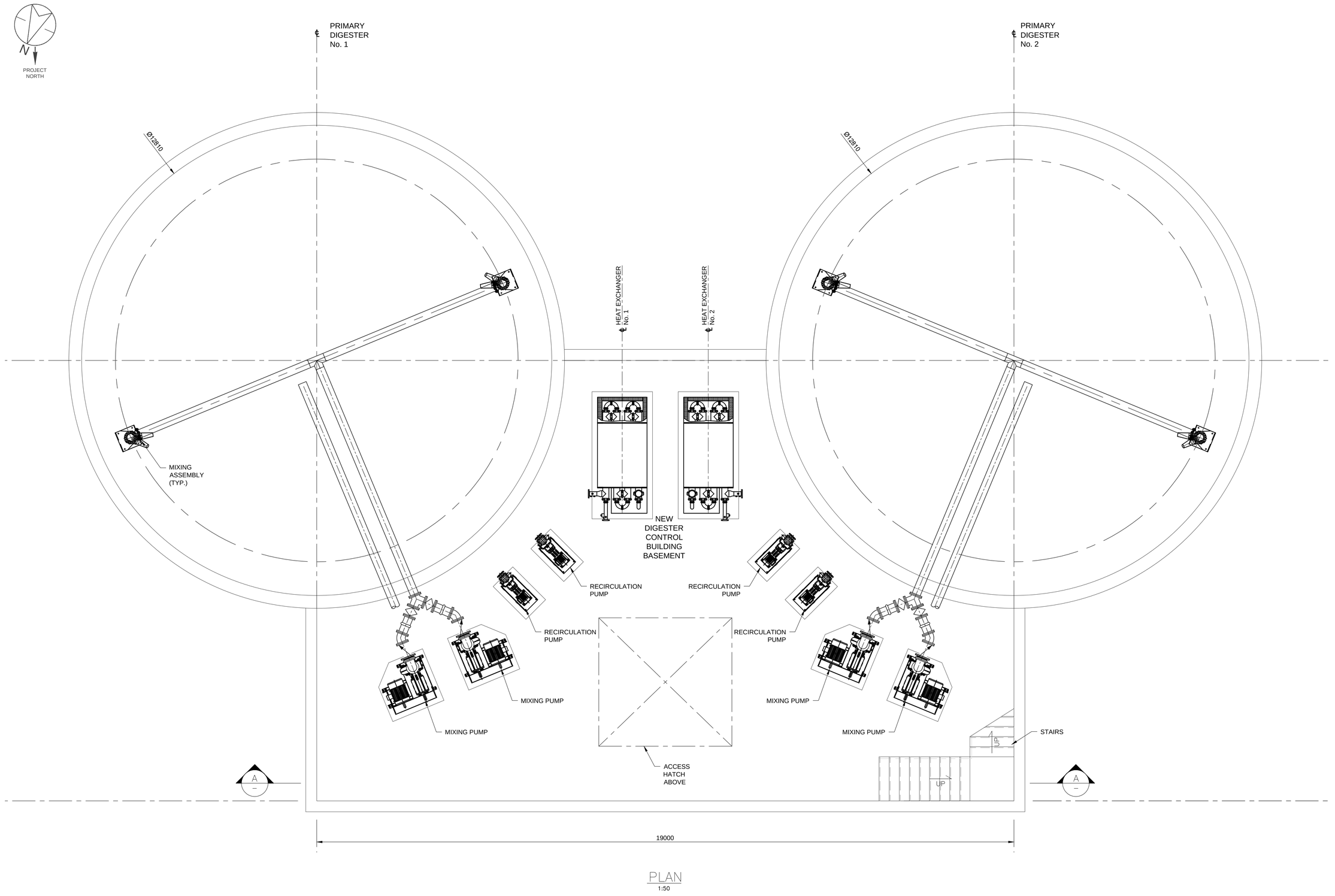
Norfolk County

HATCH

SIMCOE WWTF UPGRADES
NORFOLK COUNTY
PROCESS
SLUDGE RECEIVING FACILITY
SECTION A-A

CONSULTANT FILE No. 353644
DATE 2017/06/07
SCALE AS NOTED
REF. No. PW-E-16-78
DWG No. P503
REV.

8/22/2017 353644-Process Sludge Receiving Facility.dwg



PLAN
1:50

NO.	REVISION	DATE	INIT.

NOTES

ISSUE: PRELIMINARY

SCALE BAR: 1:50 — 0 1 2m

DRAFTING: AR
DESIGN: AK
CHECKED BY: SM
APPROVED BY: GD

Norfolk County

HATCH

SIMCOE WWTF UPGRADES
NORFOLK COUNTY
PROCESS
DIGESTER FACILITY
BASEMENT PLAN

CONSULTANT FILE No.353644
DATE 2017/07/26
SCALE AS NOTED
REF. No. PW-E-16-78
DWG No. P601
REV.

PROJECT NORTH

PRIMARY DIGESTER No. 1

PRIMARY DIGESTER No. 2

Ø12810

Ø12810

GAS ROOM

DIGESTER CONTROL BUILDING

MIXING ASSEMBLY (TYP.)

12000

3500x3500 EQUIPMENT REMOVAL HATCH

MCC ROOM

STAIRS

DN

DN

3 TON MONORAIL SYSTEM

A

A

7497

PLAN
1:50

NO.	REVISION	DATE	INIT.

NOTES

ISSUE: PRELIMINARY

SCALE BAR: 1:50 — 0 1 2m

DRAFTING: AR

DESIGN: AK

CHECKED BY: SM

APPROVED BY: GD

Norfolk County

HATCH

SIMCOE WWTF UPGRADES

NORFOLK COUNTY

PROCESS

DIGESTER FACILITY

MAIN FLOOR PLAN

CONSULTANT FILE No. 353644

DATE 2017/07/26

SCALE AS NOTED

REF. No. PW-E-16-78

DWG No. P602

REV.

PROJECT NORTH

PRIMARY DIGESTER No. 1

PRIMARY DIGESTER No. 2

Ø12810

Ø12810

NEW DIGESTER CONTROL BUILDING

A

A

PLAN
1:50

NO.	REVISION	DATE	INIT.

NOTES

ISSUE: PRELIMINARY

SCALE BAR: 1:50 — 0, 1, 2m

DRAFTING: AR

DESIGN: AK

CHECKED BY: SM

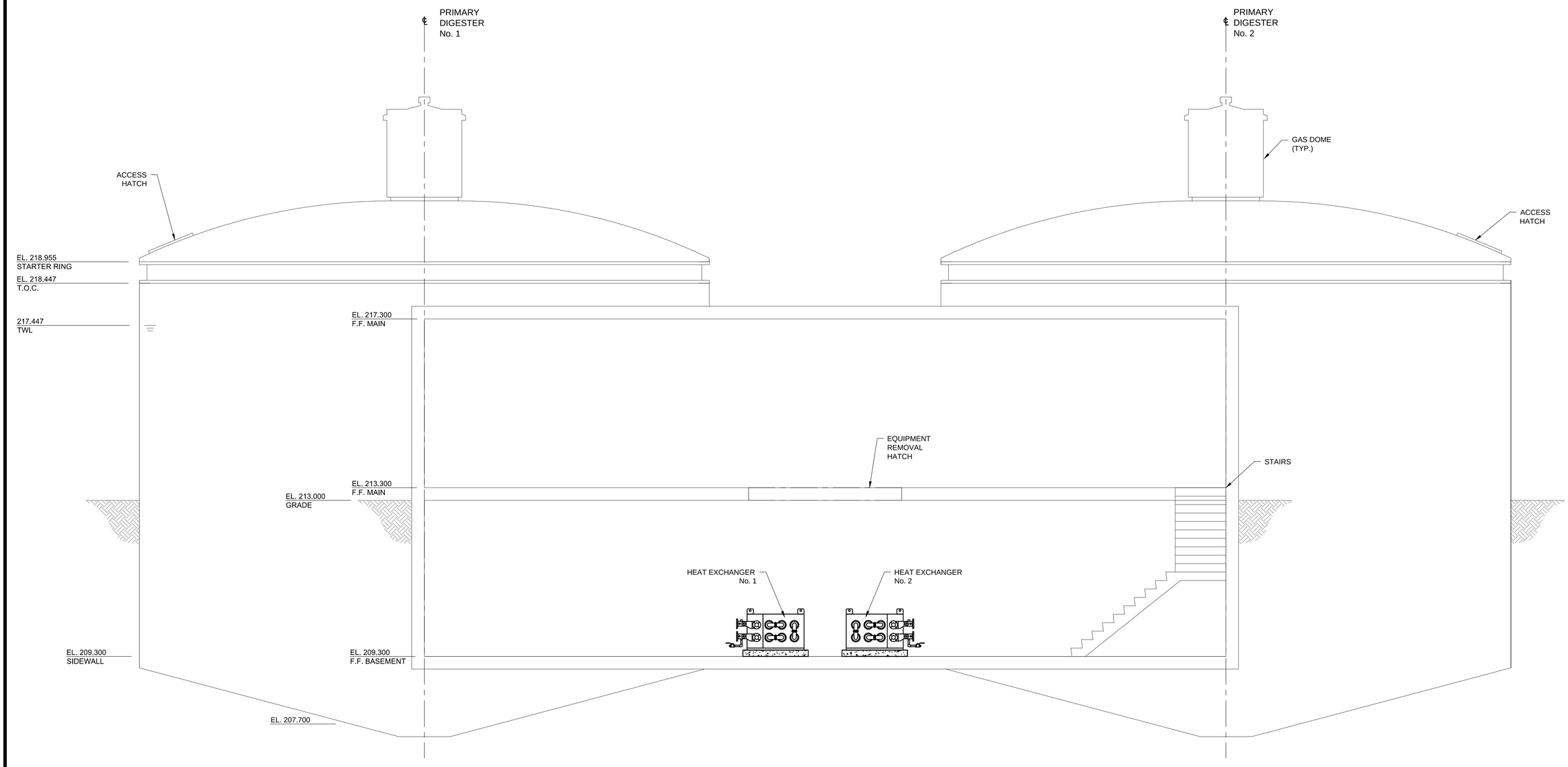
APPROVED BY: GD

Norfolk County

HATCH

SIMCOE WWTF UPGRADES
NORFOLK COUNTY
PROCESS
DIGESTER FACILITY
ROOF PLAN

CONSULTANT FILE No.353644
DATE 2017/07/26
SCALE AS NOTED
REF. No. PW-E-16-78
DWG No. P603
REV.



SECTION A
1:50

NO.	REVISION	DATE	INIT.

NOTES

ISSUE: PRELIMINARY

SCALE BAR: 1:50 — 0, 1, 2m

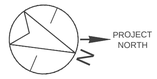
DRAFTING: AR
DESIGN: AK
CHECKED BY: SM
APPROVED BY: GD

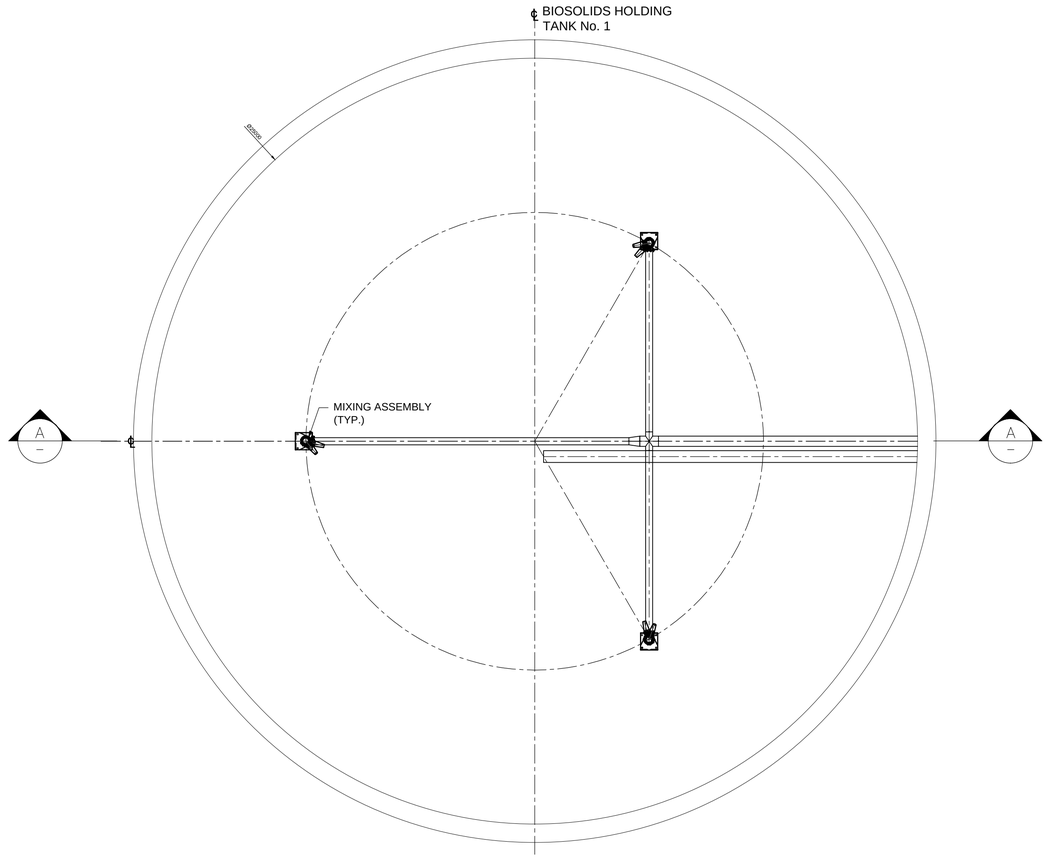
Norfolk County

HATCH

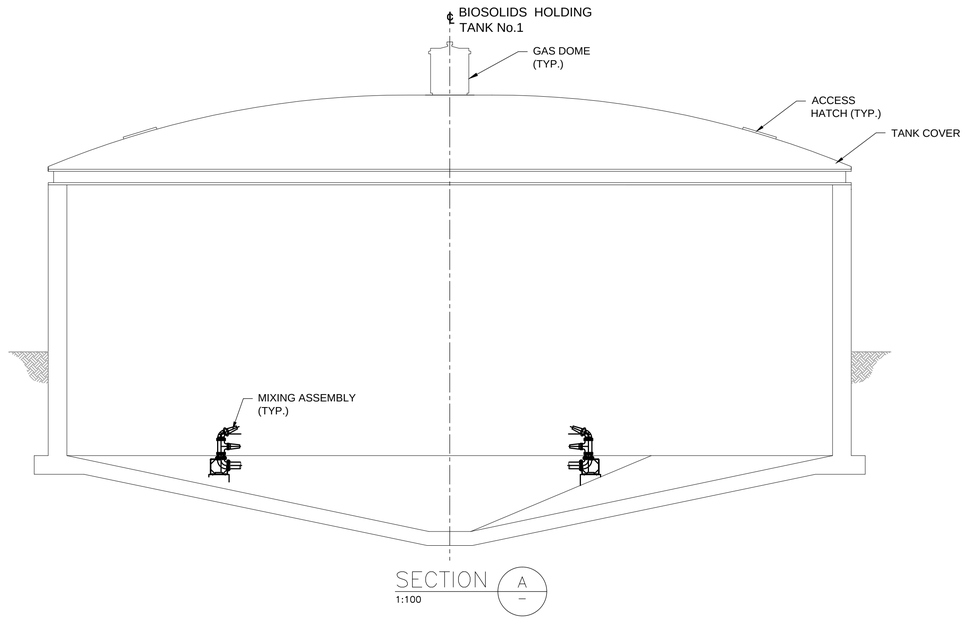
SIMCOE WWTF UPGRADES
NORFOLK COUNTY
PROCESS
DIGESTER FACILITY
SECTION A-A

CONSULTANT FILE No.353644
DATE 2017/07/26
SCALE AS NOTED
REF. No. PW-E-16-78
DWG No. P604
REV.





PLAN
1:100



SECTION A
1:100

NO.	REVISION	DATE	INIT.

NOTES

ISSUE: PRELIMINARY

SCALE BAR: 1:100 — 0 1 2 3 4m

DRAFTING: AR
DESIGN: AK
CHECKED BY: SM
APPROVED BY: GD

Norfolk County

HATCH

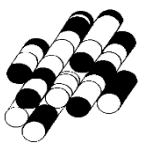
SIMCOE WWTF UPGRADES
NORFOLK COUNTY
PROCESS
BIOSOLIDS HOLDING TANK No. 1
PLAN AND SECTION

CONSULTANT FILE No.353644
DATE 2017/07/26
SCALE AS NOTED
REF. No. PW-E-16-78
DWG No. P701
REV.

Dewatering Analysis

APPENDIX D

Terraprobe Inc.



Simcoe WWTF Expansion - Headworks Building Wet Well

Job No. 7-17-0120-1

Site Statistics

Excavation Area (m2)	Excavation Depth (mbgl)	Excavation Perimeter (m)	Water Level (mbgl)	Excavation Depth (m below water table)	Vertical Area Below Water Table (m2)
76.5	14.2	37.2	2	12.2	454
123.5	12.5	56.4	2	10.5	592

Darcy - flow into excavation

$$Q = kiA$$

	Q (m^3/s)	A (m^2)	i	k (m/s)	Q (m^3/hr)	Q (L/hr)	Q (gal/min)	Q (L/day)	Factor of Safety = 1.5 Q (L/day)
Vertical	2.54E-04	454	0.1	5.60E-06	0.9149	915	4.03	10979	**16,469**
	3.32E-04	592	0.1	5.60E-06	1.1939	1194	5.26	14327	**21,490**

Horizontal	Q (m^3/s)	A (m^2)	i	k (m/s)	Q (m^3/hr)	Q (L/hr)	Q (gal/min)	Q (L/day)	**Q (L/day)**

No Horizontal Component of Dewatering Expected Based on Use of Impervious Sheet Piling to Stabilize Open Excavations

Radius of Influence - Sichardt's equation

$$R = 3000\sqrt{k}$$

R (m)	drawdown (m)	K (m/s)
86.6	12.2	5.60E-06
74.5	10.5	5.60E-06

Simcoe WWTF Expansion - Bio-Solids Holding Tank

Job No. 7-17-0120-1

Site Statistics

Excavation Area (m2)	Excavation Depth (mbgl)	Excavation Perimeter (m)	Water Level (mbgl)	Excavation Depth (m below water table)	Vertical Area Below Water Table (m2)
527.7	7.0	81.4	2	5	407

Darcy - flow into excavation

$$Q = kiA$$

	Q (m^3/s)	A (m^2)	i	k (m/s)	Q (m^3/hr)	Q (L/hr)	Q (gal/min)	Q (L/day)	Factor of Safety = 1.5 Q (L/day)
Vertical	6.92E-03	407	0.1	1.70E-04	24.9084	24908	109.68	298901	**448,351**

Horizontal	Q (m^3/s)	A (m^2)	i	k (m/s)	Q (m^3/hr)	Q (L/hr)	Q (gal/min)	Q (L/day)	Q (L/day)

No Horizontal Component of Dewatering Expected Based on Use of Impervious Sheet Piling to Stabilize Open Excavations

Radius of Influence - Sichardt's equation

$$R = 3000\sqrt{k}$$

R (m)	drawdown (m)	K (m/s)
195.6	5	1.70E-04

APPENDIX D: Dewatering Calculations
Proposed Simcoe WWTF Expansion
16 Oakwood Avenue
Simcoe, ON

$R_0 = 3000*dH*K^{0.5}$ (Sichart and Dryieleis, dH and R_0 in meters, K in m/sec)

$r_e = (ab/3.14)^{0.5}$ applies when a/b <1.5 and $R_0 >> r_e$

$$Q = \frac{3.14*K*(H^2-h_w^2)}{\ln(R_0/r_e)} + 2 * \frac{x*K*(H^2-h_w^2)}{2L_0}$$

Static Water Level	206.6	m
Dewatering Target	201.6	m
Aquifer Bottom*	194	m

*Top of clayey silt layer as observed in BH-3B

900 mm Diameter Sewer Line

K =	1.70E-04	m/s	Hydraulic Conductivity
or	14.69	m/day	
H =	12.6	m	From static wate table to the assumed aquifer bottom
h_w =	7.6	m	From the dewatering target to the assumed aquifer bottom
dH =	5.0	m	Dewatering Thickness
$R_{0\,=}$	196	m	Radius of Influence
a =	4.0	m	Depth of dewatering trench
b =	3	m	Width of dewatering trench
$r_{e\,=}$	1.922	m	Assumed for a small rectangular area at the end of the dewatering trench
x =	10	m	Length of dewatering trench
$L_{0\,=}$	196	m	Distance between maximum drawdown and zero drawdown

Q =	**1,084**	**m3/day**
or	752	L/min

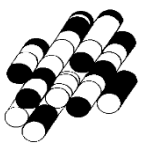
Factor of Satety 50% **1,625 m3/day**
1,129 L/min

Reference: J. Patrick Powers… [et al.] (2007), "Construction Dewatering and Groundwater Control: New Methods and Applications, 3rd ed." Wiley, Hoboken, NJ.

Laboratory Certificates of Analysis

APPENDIX E

Terraprobe Inc.



AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: TERRAPROBE INC
903 Barton Street
Stoney Creek, ON L8E5P5
(905) 643-7560

ATTENTION TO: Paul Raepple

PROJECT: 7-17-0120-46

AGAT WORK ORDER: 17H272380

MICROBIOLOGY ANALYSIS REVIEWED BY: Nivine Basily, Inorganics Report Writer

TRACE ORGANICS REVIEWED BY: Neli Popnikolova, Senior Chemist

WATER ANALYSIS REVIEWED BY: Nivine Basily, Inorganics Report Writer

DATE REPORTED: Oct 27, 2017

PAGES (INCLUDING COVER): 10

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

Member of: Association of Professional Engineers and Geoscientists of Alberta (APEGA)
Western Enviro-Agricultural Laboratory Association (WEALA)
Environmental Services Association of Alberta (ESAA)

AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation.

Results relate only to the items tested and to all the items tested
All reportable information as specified by ISO 17025:2005 is available from AGAT Laboratories upon request

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 17H272380

PROJECT: 7-17-0120-46

CLIENT NAME: TERRAPROBE INC

ATTENTION TO: Paul Raepple

SAMPLING SITE:

SAMPLED BY:

Microbiological Analysis (water)

DATE RECEIVED: 2017-10-17

DATE REPORTED: 2017-10-27

				SAMPLE DESCRIPTION:	BH 7a	BH 7b
				SAMPLE TYPE:	Water	Water
				DATE SAMPLED:	2017-10-16	2017-10-16
Parameter	Unit	G / S	RDL		8822460	8822468
Total Coliforms	CFU/100mL	2400	100		NDOGT	**13000**

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Norfolk Storm
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

8822460 RDL >1 indicates dilutions of the sample.
NDOGT - No Data; Overgrown with Target, refers to over-crowding microbial growth;

8822468 RDL >1 indicates dilutions of the sample.

Certified By: Divine Basily

Results relate only to the items tested and to all the items tested

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 17H272380

PROJECT: 7-17-0120-46

CLIENT NAME: TERRAPROBE INC

ATTENTION TO: Paul Raepple

SAMPLING SITE:

SAMPLED BY:

Norfolk Sanitary/Storm Sewer Use By-Law - Organics

DATE RECEIVED: 2017-10-17

DATE REPORTED: 2017-10-27

					SAMPLE DESCRIPTION:	BH 7a	BH 7b
					SAMPLE TYPE:	Water	Water
					DATE SAMPLED:	2017-10-16	2017-10-16
Parameter	Unit	G / S: A	G / S: B	RDL		8822460	8822468
Oil and Grease (animal/vegetable) in water	mg/L	100	15	0.5		0.6[<B]	0.8[<B]
Oil and Grease (mineral) in water	mg/L	15	15	0.5		<0.5	<0.5

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: A Refers to Norfolk Sanitary, B Refers to Norfolk Storm
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

Certified By: N Popnikolof

Results relate only to the items tested and to all the items tested

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 17H272380

PROJECT: 7-17-0120-46

CLIENT NAME: TERRAPROBE INC

ATTENTION TO: Paul Raepple

SAMPLING SITE:

SAMPLED BY:

Norfolk Sanitary/Storm Sewer Use By-Law - Inorganics

DATE RECEIVED: 2017-10-17

DATE REPORTED: 2017-10-27

					SAMPLE DESCRIPTION:	BH 7a	BH 7b
					SAMPLE TYPE:	Water	Water
					DATE SAMPLED:	2017-10-16	2017-10-16
Parameter	Unit	G / S: A	G / S: B	RDL		8822460	8822468
pH	pH Units	6.5-8.5	6.5-9.5	NA		7.89	7.86
BOD (5)	mg/L			5		<5	<5
Total Suspended Solids	mg/L	350	15	10		4480[>A]	680[>A]
Phenols	mg/L	0.10	0.020	0.001		<0.001	<0.001
Total Cyanide	mg/L	2	0.1	0.002		<0.002	<0.002
Sulphide	mg/L	2	1	0.05		<0.05	<0.05
Chloride	mg/L	1500	1500	0.20		6.21[<A]	6.21[<A]
Sulphate	mg/L	1500	1500	0.20		65.7[<A]	65.8[<A]
Cadmium	mg/L	3	1	0.001		<0.001	<0.001
Chromium	mg/L	3	1	0.003		0.014[<B]	0.004[<B]
Copper	mg/L	3	1	0.002		0.050[<B]	0.013[<B]
Lead	mg/L			0.002		0.073	0.024
Nickel	mg/L	3	1	0.003		0.004[<B]	<0.003
Zinc	mg/L			0.005		0.116	0.030
Iron	mg/L			0.010		10.6	5.10

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: A Refers to Norfolk Sanitary, B Refers to Norfolk Storm
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

8822460-8822468 Elevated RDLs indicate the degree of sample dilutions prior to the analysis to keep analytes within the calibration range, reduce matrix interference and/or to avoid contaminating the instrument.

Certified By: Divine Basily

Results relate only to the items tested and to all the items tested

AGAT Laboratories

Guideline Violation

AGAT WORK ORDER: 17H272380

PROJECT: 7-17-0120-46

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: TERRAPROBE INC

ATTENTION TO: Paul Raepple

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	UNIT	GUIDEVALUE	RESULT
8822460	BH 7a	Norfolk Sanitary	Norfolk Sanitary/Storm Sewer Use By-Law - Inorganics	Total Suspended Solids	mg/L	350	4480
8822460	BH 7a	Norfolk Storm	Norfolk Sanitary/Storm Sewer Use By-Law - Inorganics	Total Suspended Solids	mg/L	15	4480
8822468	BH 7b	Norfolk Sanitary	Norfolk Sanitary/Storm Sewer Use By-Law - Inorganics	Total Suspended Solids	mg/L	350	680
8822468	BH 7b	Norfolk Storm	Microbiological Analysis (water)	Total Coliforms	CFU/100mL	2400	13000
8822468	BH 7b	Norfolk Storm	Norfolk Sanitary/Storm Sewer Use By-Law - Inorganics	Total Suspended Solids	mg/L	15	680

Results relate only to the items tested and to all the items tested

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: TERRAPROBE INC

AGAT WORK ORDER: 17H272380

PROJECT: 7-17-0120-46

ATTENTION TO: Paul Raepple

SAMPLING SITE:

SAMPLED BY:

Microbiology Analysis

RPT Date: Oct 27, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Microbiological Analysis (water)															
Total Coliforms	8822940		NDOGT	NDOGT	NA	< 1									

Comments: NDOGT - No Data; Overgrown with Target, refers to over-crowding microbial growth; NA - % RPD Not Applicable

Certified By: Divine Basily

AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation.

Results relate only to the items tested and to all the items tested

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: TERRAPROBE INC

AGAT WORK ORDER: 17H272380

PROJECT: 7-17-0120-46

ATTENTION TO: Paul Raepple

SAMPLING SITE:

SAMPLED BY:

Trace Organics Analysis

RPT Date: Oct 27, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Norfolk Sanitary/Storm Sewer Use By-Law - Organics															
Oil and Grease (animal/vegetable) in water	TW	< 0.5	< 0.5	NA	< 0.5	NA	70%	130%	96%	70%	130%	106%	70%	130%	
Oil and Grease (mineral) in water	TW	< 0.5	< 0.5	NA	< 0.5	NA	70%	130%	84%	70%	130%	81%	70%	130%	

Comments: Tap water analysis has been performed as QC sample testing for duplicate and matrix spike due to insufficient sample volume.
When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

Certified By: N Popnikolof

AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation.

Results relate only to the items tested and to all the items tested

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: TERRAPROBE INC

AGAT WORK ORDER: 17H272380

PROJECT: 7-17-0120-46

ATTENTION TO: Paul Raepple

SAMPLING SITE:

SAMPLED BY:

Water Analysis

RPT Date: Oct 27, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Norfolk Sanitary/Storm Sewer Use By-Law - Inorganics															
pH	8824838		7.73	7.67	0.8%	NA	100%	90%	110%						
BOD (5)	8827751		7	8	NA	< 5	102%	75%	125%						
Total Suspended Solids	8822809		<10	<10	NA	< 10	102%	80%	120%						
Phenols	8819259		<0.001	<0.001	NA	< 0.001	96%	90%	110%	102%	90%	110%	104%	80%	120%
Total Cyanide	8816722		<0.002	<0.002	NA	< 0.002	102%	80%	120%	95%	90%	110%	98%	70%	130%
Sulphide	8810749		<0.05	<0.05	NA	< 0.05	102%	80%	120%	102%	85%	115%	101%	70%	130%
Chloride	8819294		157	154	1.9%	< 0.10	91%	90%	110%	110%	90%	110%	106%	80%	120%
Sulphate	8819294		<0.50	<0.50	NA	< 0.10	100%	90%	110%	108%	90%	110%	103%	80%	120%
Cadmium	8820302		<0.001	<0.001	NA	< 0.001	100%	90%	110%	104%	90%	110%	103%	70%	130%
Chromium	8820302		<0.003	<0.003	NA	< 0.003	99%	90%	110%	99%	90%	110%	106%	70%	130%
Copper	8820302		<0.002	<0.002	NA	< 0.002	98%	90%	110%	103%	90%	110%	101%	70%	130%
Lead	8820302		0.007	0.008	NA	< 0.002	100%	90%	110%	105%	90%	110%	103%	70%	130%
Nickel	8820302		<0.003	<0.003	NA	< 0.003	98%	90%	110%	100%	90%	110%	101%	70%	130%
Zinc	8820302		0.012	0.012	NA	< 0.005	98%	90%	110%	103%	90%	110%	106%	70%	130%
Iron	8820302		0.025	0.033	NA	< 0.010	96%	90%	110%	93%	90%	110%	110%	70%	130%

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By: Nivine Basily

AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation.

Results relate only to the items tested and to all the items tested

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: TERRAPROBE INC

AGAT WORK ORDER: 17H272380

PROJECT: 7-17-0120-46

ATTENTION TO: Paul Raepple

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Microbiology Analysis			
Total Coliforms	MIC-93-7010	EPA 1604	Membrane Filtration
Trace Organics Analysis			
Oil and Grease (animal/vegetable) in water	VOL-91-5011	EPA SW-846 1664A & SM 5520	GRAVIMETRIC
Oil and Grease (mineral) in water	VOL-91-5011	EPA SW-846 1664A & SM 5520	GRAVIMETRIC
Water Analysis			
pH	INOR-93-6000	SM 4500-H+ B;SM 2310 B	PC TITRATE
BOD (5)	INOR-93-6006	SM 5210 B	DO METER
Total Suspended Solids	INOR-93-6028	SM 2540 D	BALANCE
Phenols	INOR-93-6050	MOE ROPHEN-E 3179 & SM 5530 D	TECHNICON AUTO ANALYZER
Total Cyanide	INOR-93-6051	MOE 3015 & SM 4500 CN- A,B,C	TECHNICON AUTO ANALYZER
Sulphide	INOR-93-6054	SM 4500 S2- D	SPECTROPHOTOMETER
Chloride	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Sulphate	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Cadmium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Chromium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Copper	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Lead	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Nickel	MET-93-6103	EPA SW-846 6020 & 200.8	ICP-MS
Zinc	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Iron	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS

Results relate only to the items tested and to all the items tested

AGAT Laboratories

M131

Short Holding Time

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only
Work Order #: 17H272380
Cooler Quantity: 4G cooler
Arrival Temperatures: 6.2 | 6.5 | 16.6 / 3.8 | 3.5 | 3.3
Custody Seal Intact: ☐ Yes ☐ No ☐ N/A
Notes:

Report Information:
Company: Terraprobe Inc.
Contact: Paul Kaeppli
Address: 903 Barton Street Unit 22, Stoney Creek L8E 5P5
Phone: 905-643-7560 Fax: 905-643-7559
Reports to be sent to:
1. Email: pkaeppli@terraprobe.ca
2. Email:

Regulatory Requirements: ☐ No Regulatory Requirement
(Please check all applicable boxes)

☐ Regulation 153/04
Table (Indicate One) ☐ Ind/Com ☐ Res/Park ☐ Agriculture
Soil Texture (Check One) ☐ Coarse ☐ Fine

☑ Sewer Use
☑ Sanitary ☑ Storm
Region Norfolk County (Indicate One)
☐ MISA

☐ Regulation 558
☐ CCME
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
(Indicate One)

Turnaround Time (TAT) Required:
Regular TAT ☑ 5 to 7 Business Days
Rush TAT (Rush Surcharges Apply)
☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day
OR Date Required (Rush Surcharges May Apply):
Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*
For 'Same Day' analysis, please contact your AGAT CPM

Project Information:
Project: 17-0120-46
Site Location: 16 Oakwood Ave Simcoe.
Sampled By: SG
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Is this submission for a **Record of Site Condition?** ☐ Yes ☑ No

Report Guideline on Certificate of Analysis ☐ Yes ☑ No

Invoice Information: Bill To Same: Yes ☑ No ☐
Company:
Contact:
Address:
Email: lrossi@terraprobe.ca

Sample Matrix Legend
B Biota
GW Ground Water
O Oil
P Paint
S Soil
SD Sediment
SW Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI (Y/N)	Metals and Inorganics: ☐ All Metals ☐ 153 Metals (excl. Hydrides) ☐ Hydride Metals ☐ 153 Metals (incl. Hydrides)	O. Reg 153: ORPs: ☐ B-HWS ☐ Cl⁻ ☐ CN⁻ ☐ Cr⁶⁺ ☐ EC ☐ FOC ☐ Hg ☐ pH ☐ SAR	Full Metals Scan	Regulation/Custom Metals	Nutrients: ☐ TP ☐ NH_3 ☐ TKN ☐ NO_3 ☐ NO_2 ☐ NO_2+NO_3	Volatiles: ☐ VOC ☐ BTEX ☐ THM	CCME Fractions 1 to 4	ABNs	PAHs	PCBs: ☐ Total ☐ Aroclors	Organochlorine Pesticides	TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	Sewer Use
~~16 OCT~~	~~16:40~~	16																	
BH 7a	Oct 16	16:40	8	GW	Sample Field Filtered	Y													✓
BH 7b	Oct 16	16:45	8	GW	Unfiltered Sample	N													✓
					20 micron Field Filter used for Sample BH 7a														

Samples Received By (Print Name and Sign): Daniela Jalic
Time: 10:05am
Date: 10/17/17
Samples Received By (Print Name and Sign):
Date: 10/17/17
Time: 2:45
Page 1 of 1
N°: T 055978

Pink Copy - Client | Yellow Copy - AGAT | White Copy- AGAT

Date Issued: February 22, 2017

Please use an unpreserved 40ml vial for each analytical parameter listed. Sample is required for moisture content. Application requirements set forth by

Appendix D
Project Contact List

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

Norfolk County - Simcoe WWTP Contact List						
Indigenous Communities						
Indigenous Community	**Chief**	**Contact**	**CC**	**Email**	**Address**	**Phone**
Mississaugas of the Credit First Nation (MCFN)	Claire Sault	claires@mncfn.ca	Councillor Fawn Sault, Pillar 3 Lead: Environment and Sustainability Stewardship for Land, Air, Water and Natural Resources	FawnS@mncfn.ca	2789 Mississauga Road Hagersville, Ontario N0A 1H0	(905) 768-1133
Six Nations of the Grand River (SNGR)	Chief Sherri-Lyn Hill	(519) 445 - 2201; chief@snfuture.ca	Nicole Kohoko, Executive Director of Corporate Administration	LRCS@sixnations.ca	1695 Chiefswood Road Ohsweken, ON N0A 1M0	(519) 445- 2201
HCCC/HDI	N/A	Brian Doolittle, HCCC Delegate briandoolittle@hdi.land	Tracey General, Office Manager	info@hdi.land	16 Sunrise Court, Suite 600 P.O. Box 714 Ohsweken, ON N0A 1M0	(519) 445-4222
Metis Nation of Ontario Region #9 (MNO #9)	N/A	consultations@metisnation.org	N/A	N/A	Suite 1100 – 66 Slater Street Ottawa, ON K1P 5H1	(613) 798-1488
Government Ministries						
Organization	**Department**	**Name/Job Title**	**Email**	**Address**		
Ministry of Environment, Conservation and Parks	EA Notification; Environmental Assessment Branch	N/A; Director, Environmental Assessment Branch	eanotification.cregion@ontario.ca; enviropermissions@ontario.ca	135 St. Clair Avenue West, 1st Floor Toronto, Ontario M4V 1P5		
Ministry of Natural Resources	Policy Division - Environmental Planning Unit	N/A	ea.mnrf@ontario.ca	300 Water Steet, 2nd Floor South Peterborough, ON K9J 8M5		
Ministry of Tourism, Culture and Sport	Culture Division - Programs and Services Branch	N/A	MTCSheritageunit@ontario.ca	401 Bay Street, Suite 1700 Toronto, ON M7A 0A7		
Ministry of Indigenous Affairs and First Nations Economic Reconciliation	EA Review Team	Environmental Assessment Coordinator	moeccpermissions@ontario.ca	160 Bloor Street East, Suite 400 Toronto, ON M7A 2E6		
Ministry of Municipal Affairs and Housing	Municipal Services Office	N/A	MSO-Central@ontario.ca	777 Bay Street, 13th Floor Toronto, ON M7A 2J3		

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

Appendix E
Long Point Region Conservation Authority – Engagement Meeting Minutes

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

Minutes of Meeting

H353644

October 16, 2025

Norfolk County
Simcoe Wastewater Treatment Plant

Engagement Meeting:
Norfolk County: Simcoe WWTP Class EA

Meeting Date:	October 9, 2025	
Location:	Virtual (Microsoft Teams)	
Present:	Paolo Oddi (Norfolk County) Mariana Balaban (Norfolk County) Samantha Fraser (Hatch) Rizwan Rizvi (Hatch) Susanne Prince (Hatch) Mateo Gonzalez (Hatch)	Braedan Ristine (LPRCA)
Purpose:	Present and discuss the proposed biosolids upgrade project, including its environmental assessment under Schedule 'B', preferred design alternatives, and associated infrastructure improvements such as access road planning. The team reviewed long-term goals aligned with Ontario's Nutrient Management Act, evaluated technical and environmental feasibility, addressed community and conservation concerns, and outlined next steps for regulatory approvals, traffic safety, and conceptual design development.	

1. Presentation of Public Information Center Boards

- Samantha presented the Public Information Center (PIC) boards, providing an overview on the purpose of the project, review of alternative solutions, presentation of the preferred solution, and mitigation measures that will be implemented for the surrounding community.

2. Questions & Discussion

- Braedan noted that the LPRCA has no major concerns about the biosolids management upgrades based on preliminary review. However, the proposed access road will require permitting and further discussions due to proximity to the conservation area. He noted a few key considerations are:
  - Topography next to the Lynn River
  - Drainage stability and erosion assessments
  - Location of road with respect to the existing LN&E trail

© Hatch 2025 All rights reserved, including all rights relating to the use of this document or its contents.

    - Policies exist regarding road and public construction; more information is needed on how much of the plateau will be used.

- Rizwan confirmed that the road is in conceptual design phase currently, but alignment, plateau and drainage strategy will be evaluated. He reiterated the importance of complying with the regulatory approvals for the design and asked that Braedan provide current LPRCA policies for review.
- Rizwan questioned if full hydraulic simulation and stormwater modeling would be required as part of the permitting. Braedan noted that a grading plan showing the drainage paths will be required.
- Mariana noted the wants from the community to preserve the trail. She also noted the new road will be a 2-lane collector road between Sherman/Victoria and Trillium Way which will serve the treatment plant and future residential developments.
- Rizwan and Mariana noted that the elevation differences are significant and drainage crossings through the proposed road alignment will be reviewed during design.
- Mariana asked Braedan if there was a historical dam located in the conservation authority land near the treatment plant. Braedan noted he was unsure but would look into it and provide an update.
- Braedan noted that regulatory boundaries may change from what is currently available online, and this must be considered during the conceptual design process.

3. Next Steps & Action Items

- Conceptual design updates are expected to be ready by **January 2026**. A meeting will be held to present more information on the road, mitigation strategies, and regulatory measures. The meeting will also advise on permit application processes and requirements.
- A site visit to walk the proposed road path is scheduled for **October 17**. The invitation will be extended to Braedan and the LPRCA.
- Braeden to provide LPRCA policies and any available floodplain information to Hatch and Norfolk County.
- Braeden to confirm details of the possible historical dam located in the conservation area near the treatment facility.

© Hatch 2025 All rights reserved, including all rights relating to the use of this document or its contents.

Appendix F
Mississaugas of the Credit First Nation – Engagement Meeting Minutes

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

Minutes of Meeting

H353644

7/28/2025

Norfolk County
Simcoe Wastewater Treatment Plant

Engagement Meeting:
Norfolk County and Mississaugas of the Credit First Nation

Meeting Date:	July 28, 2025	
Location:	Virtual (Microsoft Teams)	
Present:	Paolo Oddi (Norfolk County) Mariana Balaban (Norfolk County) Oya Koc (Hatch) Susanne Prince (Hatch) Carson Brennen (Hatch)	Abby Lee (MCFN DOCA) Jeremy Sardine (MCFN DOCA)
Purpose:	To engage with the Mississaugas of the Credit First Nation Department of Consultation and Accommodation (MCFN DOCA) regarding the Simcoe Wastewater Treatment Plant Biosolids Management Upgrade and associated Schedule 'B' Class Environmental Assessment (EA) process.	

1. Project Overview

- Oya Koc provided an overview of the project and the purpose of the Class EA under Schedule ‘B’.
- The goal was to share project background, outline current activities, and review key milestones (2016, 2019, and 2029).
- Focus remains on biosolids management, infrastructure components, and environmental considerations.

2. Study Area & Environmental Review

- Oya outlined the study area and reviewed the existing conditions and natural environment assessment.
- MCFN indicated familiarity with the site and its surroundings.
- Road inclusion is under consideration. Oya asked for direction on this potential component.

3. Traffic and Access Concerns

- Paolo Oddi emphasized access and the need to minimize impacts through the design process.
- Traffic congestion and safety for truck access were discussed.
- Mariana Balaban noted increased traffic and the challenges posed by road elevations. The new facility will aim to optimize flow and reduce community impacts.

© Hatch 2025 All rights reserved, including all rights relating to the use of this document or its contents.

4. Archaeological Assessments

- A Stage 1 Archaeological Assessment is underway.
- Oya offered to share the report with MCFN.
- Abby Lee requested copies of the Stage 1 report and any subsequent Stage 2 assessments.
- Oya confirmed a Stage 2 assessment will be conducted if required and will also be shared.
- ASI has been retained to complete archaeological work; MCFN expressed support due to their familiarity with MCFN protocols.

5. Alternatives Review

- Oya presented the Long List of Alternative Solutions and the evaluation table.
- Four alternatives were discussed.
- Jeremy Sardine had no immediate comments but requested consultation and document sharing if a road is constructed.

6. Environmental & Design Considerations

- Abby inquired about mitigation related to a creek bed near the trail system.
- Oya confirmed that the road alignment has not been finalized but the creek and trail will be considered in design and construction.
- Hatch is responsible for the EA and Public Information Centre (PIC); ASI is handling archaeological assessments.

7. Public Information Centre (PIC)

- Tentative date set for August 13, 2025.
- Stakeholders, including Indigenous communities, will be notified in advance.
- Abby noted that MCFN typically does not attend PICs but appreciated the invitation.

8. Project Benefits

- Mariana outlined the benefits of the upgrade, including reduced biosolids holding time (currently 8 months), improved biosolids quality, and compliance with upcoming regulations.
- Technology upgrades will produce fertilizer and reduce odor impacts.
- Biogas recovery systems and flaring for emission control are planned.
- Simultaneous upgrades to both biosolids management and liquid trains are essential to the project's success.

9. Follow-up and Information Sharing

- MCFN reiterated interest in receiving all archaeological and environmental reports (Stage 1, Stage 2 if applicable, and environmental memo).
- Mariana requested that MCFN provide costs associated with technical report reviews.
- Abby confirmed that costs would be shared with Paolo Oddi.
- Paolo committed to distributing reports to both Abby and Jeremy once available.
- Oya clarified that the environmental report would be issued as a memorandum.

© Hatch 2025 All rights reserved, including all rights relating to the use of this document or its contents.

Appendix G
Engagement Tracking Log

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

Mississaugas of the Credit First Nation (MCFN)

Line Item	Date of Receipt	Indigenous Community	Correspondent(s)	Method of Communication	Subject	Date of Response	Response and Resolution
1	06/20/2025	Mississaugas of the Credit First Nation (MCFN)	Paolo Oddi (Norfolk County)	Email	Notice of Commencement	7/2/2025	See line item 2
2	07/2/2025	MCFN	Abby LaForme (MCFN)	Email	Interest in holding meeting to review the project. Following dates MCFN is available: July 21, 2025- 9:30am- Noon July 22, 2025- Noon- 3pm July 28, 2025- 9:30am – Noon & 1pm- 3pm.	7/23/2025	See line item 3
3	07/23/2025	MCFN	Paolo Oddi (Norfolk County)	Email	The county provided their availability. Offered to meet virtually on Monday, July 28th from 10:00 a.m. to 11:00 a.m.	7/28/2025	See line item 5
4	07/28/2025	MCFN	Paolo Oddi (Norfolk County)	Email	Notice of Public Information Centre	N/A	N/A
5	07/28/2025	MCFN	Paolo Oddi (Norfolk County)	Microsoft Teams	Review of project materials and information	N/A	N/A
6	10/03/2025	MCFN	Carson Brennen (Hatch)	Email	Coordination of S2AA	10/16/2025	See line item 7
7	10/16/2025	MCFN	Fawn Sault (MCFN)	Email	Coordination of S2AA	10/16/2025	MCFN forwarded correspondence to correct department
8	10/16/2025	MCFN	Adam LaForme (MCFN)	Email	Coordination of S2AA	10/29/2025	See line item 10
9	10/24/2025	MCFN	Jason Barret (ASI)	Email	Logistical coordination of S2AA	N/A	N/A
10	10/29/2025	MCFN	Adam LaForme (MCFN)	Email	Coordination of S2AA	11/03/2025	See line item 11

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

Line Item	Date of Receipt	Indigenous Community	Correspondent(s)	Method of Communication	Subject	Date of Response	Response and Resolution
11	11/03/2025	MCFN	Carson Brennen (Hatch)	Email	Coordination of S2AA	N/A	N/A
12	11/05/2025	MCFN	Carson Brennen (Hatch)	Email	Coordination of S2AA	N/A	N/A
13	12/18/2025	MCFN	Carson Brennen (Hatch)	Email	Notice of Completion	N/A	N/A
14	02/26/2026	MCFN	Jason Barrett (ASI)	Email	Stage 2 Archaeological Assessment Report	N/A	N/A

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

Six Nations of the Grand River (SNGR)

Line Item	Date of Receipt	Indigenous Community	Correspondent(s)	Method of Communication	Subject	Date of Response	Response and Resolution
1	06/20/2025	Six Nations of the Grand River (SNGR)	Paolo Oddi (Norfolk County)	Email	Notice of Commencement	N/A	N/A
2	07/28/2025	SNGR	Paolo Oddi (Norfolk County)	Email	Notice of Public Information Centre	N/A	N/A
3	10/03/2025	SNGR	Carson Brennen (Hatch)	Email	Notice of S2AA	10/06/2025	See line item 4
4	10/06/2025	SNGR	Dawn LaForme (SNGR)	Email	S2AA coordination	10/16/2025	See line item 5
5	10/16/2025	SNGR	Carson Brennen (Hatch)	Email	S2AA coordination	10/20/2025	See line item 6
6	10/20/2025	SNGR	Dawn LaForme (SNGR)	Email	S2AA coordination	10/22/2025	See line item 7
7	10/22/2025	SNGR	Carson Brennen (Hatch)	Email	S2AA coordination	N/A	N/A
8	10/24/2025	SNGR	Jason Barret (ASI)	Email	Logistical coordination of S2AA	N/A	N/A
9	12/18/2025	SNGR	Carson Brennen (Hatch)	Email	Notice of Completion	N/A	N/A
10	02/26/2026	SNGR	Jason Barrett (ASI)	Email	Stage 2 Archaeological Assessment Report	N/A	N/A

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

Haudenosaunee Confederacy Chiefs Council (HCCC) and Haudenosaunee Development Institute (HDI)

Line Item	Date of Receipt	Indigenous Community	Correspondent(s)	Method of Communication	Subject	Date of Response	Response and Resolution
1	06/20/2025	Haudenosaunee Confederacy Chiefs Council (HCCC) and Haudenosaunee Development Institute (HDI)	Paolo Oddi (Norfolk County)	Email	Notice of Commencement	N/A	N/A
2	07/28/2025	HCCC/HDI	Paolo Oddi (Norfolk County)	Email	Notice of Public Information Centre	N/A	N/A
3	10/03/2025	HDI	Carson Brennen (Hatch)	Email	Coordination of S2AA	10/06/2025	HDI expressed interest in participating in the S2AA
4	10/17/2025	HDI	Carson Brennen (Hatch)	Email	Coordination of S2AA	10/24/2025	See line item 5
5	10/24/2025	HDI	Raechelle Williams (HDI)	Email	Coordination of S2AA	N/A	N/A
6	10/27/2025	HDI	Jason Barret (ASI)	Email	Logistical coordination of S2AA	N/A	N/A
7	11/03/2025	HDI	Carson Brennen (Hatch)	Email	Coordination of S2AA	N/A	N/A
8	12/18/2025	HDI	Carson Brennen (Hatch)	Email	Notice of Completion	1/6/2026	See line item 9
9	01/6/2026	HDI	Matt Turner (HDI)	Email	Meeting request to discuss the project and capacity funding to review project documents.	1/12/2026	See line item 10
10	01/12/2026	HDI	Paolo Oddi (Norfolk County)	Email	The County provided their availability. Offered to meet virtually in the afternoon of January 29 or the morning of January 30.	1/12/2026	See line item 11

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

Line Item	Date of Receipt	Indigenous Community	Correspondent(s)	Method of Communication	Subject	Date of Response	Response and Resolution
11	01/12/2026	HDI	Matt Turner (HDI)	Email	HDI confirmed January 30 works best. Norfolk County (Paolo) sent meeting invitation.	1/12/2026	See line item 12
12	01/30/2026	HDI	Paolo Oddi (Norfolk County)	Microsoft Teams	Review of project materials and information	N/A	N/A
13	01/30/2026	HDI	Matt Turner (HDI)	Email	HDI requested information from Norfolk County in order to general standard agreement.	2/20/2026	See line item 13
14	02/20/2026	HDI	Samantha Fraser (Hatch)	Email	Provided requested documentation to HDI, including Stage 1 Archaeological Assessment (AA) Report for the access road, Stage 2 AA for the Biosolids Site, and the MECP Project File Report Review Letter.	N/A	N/A
15	02/24/2026	HDI	Matt Turner (HDI)	Email	Provided HDI's budget plan for the project.	N/A	N/A
16	02/26/2026	HDI	Jason Barrett (ASI)	Email	Stage 2 Archaeological Assessment Report	N/A	N/A

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

Ministry of Environment, Conservation and Parks (MECP)

Line Item	Date of Receipt	Stakeholder	Correspondent(s)	Method of Communication	Subject	Date of Response	Response and Resolution
1	06/20/2025	Ministry of Environment, Conservation and Parks (MECP)	Carson Brennen (Hatch)	Email	Notice of Commencement	6/30/2025	See line item 2
2	06/30/2025	MECP	Serina Liu; CC'd Joan Del Villar Cuicas (MECP)	Email	MECP required additional information to proceed with issuing the Acknowledgment Letter.	N/A	N/A
3	07/4/2025	MECP	Joan Del Villar Cuicas; CC'd Neil Hannington; Jeremy Gamble (MECP)	Email	MECP issued their Acknowledgment Letter	N/A	N/A
4	12/18/2025	MECP	Carson Brennen (Hatch)	Email	Notice of Completion	N/A	N/A
5	01/07/2026	MECP	Kady Kaurin (MECP)	Email	PFR review extension	01/09/2026	MECP review period extended until 01/30/2026
6	01/30/2026	MECP	Kady Kaurin (MECP)	Email	PFR review comments	N/A	N/A

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

Ministry of Natural Resources (MNR)

Line Item	Date of Receipt	Stakeholder	Correspondent(s)	Method of Communication	Subject	Date of Response	Response and Resolution
1	06/20/2025	Ministry of Natural Resources (MNR)	Carson Brennen (Hatch)	Email	Notice of Commencement	N/A	N/A
2	12/18/2025	MNR	Carson Brennen (Hatch)	Email	Notice of Completion	N/A	N/A

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

Ministry of Tourism, Culture and Sport (MTCS)

Line Item	Date of Receipt	Stakeholder	Correspondent(s)	Method of Communication	Subject	Date of Response	Response and Resolution
1	06/20/2025	Ministry of Tourism, Culture and Sport (MTCS)	Carson Brennen (Hatch)	Email	Notice of Commencement	N/A	N/A
2	12/18/2025	MTCS	Carson Brennen (Hatch)	Email	Notice of Completion	N/A	N/A

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

Ministry of Indigenous Affairs and First Nations Economic Reconciliation (MIAFNER)

Line Item	Date of Receipt	Stakeholder	Correspondent(s)	Method of Communication	Subject	Date of Response	Response and Resolution
1	06/20/2025	Ministry of Indigenous Affairs and First Nations Economic Reconciliation (MIAFNER)	Carson Brennen (Hatch)	Email	Notice of Commencement	N/A	N/A
2	12/18/2025	MIAFNER	Carson Brennen (Hatch)	Email	Notice of Completion	N/A	N/A

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

Ministry of Municipal Affairs and Housing (MMAH)

Line Item	Date of Receipt	Stakeholder	Correspondent(s)	Method of Communication	Subject	Date of Response	Response and Resolution
1	6/20/2025	Ministry of Municipal Affairs and Housing (MMAH)	Carson Brennen (Hatch)	Email	Notice of Commencement	N/A	N/A
2	12/18/2025	MMAH	Carson Brennen (Hatch)	Email	Notice of Completion	N/A	N/A

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

Long Point Region Conservation Authority (LPRCA)

Line Item	Date of Receipt	Stakeholder	Correspondent(s)	Method of Communication	Subject	Date of Response	Response and Resolution
1	9/18/2025	Long Point Region Conservation Authority (LPRCA)	Carson Brennen (Hatch)	Email	Notice of Commencement	N/A	N/A
2	9/26/2025	LPRCA	Braedan Ristine (LPRCA)	Email	Request to schedule meeting	9/29/2025	Suggested meeting date on 10/06/2025
3	10/01/2025	LPRCA	Carson Brennen (Hatch)	Email	Meeting scheduling	10/02/2025	See line item 4
4	10/03/2025	LPRCA	Braedan Ristine (LPRCA)	Email	Meeting scheduling	10/06/2025	See line item 5
5	10/06/2025	LPRCA	Carson Brennen (Hatch)	Email	Meeting scheduling	10/06/2025	Meeting set for 10/09/2025
6	10/09/2025	LPRCA	Paolo Oddi (Norfolk County)	Microsoft Teams	Engagement meeting	N/A	N/A
7	12/18/2025	LPRCA	Carson Brennen (Hatch)	Email	Notice of Completion	N/A	N/A

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

Appendix H
Notices

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

Notice of Study Commencement Simcoe Wastewater Treatment Plant – Biosolids Management Upgrade Municipal Class Environmental Assessment

June 23, 2025

- Public Notices (/news-and-notices/categories/public-notices/)

Norfolk County (County) has initiated a Municipal Class Environmental Assessment (Class EA) for the Simcoe Wastewater Treatment Plant (WWTP). The Norfolk County Integrated Sustainable Master Plan (ISMP), finalized in

September 2016, identified upgrades to the Simcoe WWTP's solids handling processes, including utilizing biosolids storage tanks at the Simcoe WWTP to store biosolids from Port Dover and Port Rowan WWTPs based on a planning horizon year of 2041.

The purpose of this study is to review and update the proposed upgrades in the ISMP based on best available technologies and updated regulatory compliance requirements for biosolids management servicing needs projected to 2051 at County-wide level. A map of the study area is provided in Figure 1.

This Study is being undertaken in accordance with the requirements for Schedule 'B' projects within the Municipal Class EA document (2000, as amended), under the Ontario Environmental Assessment Act.

Public Information Centre

Posted Friday, July 25, 2025

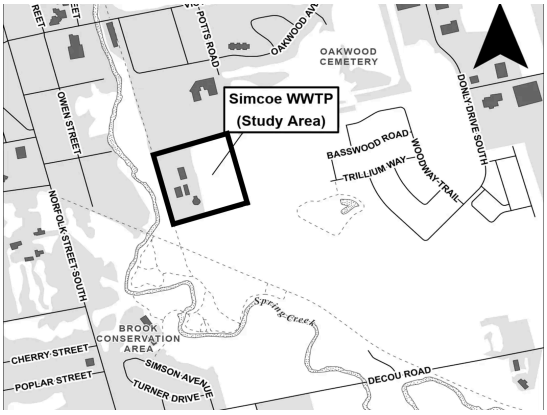
Public consultation is an essential component of the Class EA process, and we welcome your feedback. Norfolk County plans to host a Public Information Centre (PIC) during the study on August 12, 2025.

The PIC will provide background information on the study, compare the alternative solutions, and compare the alternative design concepts to identify a preliminary preferred design concept to be implemented.

Additional information on the PIC and study will be provided closer to the event date on this page.

Date: August 12, 2025
Time: Drop in from 5:00 to 7:00 p.m.
Location: Norfolk County Administration Building Council Chambers Public Entrance, 50 Colborne St S, Simcoe, Ontario N3Y 4H3 **(https://share.google/p7nE23Ji8tLHXA9c5)**

View a copy of the presentation. **(/media/xippnln0/pic-presentation-simcoe-biosolids-ea.pdf)**



(/media/3oqlpvnk/simcoe-wwtp-study-area-map.png)
Figure 1 - Study Area Location

Project Contact Information

If you would like more information about the study or would like to be added to the contact list to receive future notices, please contact:

Paolo Oddi, C. Tech
Project Manager
Norfolk County

Tel.: (519) 426-5870 ext. 5035
Email: paolo.oddi@norfolkcounty.ca (mailto:paolo.oddi@norfolkcounty.ca)

Oya Koç, P.Eng.
Project Manager
Hatch Ltd.
Tel.: (289) 326-1808
Email: oya.koc@hatch.com (mailto:oya.koc@hatch.com)

Information will be collected in accordance with the Freedom of Information and Protection of Privacy Act. With the exception of personal information, all comments will become part of the public record.

This Notice was first issued on Monday, June 23, 2025.

Subscribe

(/subscribe-to-news-and-notices/)

Contact Us

ServiceNorfolk

50 Colborne Street South
Simcoe, Ontario
N3Y 4H3

Phone: 519-426-5870 (tel:519-426-5870) or 226-NORFOLK (tel:226-667-3655), extension 0

More ways to contact us (/contact/)

Mailing Address

Norfolk County
County Administration Building
50 Colborne Street South
Simcoe, Ontario N3Y 4H3

Share your feedback

Visit Engage Norfolk to share your feedback and ideas about ongoing projects and initiatives with us.

Visit Engage Norfolk (https://engagenorfolk.ca)

Connect

View our Instagram page (https://www.instagram.com/norfolkcounty.ca/) View our Facebook page (https://www.facebook.com/NorfolkCountyCA) View our Youtube page (https://www.youtube.com/channel/UCpz4tpLVdDV4xJKlCreRCHA) View our Twitter page (https://twitter.com/NorfolkCountyCA)

© 2025 Norfolk County Accessibility (https://www.norfolkcounty.ca/accessibility/) Privacy Policy (https://www.norfolkcounty.ca/council-administration-and-government/public-records/) Sitemap (https://www.norfolkcounty.ca/sitemap/) Website Feedback (https://forms.norfolkcounty.ca/Website-Feedback-Form) Contact (https://www.norfolkcounty.ca/contact/) Made with Govstack (https://govstack.com/)

Appendix I
Public Information Centre Poster Boards

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

Welcome to Norfolk County's Public Information Centre!

Simcoe Wastewater Treatment Plant – Biosolids Management Upgrade

Tuesday August 12, 2025, from 5:00pm to 7:00pm

Share your Feedback

Norfolk COUNTY

Simcoe Wastewater Treatment Plant – Biosolids Management Upgrade

Schedule “B” Municipal Class Environmental Assessment

Public Information Centre

August 12, 2025, from 5:00pm to 7:00pm

Norfolk County Administration Building Council Chambers
50 Colborne St S, Simcoe ON

Indigenous Acknowledgement

The Municipality of Norfolk County is committed to furthering Truth and Reconciliation in our communities. We recognize the historical and current contributions of Indigenous Peoples throughout Canada, and particularly in Norfolk County, that have added to the rich cultural and social fabric that exists here today.

We will strive to continually strengthen and develop the spirit of respect, co-operation and collaboration to the mutual benefit of all Norfolk County residents.

Welcome!

Objectives of Public Information Centre (PIC):

1. Introduce the project with background
2. Provide an overview of the study process
3. Present the alternative solutions being considered
4. Present the evaluation process used to identify the recommended preferred solution
5. Discuss next steps and obtain your input

What should I be doing?

- ✓ Reviewing the PIC presentation boards
- ✓ Ask questions or share your comments with the team members in attendance
- ✓ Complete the feedback form or provide comment via email. Any feedback received will inform the selection and finalization of the preferred solution

Norfolk COUNTY

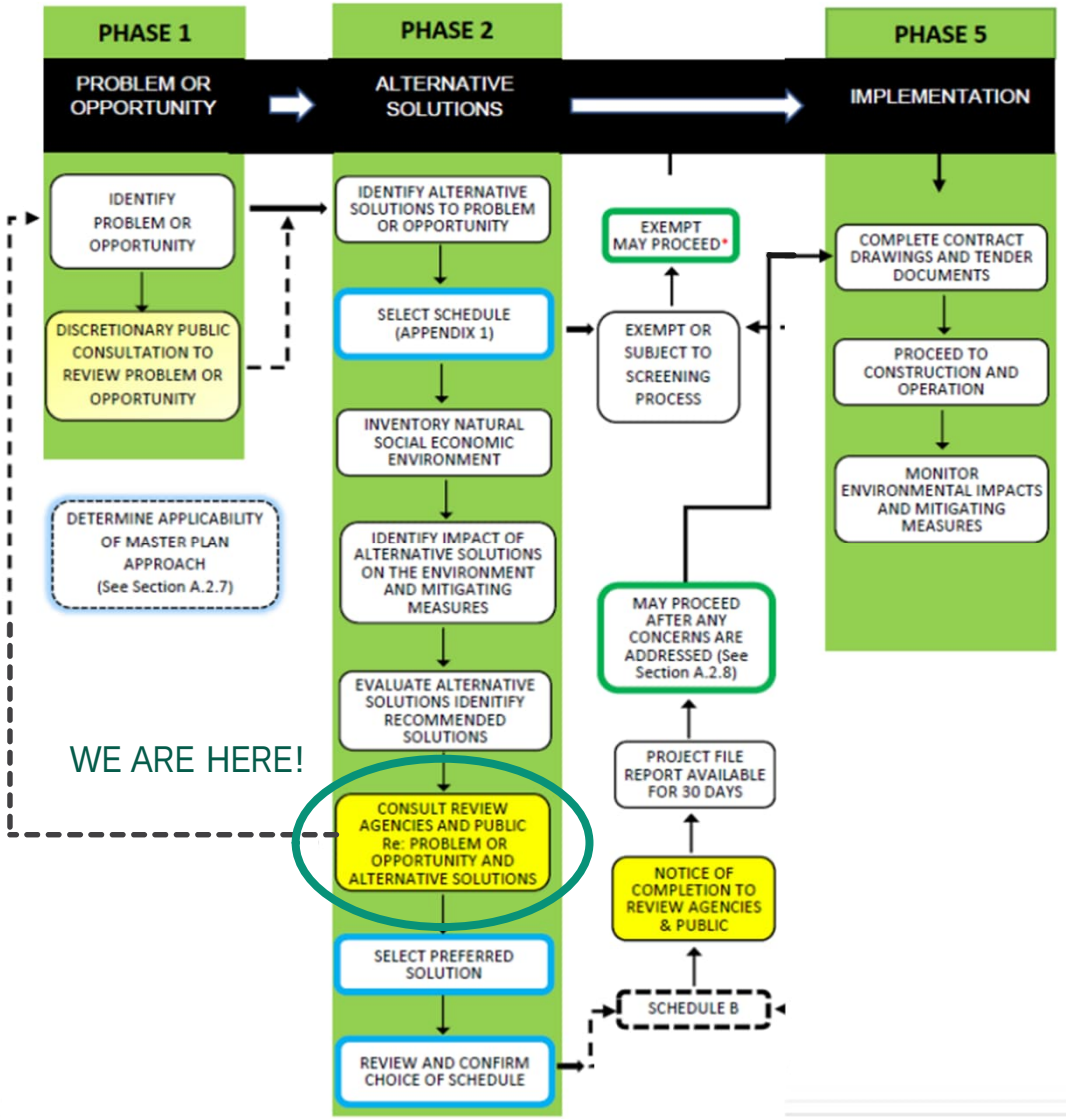
Class Environmental Assessment (EA) Study Process

As the proponent, Norfolk County is committed to conducting a Schedule “B” Class EA for this project.

Schedule “B” projects have the potential for some adverse environmental effects. It requires that the proponent contact affected members of the public and relevant review agencies.

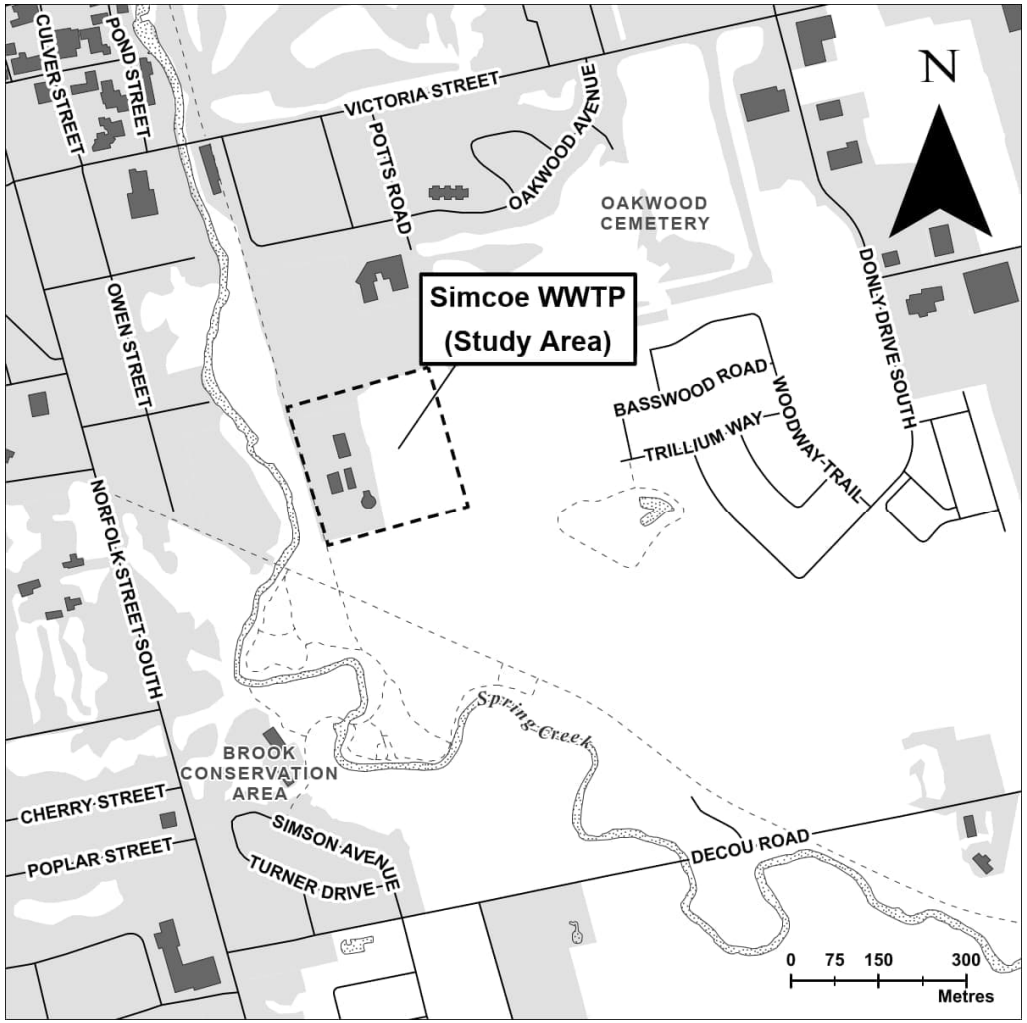
Where are We?

- The County completed the initial studies and developed the preliminary preferred solution
- This PIC represents the “Consult Review Agencies and Public in Problem or Opportunity and Alternative Solutions” step



Project Study Area

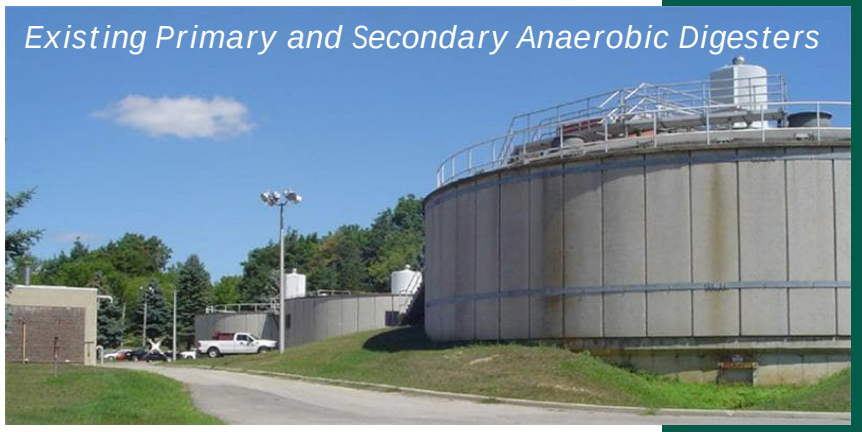
- The limits of the Study Area extend to the municipal property boundary of the Simcoe Wastewater Treatment Plant (WWTP)
- Location: 16 Oakwood Ave, Simcoe, ON N3Y 1H3
- Plant Vicinities:
  - North: Medium-density residential
  - East: Residential & Institutional/Services
  - South: Low-density residential & Brook Conservation Area
  - West: Residential, light commercial fringe & LE&N Trail
- Community Features Nearby: School, Cemetery, Conservation Land, Trail, Park, Memorial Site, Public Facilities, Recreation Areas
- Lynn River, Small Pond in Wellington Park, Watershed – Drains into Lake Erie



Problem and Opportunities

- **Regulatory Requirements: Biosolids management options must be reviewed in alignment with the current planning horizon to 2051 and in accordance with Ontario's Nutrient Management Act**
- **Current operation of the plant is experiencing issues with ESA Code and regulatory compliance with respect to digester performance and biosolids quality**
- The Norfolk County Integrated Sustainable Master Plan (ISMP) from 2016 identified that upgrades to the Simcoe WWTP solids handling processes are required
- Older technologies, close to end-of-life service life and safety compliance issues with the existing biosolids handling facilities at Simcoe and Port Dover WWTPs
- Newer technologies have become more prominent in the wastewater treatment industry and should be evaluated against conventional technologies
- Possibility to convert biosolids to higher value final product such as Class A product that complies with Canadian Food Inspection Agency (CFIA) fertilizer quality designation
- Lack of expansion space at the other four plants within the Norfolk County to expand/upgrade biosolids facilities to meet the current requirements





Existing Primary and Secondary Anaerobic Digesters

Norfolk County must develop a long-term biosolids management solution to effectively handle materials generated at all wastewater treatment plants. The solution should accommodate future growth, evaluate emerging technologies, maximize value, be fiscally responsible, and minimize environmental impacts.

Norfolk COUNTY

Project Background

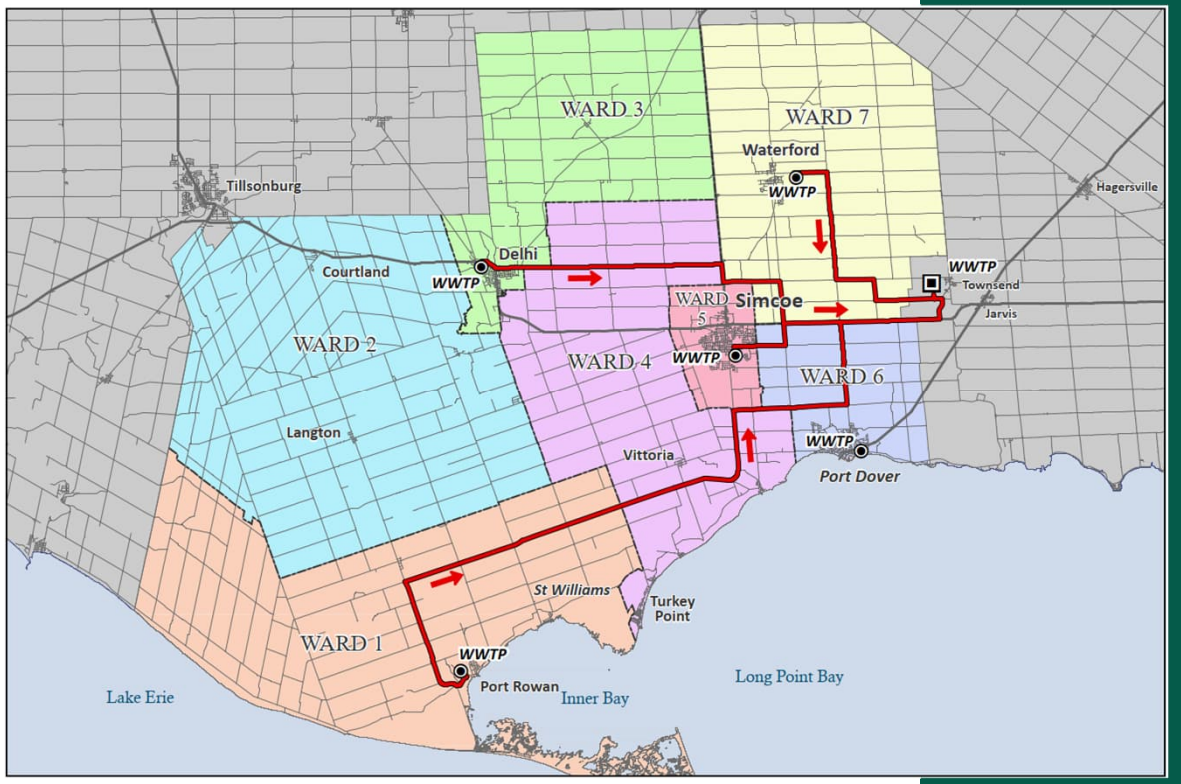
- **In 2016**, the Integrated Sustainable Master Plan (ISMP) presented a Biosolids Management Solution for the Simcoe WWTP for the 25-year planning horizon and growth management plan
  - Aerobic digestion and thickening of Simcoe WWTP Biosolids
  - Repurposing of the existing anaerobic digesters for storage of biosolids from Simcoe, and excess biosolids from Port Rowan and Port Dover WWTPs in future
  - Builds on 2007 Biosolids Management Options Report
- **In 2019**, the Biosolids Management Solution was re-evaluated for a design year of 2041
  - Considered Delhi WWTP as an additional source of biosolids
  - Recommended technology change to anaerobic digestion at Simcoe WWTP
- **Starting 2024**, Norfolk County started the process to re-evaluate solutions for three reasons
  - County-wide review of biosolids management was necessary
  - New growth projection to 2051, including addition of Waterford WWTP sludge to the design basis
  - New technologies, including Thermal Hydrolysis Process (THP), became more feasible



Simcoe Wastewater Treatment Plant – Overview

2025 Biosolids Disposal Routes (Current)

Wastewater Treatment Plants	Design Capacity (ADF m^3/d)	Biosolids Class B Production (kg/d)	# trucks per week	Disposal Route
Simcoe	15,400-Rated Capacity 7,261-Actual	1,918	5.5	• 75% to Townsend Lagoons • 25% to Land Application
Delhi	3,182	426	1.5	• 33% to Townsend Lagoons • 67% to Land Application
Waterford	2,200	153	0.5	• 100% Facultative Lagoon Clean Up sent to Townsend Lagoons (2002 & 2025)
Port Dover	5,400	740	2.5	• 100% to Land Application with Storage at the Plant
Port Rowan	1,140	226	1	• 50% to Townsend Lagoons • 50% to Land Application
Norfolk County Totals	**27,322**	**3,463**	**11**	• 51% to Townsend Lagoons • 49% to Land Application



Current Truck Route for Sludge Hauling to Townsend Lagoons





What are Biosolids?

Biosolids are nutrient-rich organic materials produced during the treatment of domestic sewage sludge. Once treated to meet regulatory standards, biosolids can be beneficially reused most commonly through land application.

There are two classifications of biosolids considered in this project:

Class A and Class B

Class B Biosolids have undergone treatment to reduce pathogens but do not eliminate them entirely. They are subject to additional restrictions for public health and environmental safety. Non-Agricultural Source Material (NASM) Plans (OMAFRA protocols) are required prior to land application. All five wastewater facilities currently produce Class B biosolids.

Nutrient Management Act, O. Reg. 267/03

E-Coli < 2,000,000 CFU/g (dry solids).

Class A Biosolids must have pathogens reduced to virtually all non-detectable levels and comply with very strict standards for odours, metals, and vector attraction reduction. Class A biosolids are safe for residential home use for lawns and gardens and in agricultural applications. Class A Biosolids are considered fertilizers and therefore NASM Plans are not required.

Nutrient Management Act, Fertilizers Act,

E-Coli < 1,000 CFU/g (dry solids).

All municipal biosolids that are land applied must meet safety standards for trace metals, pathogen indicators, dioxins and furans and pesticide residues if applicable



Transfer from Truck to Field Applicator

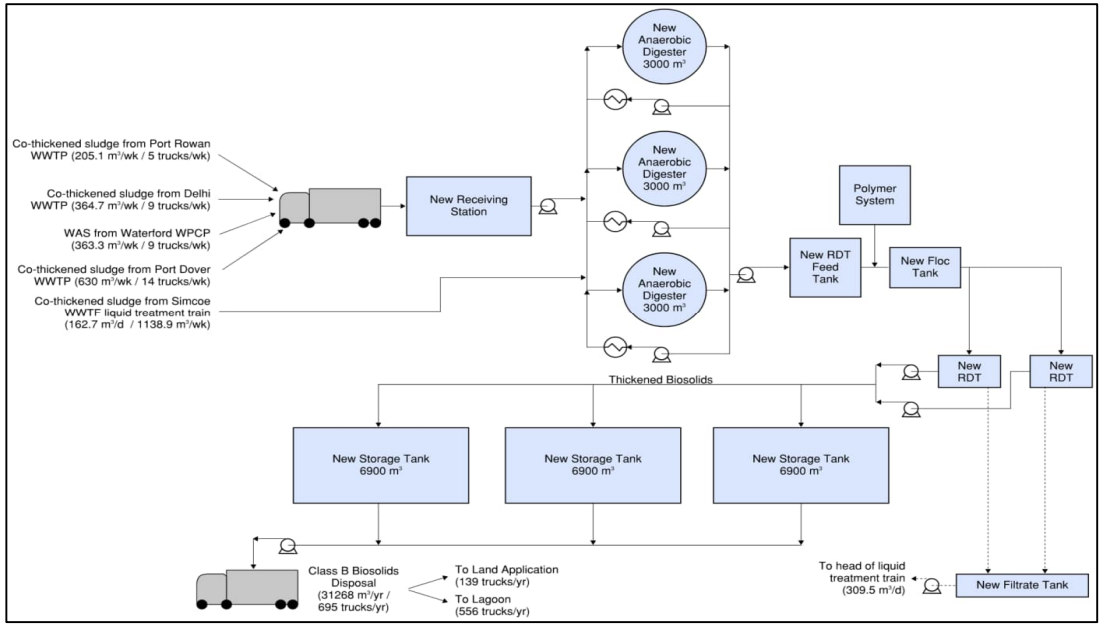


Fertilizer (Class A Biosolids) Land Application

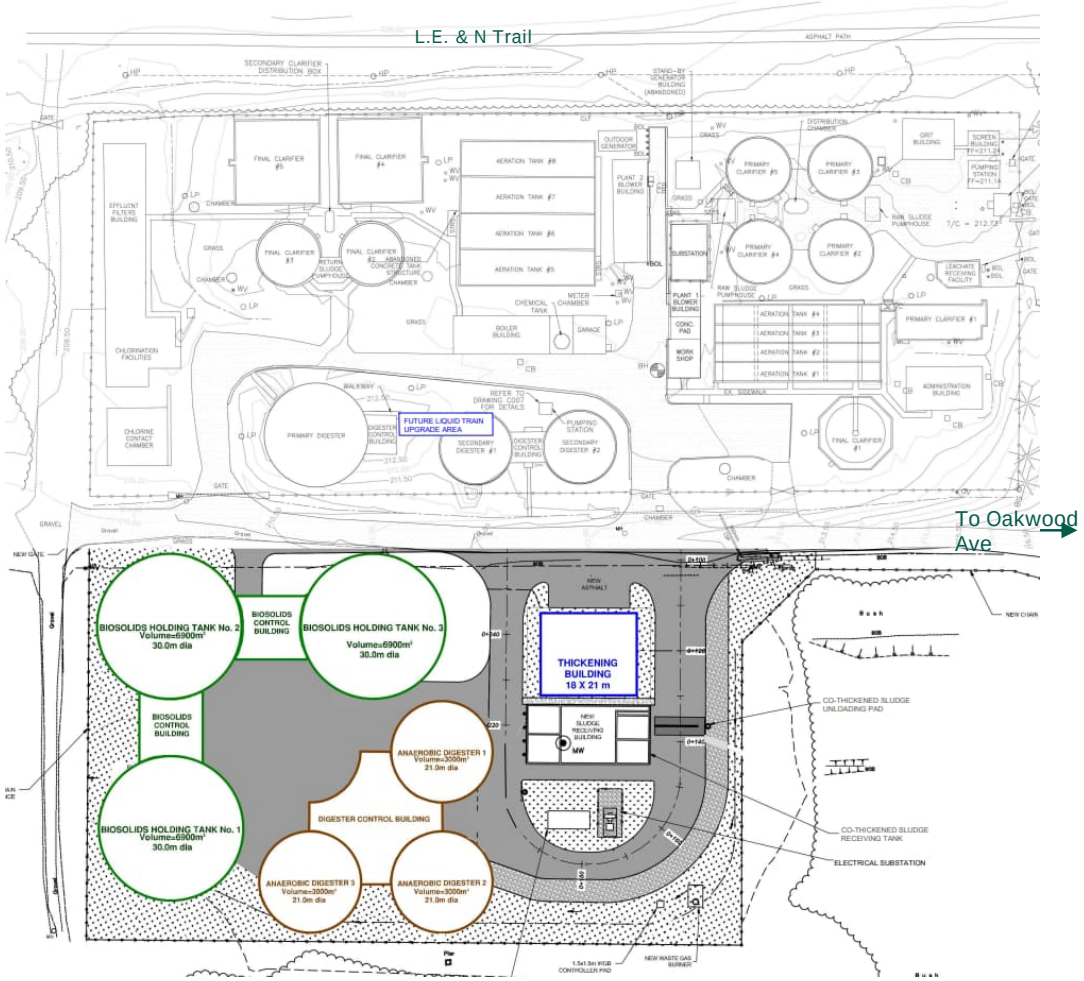
Long List of Alternative Solutions Evaluation

Alternative Number	Alternative Solution	Meets 2051 Growth Requirements?	Feasible Solution?
1	Do Nothing	**No**	**No** *Ruled out*
2	2016 Master Plan (ISMP) Solution – Aerobic digestion and thickening of Simcoe Biosolids, and repurposing of the Simcoe WWTP anaerobic digesters for storage of biosolids from Simcoe, and excess biosolids from Port Rowan and Port Dover WWTPs in future	**No** •*Meets only 2041 planning horizon* •*Did not include Delhi and Waterford WWTPs* •*2019 Delhi WWTP was added*	**No** *Ruled out due to high cost & failure to provide a complete solution for the County*
3	Centralized (for all WWTPs) Anaerobic Digestion and Biosolids Storage with Thickening at Simcoe WWTP	**Yes**	**Yes** *Carried Forward*
4	Centralized (for all WWTPs) Thermal Hydrolysis Process (THP) Stabilization and Biosolids Storage at Simcoe WWTP	**Yes**	**Yes** *Carried Forward*

Short Listed Alternative Solution 3 – Centralized Anaerobic Digestion and Biosolids Storage with Thickening at Simcoe WWTP

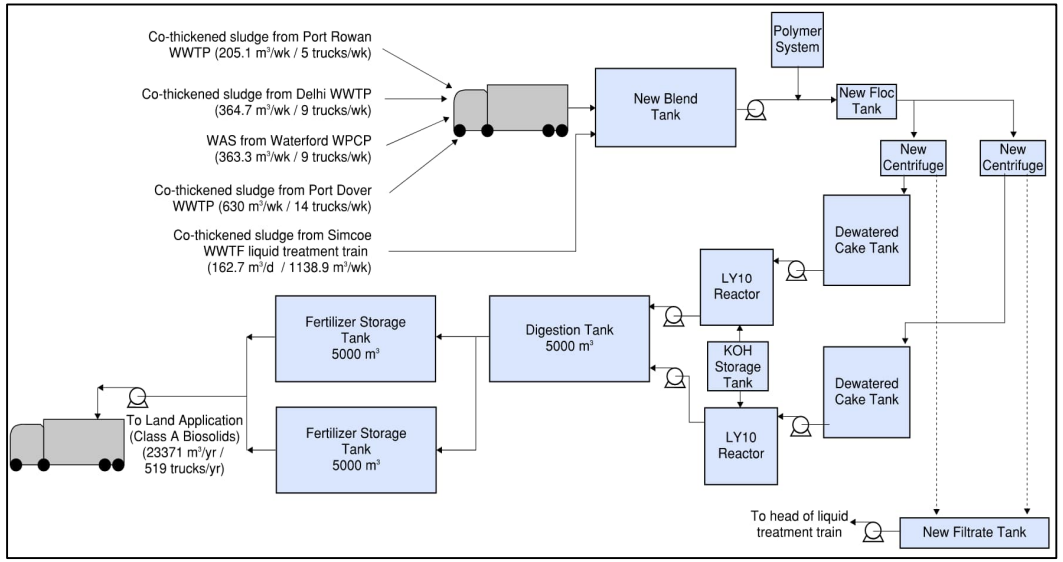


Proposed Process Flow Schematic

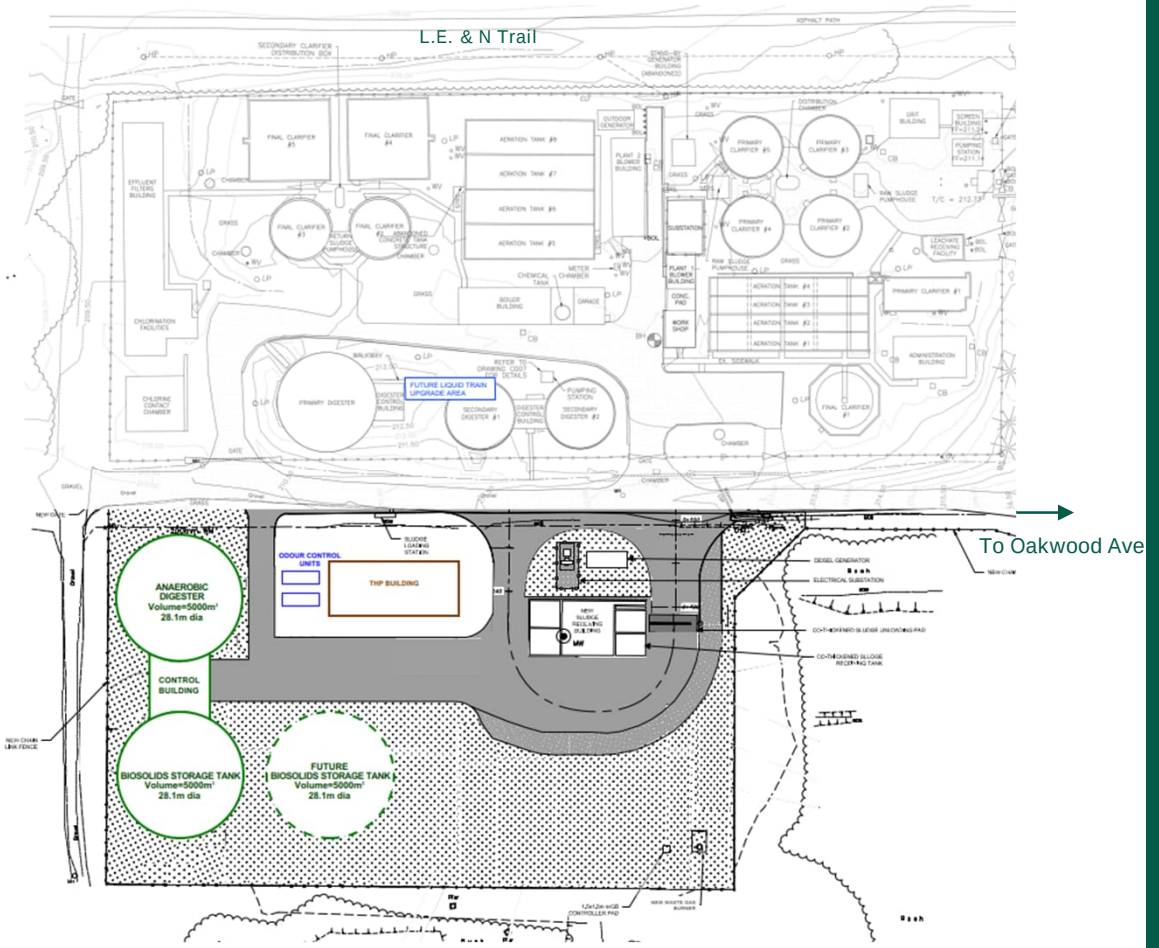


Preliminary Site Layout

Short Listed Alternative Solution 4 – Centralized Thermal Hydrolysis Process Stabilization and Biosolids Storage at Simcoe WWTP



Proposed Process Flow Schematic



Preliminary Site Layout

Technical Feasibility Comparison

Alternative Solution 3 – Centralized Anaerobic Digestion

- Produces Class B biosolids, with higher pathogen levels – less ideal for reuse near communities
- Odours can be more noticeable, potentially affecting nearby residents
- Limited operating flexibility as all system components need to be sized to ultimate 2051 flows and loadings, which will impact short term performance if growth is delayed
- Treatment process produces larger volume of biosolids, requiring more trucks (4/week) for hauling compared to THP process and requires larger storage capacity (e.g., 240 days) – increasing land and footprint needs

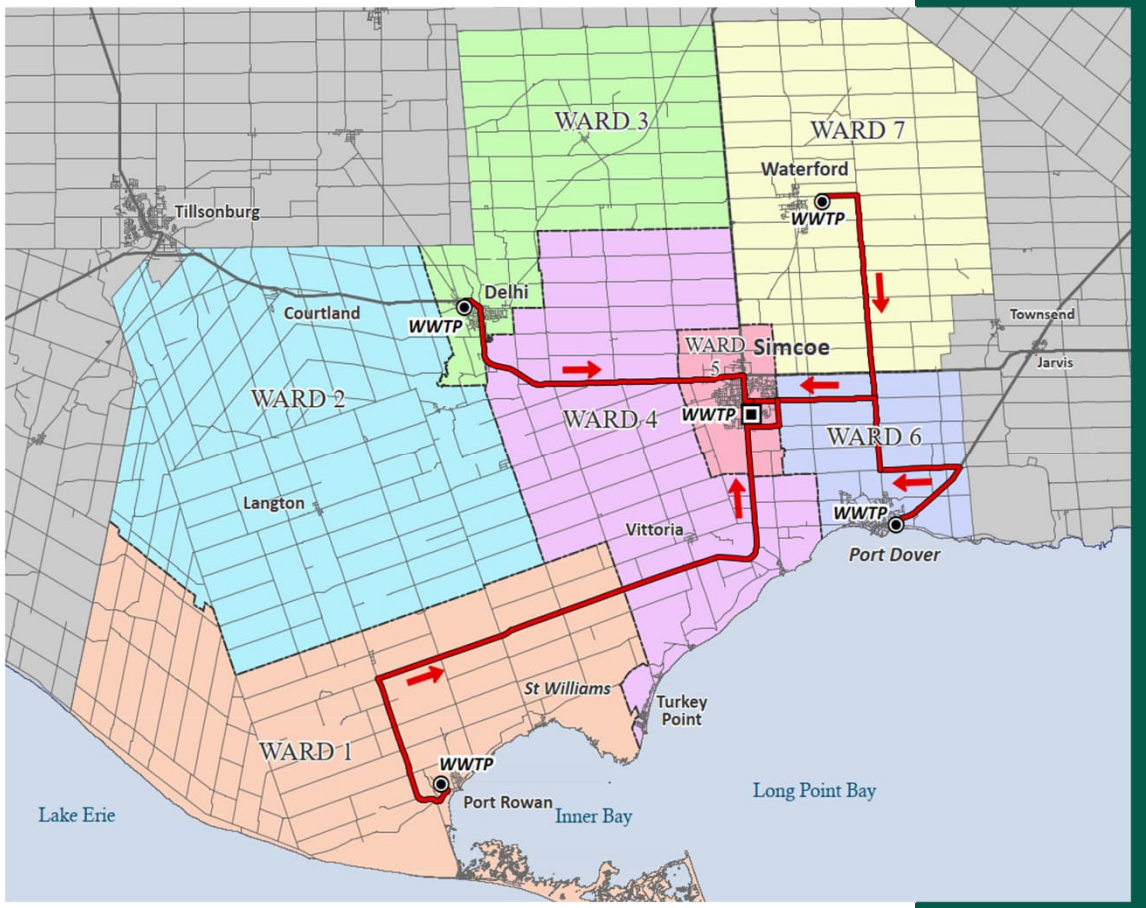
Alternative Solution 4 – Centralized Thermal Hydrolysis Process

- Advanced treatment delivers Class A biosolids, safest for community and environment
- Significantly reduces pathogens and odours, minimizing nuisance to neighbors
- Higher operating flexibility allows system run time to be adjusted to increase treatment capacity, having no impact on short term performance
- Onsite storage is not regulated - treatment process produces lower volume of biosolids, requiring fewer trucks for hauling and reducing overall storage requirements – smaller footprint, less land use

Norfolk COUNTY

2051 Biosolids Management Forecast (Future)

Wastewater Treatment Plants	Design Capacity Forecast (ADF m3/d)	Sludge Production Forecast (m3/d)	# Sludge trucks per week to Simcoe	# Biosolids trucks to land per week from Simcoe Alternative 3	# Fertilizer trucks to land per week from Simcoe Alternative 4
Simcoe	15,400	4,475	Sludge Treated on Site	14	10
Delhi	3,182	1,563	9	0	0
Waterford	3,500	779	8	0	0
Port Dover	7,500	1,889	14	0	0
Port Rowan	2,280	790	4	0	0
Norfolk County Totals	**31,862**	**9,496**	**35**	**14**	**10**



Truck Route for Sludge Hauling with County-wide Biosolids Management Facility at Simcoe WWTP

Financial Impact Comparison

Indicator / Alternative	Alternative 3 – Centralized Anaerobic Digestion and Biosolids Storage with Thickening at Simcoe WWTP	Alternative 4 – Centralized Thermal Hydrolysis Process Stabilization and Biosolids Storage at Simcoe WWTP
Capital Cost	$100,330,000*	$56,264,000*
Annual Operation and Maintenance Cost	$530,000**	$915,000**
27-year Life Cycle Cost (to 2051)	$121,305,000	$92,455,000

Recommended Preferred Alternative

* *Proposed Access Road worth $7M-$9M is not included in the capital cost*

** *Annual Operation and Maintenance Costs including core process elements for each alternative for comparison purposes*

Norfolk COUNTY

Detailed Evaluation of Short-listed Alternatives

Evaluation Criteria	Alternative 3 – Centralized Anaerobic Digestion and Biosolids Storage with Thickening at Simcoe WWTP	Rating	Alternative 4 – Centralized Thermal Hydrolysis Process Stabilization and Biosolids Storage at Simcoe WWTP	Rating
Environmental	• Reduction in current CO_2 emissions • Produces lower quality **Class B** biosolids – E. coli levels must be < 2,000,000 CFU/g • A Non-Agricultural Source Material (NASM) Plan is required for an agricultural operation/ application • Storage at Townsend lagoons required when land application is not feasible	◑	• Reduction in current CO_2 emissions • Achieves **Class A** biosolids standard – E. coli < 1,000 CFU/g; produces higher quality biosolids • Pathogen and Odour Reduction • Storage at Townsend lagoons no longer required • Enhanced Biogas Production which will be used for energy recovery	◔
Social	• Higher biosolids volume to be hauled from Simcoe WWTP (14 trucks per week) • Increased incoming sludge truck traffic (35 trucks/week) than current operation	◑	• Lower biosolids volume to be hauled from Simcoe WWTP (10 trucks per week) • Increased incoming sludge truck traffic (35 trucks/week) than current operation	◔
Economic	• Higher capital cost • Lower operating cost • Higher life cycle cost	●	• Lower capital cost • Higher operating cost • Lower life cycle cost	◑
Technical	• Follows NASM regulatory requirements • Product quality will restrict its use • 240 days of storage and a larger storage footprint • Lower operational risk: • Operating temperatures (<40C) • Process includes gas emissions and explosion risk	◑	• Follows Canadian Food Inspection Agency (CFIA) regulations • Pathogen destruction • Product quality will not restrict its use • Operational flexibility for increased capacity • Higher operational risk: • Operating temperatures (<100C) • Process includes high speed rotating equipment, chemical use, gas emissions, explosion risk	◑
Planning	• Larger footprint with no room for future expansion	◑	• Smaller footprint with room for future expansion	◔

Legend: Most preferred ○ ◔ ◑ ◕ ● Least Preferred

Recommended Preferred Alternative

Recommended Preferred Solution: Alternative 4 – Centralized Thermal Hydrolysis Process Stabilization and Biosolids Storage at Simcoe WWTP

New Norfolk County Biosolids Management Facility to be located east of the Simcoe WWTP – Phase 1 Upgrades

Facility will receive biosolids from all other WWTPs in Norfolk County to produce a Class A product

- Suitable for use as a fertilizer with minimal restrictions
- Proven through testing to produce Class A quality and low PFAS concentrations

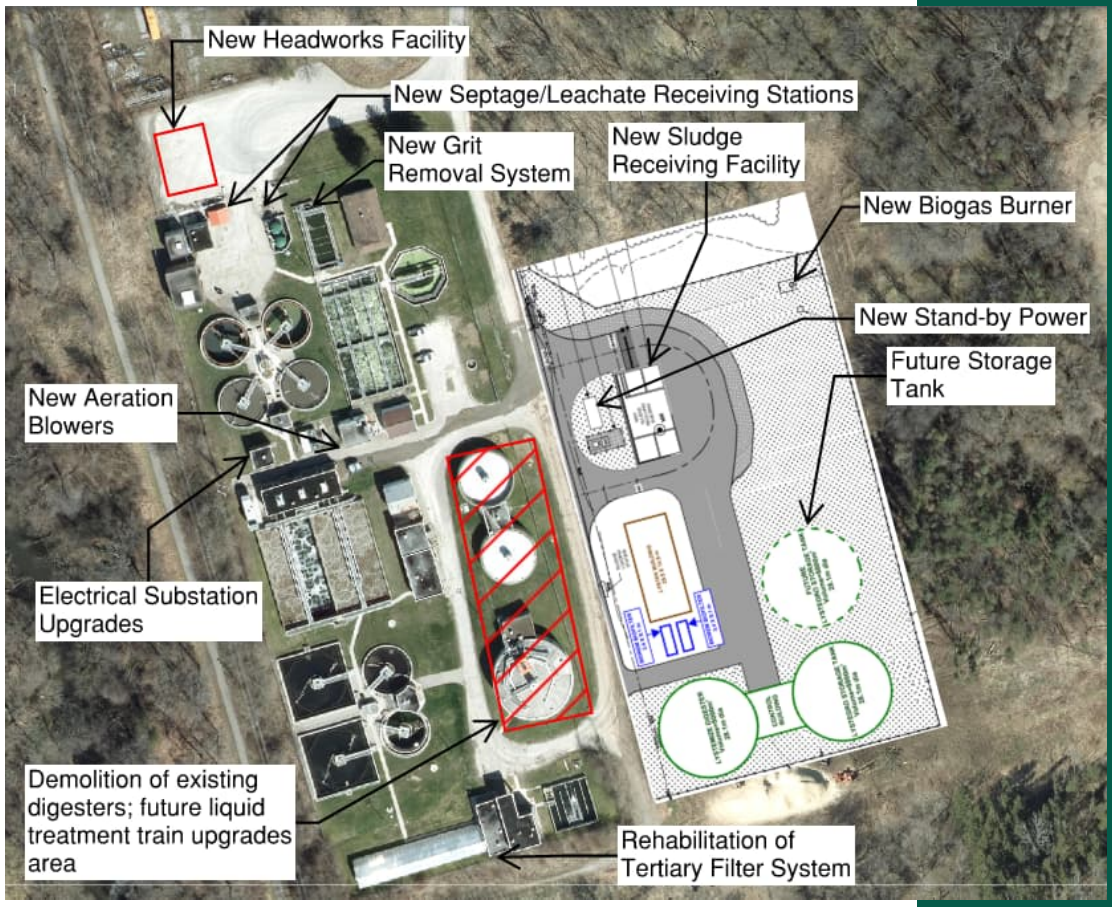
Overall sludge truck traffic will increase to a total of 35 trucks (in and out) per week on average

A new access road will be constructed to mitigate traffic impacts on the surrounding community

Highest economic benefit of all options, with lower life cycle costs

Planned Simcoe WWTP Phase 2 upgrades to support the biosolids facility will include

- New headworks facility with screening and grit separators
- New septage, raw sewage and leachate receiving stations
- Electrical substation and stand-by power unit
- Sludge recirculation pumping stations



Alternative 4 has been identified as the preferred solution, offering the best overall balance of environmental protection, community benefit, cost efficiency, and long-term planning

Typical Thermal Hydrolysis Process Application





Dewatering centrifuge and dewatered biosolids tank



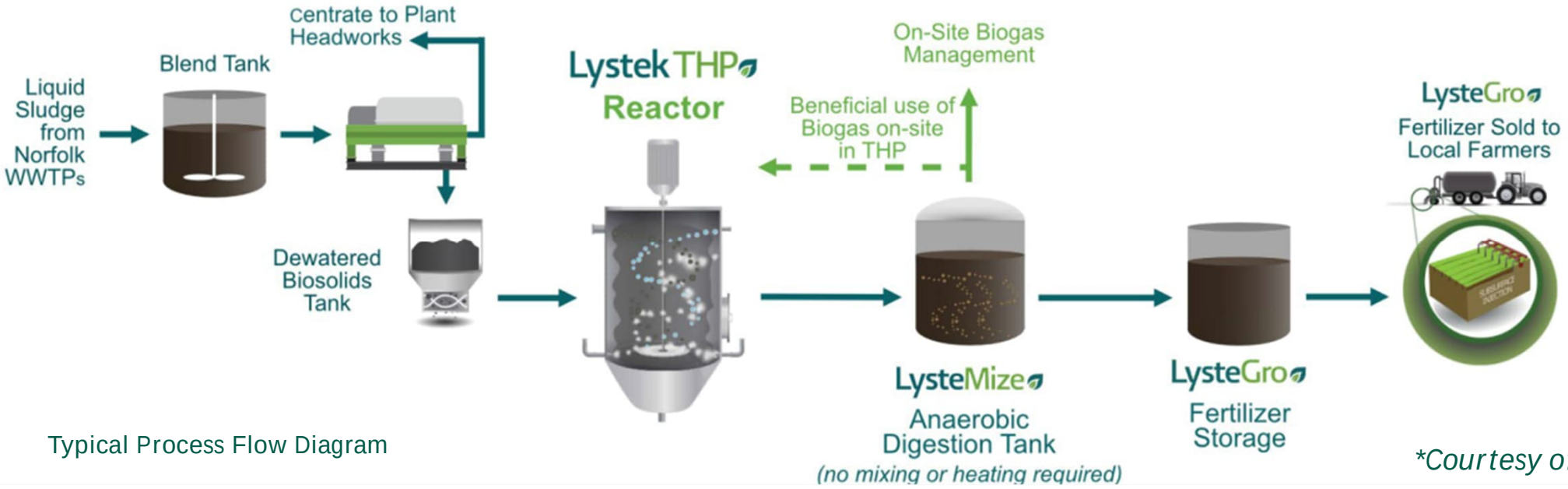
Odour Control Unit



Typical THP Building



Storage Tanks



Typical Process Flow Diagram

*Courtesy of Lystek

Proposed Access Road – Phase 1 Upgrades

Projecting up to twice as many trucks entering and leaving the plant by 2051

The current Oakwood Avenue access is not feasible for future increased truck traffic due to:

- Restricted truck access times due to school drop offs/pickups means increased truck traffic during other times
- Safety concerns for both public and operations staff

Proposing a new access road, approximately 1km long, from either Victoria Street or Sherman Avenue to the plant. Alignment feasibility under review, pending Class EA completion

Traffic impact mitigation includes controlled hauling routes that divert heavy trucks away from sensitive areas near the school and cemetery to improve road safety and reduce disturbances

Scope includes a road extending to the south side of the plant, with width and construction designed to meet municipal standards and accommodate safe, two-way traffic

The road alignment will be designed to prioritize the preservation of existing trails and natural areas

The design will accommodate potential future plant expansions or infrastructure upgrades, ensuring long-term value and operational flexibility

Additional cost estimated between $7M and $9M, depending on site conditions and mitigation measures (slope, watershed, soil type)



*Includes leachate, septage, raw sludge, chemical delivery, and sludge trucks
**Includes trucks for leachate, septage, raw sludge and chemical deliveries

Norfolk County

Archaeological Assessment

- The Stage 1 Archaeological Assessment showed that parts of the Project Area have archaeological potential, and a Stage 2 assessment is required due to:
  - 16 previously registered archaeological sites within 1km
  - Water sources within 300m (Lynn River)
  - Elevated topography (Lynn River Terrace)
  - Early settlements within 100m (possible homesteads)
- Norfolk County is committed to completing the Stage 2 assessment prior to any construction activities



Natural Environment Assessment

- 35 species of birds and 2 mammal species observed. Species at Risk were seen near south-west corner of existing site (possibly outside construction area):
  - Red-headed Woodpecker (endangered)
  - Chimney Swift (threatened)
- Preliminary vegetation assessments characterized the property as primarily cultural meadow habitat with deciduous-dominant mixed woodlands adjacent



Existing L.E. & N Trail West of Study Area



Potential Impacts and Proposed Mitigation



Short-Term Construction Impacts
Noise, Dust, Traffic, Vibration, Public and Workers Safety

- Health and safety is a priority to the County. All construction will adhere to strict safety guidelines
- Traffic management controls will be maintained on surrounding streets
- Construction activities will comply with local noise by-laws



Natural Environment Impacts

- Complete Stage 2 Archaeological Assessments to ensure no archaeological potential is disrupted
- Ensure construction area is clear of nesting sites prior to start of work

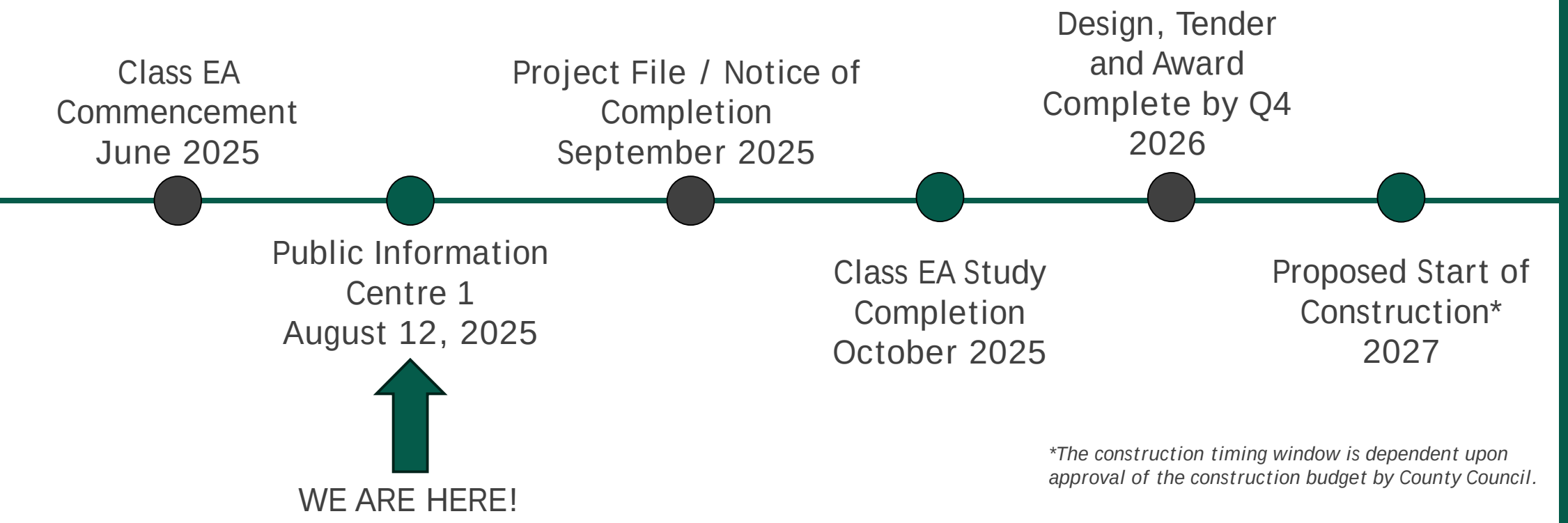


Long-Term Community Impacts
Odour Control, Traffic

- Implementation of odour, noise and emissions control measures to limit impact on surrounding community
- Considering an alternative road to improve access to the plant as well as public and operational traffic safety

Norfolk County

Project Timeline



**The construction timing window is dependent upon approval of the construction budget by County Council.*

Next Steps

- Review and consider all input received from stakeholders and the community
- Confirm the preferred solution based on evaluation and feedback
- Release the Project File for a 30-day public review period
- Issue the Notice of Completion
- Proceed with the detailed design and engineering of the preferred solution
- Continue to engage with the community and provide updates throughout the project

Thank you!

Comments or Questions?

Your questions and comments are greatly appreciated!

Please email them by September 9, 2025, to:
Paolo Oddi, Project Manager
paolo.oddi@norfolkcounty.ca

Appendix J
Feedback Forms

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

Norfolk County – Simcoe WWTP – Biosolids Management Upgrade
Public Information Centre - August 12, 2025
Sign-In Sheet

HATCH

Name	Email	Phone Number	Interested in future Project Updates?
[redacted]			
[redacted]			

Additional comments?

If you would like to receive a written response to your comments, please provide us with the following information:

Name: [redacted]

Email Address: [redacted]

☑ Yes, I would like to be added to the e-mail distribution list.

PLEASE LEAVE YOUR COMPLETED FEEDBACK FORM AT THE REGISTRATION TABLE ON THE WAY OUT.

Thank you.

Please forward all feedback by August 26, 2025.

Paolo Oddi, C. Tech
Project Manager
paolo.oddi@norfolkcounty.ca

WELCOME

Simcoe WWTP – Biosolids Management Upgrade
Municipal Class Environmental Assessment

Public Information Centre, August 12, 2025

Objectives of the Public Information Centre #1:

- Introduce the project with background.
- Provide an overview of the study process.
- Present the alternative solutions being considered.
- Present the evaluation process used to identify the recommended preferred solution.
- Discuss next steps and obtain your input.

How does the Public Meeting work?

The Meeting will provide an update on progress to date, present the preliminary preferred design concept and outline next steps. The Meeting will be held in an open house style for individuals to drop-in with members of the Project Team available to answer questions. Feedback is welcome from all.

FEEDBACK FORM

1. Do you have any feedback for the Project Team regarding the preliminary preferred design concept?

Fully support the thermal plan. My only concern is ~~the~~ to ensure that the trail connection can be maintained

2. Do you have any feedback or concerns regarding the impacts and benefits of preliminary preferred solution?

Only the trail considerati

3. Do you have any outstanding questions or concerns regarding the project schedule?

None

4. Do you have any outstanding questions or concerns with the next steps of the consultation process?

None

Appendix K
Haudenosaunee Development Institute – Engagement Meeting Minutes

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

Minutes of Meeting

H353644

January 30, 2026

Norfolk County
Simcoe Wastewater Treatment Plant

Engagement Meeting:
Norfolk County: Simcoe WWTP Class EA

Meeting Date:	January 30, 2026	
Location:	Virtual (Microsoft Teams)	
Present:	Paolo Oddi (Norfolk County) Mariana Balaban (Norfolk County) Stephanie Davis (Norfolk County) Oya Koc (Hatch) Samantha Fraser (Hatch)	Matt Turner (HDI) Todd Williams (HDI)
Purpose:	To engage with the Haudenosaunee Development Institute (HDI) regarding the Simcoe Wastewater Treatment Plant Biosolids Management Upgrade and associated Schedule 'B' Class Environmental Assessment (EA) process.	

1. Project Status Overview

- Oya noted that the Public Information Center (PIC) was held on August 12, and the Project File Report (PFR) was posted online and issued for stakeholder review on December 18. The review period ended on January 16, but the MECP requested an extension and has until January 30 to review.
- Matt noted his colleague Raechelle Williams forwarded the information to him on January 5.

2. HDI Engagement

- Matt noted that capacity funding will be required to review the project documents and for involvement throughout the construction phase of the project. HDI will prepare a budget breakdown and share with Norfolk County to have an agreement executed.
- Matt requested that, in future, HDI be included in the ecological surveys for infrastructure projects in Norfolk County.
- Matt to be added to the contact distribution list for the project. Matt also requested that all future communications be sent to info@hdi.land as the main point of contact*

  *post-meeting note: info@hdi.land was included as the main contact email on the project contact list. No updates are required.

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

- Mariana noted that Norfolk County issues statements about their projects in their local newspapers and on the radio and asked if there were any key media outlets that HDI follows. Matt noted there is not, and that all communications should be sent directly to them at info@hdi.land.

3. PIC Presentation Overview

- Oya presented the key slides from the PIC, including the biosolids quality, truck routing, proposed access road, Stage 1 archaeological assessment results and natural environment assessment overview.
- Mariana outlined the benefits of the upgrade, including reduced biosolids holding time (currently 8 months) and improved biosolids quality.

4. Project File Report (PFR) Review

- Matt noted that they will not be able to review within the next few days, especially without capacity funding. Todd requested that the approval letter from the MECP outlining any project conditions be shared with HDI once it has been received.
- Oya noted that the PFR included the results from the Stage 1 Archaeological Assessment, however, the Stage 2 assessment has now been completed and showed no significant findings within the project area. The Stage 2 report will be shared with HDI.
- Matt noted that species at risk were identified within the Class EA documentation. Oya confirmed and noted that the County is committed to mitigating impacts to endangered species during the construction phase.

5. Next Steps and Action Items

- The following information will be shared with HDI:
  - Stage 2 Archaeological Assessment Report.
  - MECP Approval Letter, once received.
- HDI to provide budget breakdown to Norfolk County for agreement to be executed.

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

Appendix L
Stage 2 Archaeological Assessment

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

Stage 2 Archaeological Assessment: Simcoe Wastewater Treatment Plant 16 Oakwood Avenue (Lot 1, Concession 5, Geographical Township of Woodhouse, County of Norfolk) Town of Simcoe, Norfolk County

Original Report

Prepared for:

Hatch Ltd.
1235 North Service Road West
Oakville ON, L6M 2W2

Archaeological Licence: P383 (Williams)

PIF P383-0509-2025

Archaeological Services Inc. File: 25EA-178

26 January 2026



Executive Summary

Archaeological Services Inc. (ASI) was contracted by Hatch Ltd., on behalf of Norfolk County, to conduct a Stage 2 Archaeological Assessment as part of the Simcoe Wastewater Treatment Plant Expansion project. This project is being conducted to support an addendum to the Norfolk County Integrated Sustainable Master Plan, and involves potential upgrades adjacent to the east of the existing facilities at 16 Oakwood Avenue in the Town of Simcoe, Ontario.

A Stage 1 assessment for the Simcoe Wastewater Treatment Plant project was previously completed by ASI in 2025, which determined that portions of the Project Area retained archaeological potential and Stage 2 test pit survey was recommended.

The Stage 2 property survey was conducted from October 29-31, November 11, 19-20, and 24, 2025, in accordance with the *Ontario Heritage Act* and the *Standards and Guidelines for Consultant Archaeologists* by test pit survey. Approximately one percent of the Project Area (0.01 hectare) was found to have low archaeological potential on account of disturbance. The remaining 99 percent (1.16 hectares) was subject to test pit survey at five and judgemental 10 metre intervals.

No archaeological resources were encountered during the Stage 2 survey, and no further archaeological assessment is recommended.

Project Personnel

- **Principal**: Lisa Merritt, MSc (P094), Principal, Infrastructure
- **Senior Project Manager**: Sarah Jagelewski, BA Hons (R405), Lead Archaeologist, Manager, Infrastructure
- **Division Coordinator**: Katrina Thach, BA Hons (R1225), Associate Archaeologist, Assistant Manager, Infrastructure
- **Project Administrator**: Danielle Bella, BA Hons, Archaeologist, Technical Writer, Infrastructure
- **Project Director (Licencee)**: Blake Williams, MLitt (P383), Lead Archaeologist, Project Manager, Infrastructure
- **Project Manager**: Jason Barrett, PhD Lead Archaeologist, Project Manager, Infrastructure
- **Field Director**: Paul Roschman, BSc (R1350), Archaeologist, Field Director
- **Field Archaeologists**: Mex Keating; Teona Kebede; Catrina Killin
- **Report Preparation**: Danielle Bella, BA Hons, Archaeologist, Technical Writer, Infrastructure
- **Graphics**: Michelle Nguyen, BA, Archaeologist, GIS Technician, Operations
- **Report Review**: Sarah Jagelewski; Jessica Lytle, MSc (P1066), Lead Archaeologist, Coordinator, Infrastructure

Table of Contents

Executive Summary 1
Project Personnel 2
1.0 Project Context 5
1.1 Development Context 5
1.1.1 Treaties and Traditional Territories 6
1.2 Historical Context 8
1.2.1 Town of Simcoe 9
1.3 Archaeological Context 10
1.3.1 Current Land Use and Field Conditions 11
1.3.2 Geography 11
1.3.3 Previously Registered Archaeological Sites 12
1.3.4 Previous Archaeological Assessments 14
2.0 Field Methods 14
2.1 Areas of Low Archaeological Potential 15
2.2 Test Pit Survey 16
3.0 Record of Finds 16
3.1 Inventory of Documentary and Material Record 17
4.0 Analysis and Conclusions 17
5.0 Recommendations 18
6.0 Advice on Compliance with Legislation 19
7.0 Bibliography and Sources 21
8.0 Images 23
9.0 Maps 27
Appendix A: 30 Percent Conceptual Designs 30

List of Tables

Table 1: Registered Sites within One Kilometre of the Project Area 12

Table 2: Inventory of Documentary and Material Record 17

List of Images

Image 1: Test pit demonstrating disturbed stratigraphy 23
Image 2: Test pit survey at five metre intervals 23
Image 3: Test pit demonstrating disturbed stratigraphy 24
Image 4: Footprint of rectangular concrete pad is disturbed; low archaeological potential 24
Image 5: General conditions of the Project Area 25
Image 6: Test pit survey at judgemental 10 metre intervals 25
Image 7: Test pit survey at five metre intervals 26
Image 8: Test pit survey at judgemental 10 metre intervals 26

List of Figures

Figure 1: Location of the Project Area 28
Figure 2: Stage 2 Archaeological Assessment Results for the Simcoe Wastewater Treatment Plant 29

1.0 Project Context

Archaeological Services Inc. (ASI) was contracted by Hatch Ltd., on behalf of Norfolk County, to conduct a Stage 2 Archaeological Assessment as part of the Simcoe Wastewater Treatment Plant (WWTP) project. This project is being conducted to support an addendum to the Norfolk County Integrated Sustainable Master Plan (MMM Group Ltd, 2016), and involves potential upgrades adjacent to the east of the existing facilities at the Simcoe WWTP at 16 Oakwood Avenue in the Town of Simcoe, Ontario. See Appendix A for the 30 percent Conceptual Designs.

The Stage 2 Project Area measures approximately 150 metres by 90 metres at its widest and covers an area of approximately 1.17 hectares (Figure 1). The Project Area has been defined based on the proposed site plan as part of the conceptual design phase (Appendix A).

All activities carried out during this assessment were completed in accordance with the *Ontario Heritage Act* (R.S.O. c. O.18, 1990, as amended in 2025) and the 2011 *Standards and Guidelines for Consultant Archaeologists* (S & G), currently administered by the Ministry of Citizenship and Multiculturalism (MCM, 2011).

1.1 Development Context

All work has been undertaken as required by the *Environmental Assessment Act* (R.S.O. c. E.18, 1990, as amended in 2025) and regulations made under the Act, and are therefore subject to all associated legislation. This project is being conducted in accordance with the *Municipal Class Environmental Assessment* process (Municipal Engineers Association, 2023).

In addition, this Stage 2 assessment has been commissioned to satisfy the recommendations of the previous Stage 1 assessment (ASI, 2025: P094-0455-2025) that was undertaken as part of the same project.

ASI has been actively engaging with Indigenous communities who have expressed an interest in the archaeological work within the Project Area for this

project on behalf of Norfolk County. Representatives from the Haudenosaunee Development Institute and the Mississaugas of the Credit First Nation were present on site and participated during the Stage 2 property survey. No concerns were expressed during the execution of the fieldwork. A detailed account of all First Nations engagement can be found in the *Supplementary Documentation: Indigenous Engagement* document associated with this report.

Authorization to access and carry out all activities necessary for the completion of this Stage 2 assessment was granted by Hatch Ltd. on September 8, 2025.

1.1.1 Treaties and Traditional Territories

Deed from the Five Nations to the King, of their Beaver Hunting Ground

In the late seventeenth century, the Haudenosaunee of the Five Nations Confederacy residing in upstate New York and Southern Ontario were dealing with military engagements and encroachment from French forces as well as the movement of the Mississaugas and other Anishinaabeg peoples into the area, all of which contributed to fears among the Confederacy about the loss of their beaver hunting grounds (Williams & Nelson, 1995). To address their concerns, the Confederacy met with the Province of New York's acting colonial governor John Nanfan, as well as a British representative on behalf of the Indian Affairs Department, Robert Livingston, in July 1701. The Confederacy hoped to urge the English into action in their disputes with the French and their Indigenous allies. The British hoped that an alliance with the Haudenosaunee would continue to ensure a strong trading relationship, keep French efforts to control the fur trade in check, and assert British control deeper into North America (Brandao & Starna, 1996; Jamieson, 2013).

Ultimately, the Deed from the Five Nations to the King, sometimes referred to as the Treaty of Fort Albany, the Nanfan Treaty, the Albany Deed, or Livingston's Deed, was signed by representatives of the British Crown and the Haudenosaunee Confederacy in 1701 (Williams & Nelson, 1995). The Deed established the Beaver Hunting Grounds as a vast territory spanning much of the lands surrounding the

lower Great Lakes, including Southern Ontario, as well as into the Ohio River Valley (Jamieson, 2013).

There has been significant debate about the terms of the agreement. The Six Nations of the Grand River interpret the agreement as a valid treaty that recognized the Confederacy's ownership of and access to the natural resources within the Beaver Hunting Grounds, while also receiving the Crown's support and protection (Jamieson, 2013; Williams & Nelson, 1995). Others, though, note that while the Haudenosaunee fished and hunted in Southern Ontario in the late seventeenth century, these lands were not under their authority at the time and as such, they could not negotiate a formal treaty with the British Crown for this territory (Calverley, 2002; Jennings, 1984; Schmalz, 1984). Research indicates that the British did not formally recognize the agreement, and currently neither the Canadian government nor the British Crown recognize the 1701 Deed as a treaty.

Treaty 3, Between the Lakes Purchase

Following the American Revolutionary War (1775-1783), the British Crown needed to find lands on which to settle United Empire Loyalists, including approximately 2,000 members of the Six Nations confederacy who had fought alongside British troops. Led by Sir Frederick Haldimand who was the governor of Quebec at that time, the Crown was initially planning on providing lands for Loyalist settlers in Quebec and Southeastern Ontario, including providing land in the Bay of Quinte for Six Nations refugees. This was not suitable for many of the members of Six Nations and a contingent of approximately 1,800 community members, led by Chief Joseph Brant, requested land north of Lake Erie along the Grand River. Brant felt that the location in the Bay of Quinte was too isolated and that his followers could be better served by being closer to the Six Nations communities that chose to remain in the United States in western New York (Surtees, 1984, p. 21).

Recognizing that, under the terms of the Royal Proclamation of 1763, the land needed to be purchased prior to settlement, Colonel John Butler was sent to negotiate with the Mississaugas of the Credit for lands east of Lake Ontario and north of Lake Erie. On May 22, 1784, the Mississaugas of the Credit agreed to cede approximately 3,000,000 acres (1,214,057 hectares) of land containing all

or part of Brant, Elgin, Middlesex, Oxford, and Wellington Counties as well as the Regions of Haldimand-Norfolk, Halton, Hamilton-Wentworth, Niagara, and Waterloo. In exchange for these lands, the Mississaugas received £1180.74 worth of trade goods (Crown-Indigenous Relations and Northern Affairs, 2016; Surtees, 1984). Of the 3,000,000 acres (1,214,057 hectares), approximately 550,000 acres (222,577 hectares) was set aside for the settlement of Six Nations people.

However, due to uncertainties with the description of the lands in the original surrender, Treaty 3 was renegotiated on December 7, 1792, to clarify what was ceded. This largely revolved around the northern boundary of the Treaty area and in particular the area set aside for Six Nations settlement along the Grand River (see Haldimand Tract and Treaty 4). The signees on the side of the British included Lieutenant Governor John Graves Simcoe, John Butler, Robert Kerr, Peter Russell, John McGill, and Davie William Smith. The signees on the side of the Mississauga included Chiefs Wabakayne, Wabanip, Kautabus, Wabaniship and Mottotow (Crown-Indigenous Relations and Northern Affairs, 2016; Surtees, 1984).

The original text stipulated that the north-west boundary of the parcel was an imaginary line between Burlington Bay and the Thames River, which is inconsistent with the geography of the area. The boundaries of the parcel were corrected to create a polygon encompassing the Niagara peninsula up to Burlington Bay and then up north to the present-day town of Arthur then south to the present-day town of Woodstock to finally meet Lake Erie at Port Bruce. Treaty 3 lands exclude a corridor along the Grand River set aside for Six Nations (Crown-Indigenous Relations and Northern Affairs, 2016; Native Land Digital, 2018).

1.2 Historical Context

A comprehensive review of the precontact Indigenous and Euro-Canadian occupations of the Norfolk region is presented in the Stage 1 report (ASI, 2025, pp. 9–16). To summarize, background research indicates that the general vicinity of the Project Area has been attractive to human settlement for thousands of years, primarily by Indigenous people and more recently by Euro-Canadian settlers. Historically, the Project Area corridor is within part of Lot 1,

Concession 5 in the Geographical Township of Woodhouse, County of Norfolk, Ontario.

1.2.1 Town of Simcoe

The Town of Simcoe is located on the Lynn River 38 kilometres south of the City of Brantford. The town was visited by Sir John Graves Simcoe, first lieutenant-governor of Upper Canada, in 1795. Governor Simcoe made this stop during his journey to establish Fort Norfolk on Fort Erie and granted land to potential settlers, including Aaron Culver with the provision that he was to build mills on the river (Ontario Heritage trust, 2025). By 1812, a settlement formed surrounding the saw and grist mills Culver had built. The mills were burnt during the War of 1812. Captain Bird, a prominent merchant in the settlement, was deeded some land by Culver and subsequently the town was initially called Birdtown (American Biographical Publishing Company, 1880). Aaron Culver further subdivided his land into village lots between 1819 and 1823, proposing the village be renamed in remembrance of the late lieutenant-governor Simcoe's visit.

The Simcoe Post Office opened in 1829 with Duncan Campbell as postmaster (American Biographical Publishing Company, 1880). In 1836 a courthouse and jail were constructed. Simcoe became the seat of the newly created Talbot District in 1837, and in 1851 was incorporated as a village and became the seat of Norfolk County. A branch of the Great Western Railway was completed from Glencoe through Simcoe to Fort Erie in 1872. A line from Woodstock to Port Dover was built in 1875. These lines cause an increase in Simcoe's population. Simcoe was incorporated as a town in 1878. Dr. John Wilson was the first mayor of Simcoe.

In addition to saw and grist mills, Simcoe's early industries included Cable's Carriage Works and the "alligator tug" tugboat (Churcher, 2022). The alligator tug was created by John West of West, Peachy and Sons and was able to operate on both water and land using cables and winches. The alligator tug was an asset to the lumbering industry. During the Depression, the flue-cured tobacco industry was a saving factor for Simcoe, as was fruit production. These industries drew people to the area. A large tin can manufacture plant was established around 1930.

Simcoe features several historic churches. Presbyterian minister Reverend Jabez Culver held services in his own log home until his death in 1818 (Wilson, 1983). A frame church was built to hold Methodist Episcopal services by 1820. In 1868, a new brick church was completed, then known as the Windham Memorial Chapel of the New Connection Methodist Church. Its name was later changed to the Windham United Church (United Church of Canada, 1962). A church named the Old Windham Church, which stands present-day, was completed in 1962. The Methodist Church was built in 1840. The three churches eventually united to form the Methodist Church of Canada. The Old Mud Church was constructed in 1843 of clay and straw bricks by the Congregationalists of Simcoe and destroyed by a fire in 1876 (Owen, 1898). Saint Andrew's Church of Scotland, constructed in 1847, and the Canadian Presbyterian Church, built in 1868, were united in 1876. The united congregation built St. Paul's Presbyterian Church in 1886. Trinity Anglican Church was originally completed in 1850 and then renovated in 1882. Central School, constructed in 1858, was a Union School offering education to all students of Simcoe until a high school was erected in 1893-4. The South Ward Public School was erected in 1917, and the North Ward School in 1928.

In 1974, Simcoe became part of the Regional Municipality of Haldimand-Norfolk and the town was enlarged to include part of the Townships of Charlotteville, Townsend, Windham, and Woodhouse.

1.3 Archaeological Context

This section provides background research pertaining to previous archaeological fieldwork conducted within and in the vicinity of the Project Area, its environmental characteristics (including drainage, soils or surficial geology and topography, etc.), and current land use and field conditions. Three sources of information were consulted to provide information about previous archaeological research: the site record forms for registered sites available online from the MCM through *Ontario's Past Portal*; published and unpublished documentary sources; and the files of ASI.

1.3.1 Current Land Use and Field Conditions

The Project Area is located east of the existing Simcoe WWTP facilities at 16 Oakwood Avenue in the Town of Simcoe, Ontario. The Project Area includes tall unmaintained grasses, trees, and woodlot on a higher terrain extending along its eastern limits. Most of the property is heavily covered in overgrown vegetation. A rectangular concrete pad is located within the western portion of the Project Area.

The Stage 2 survey for the Simcoe Wastewater Treatment Plant project was conducted from October 29-31, and November 11, 19-20, and 24, 2025, under the field direction of Paul Roschman (R1350).

1.3.2 Geography

A comprehensive summary of the geology and physiography of the Norfolk region is presented in the Stage 1 report (ASI, 2025, pp. 17–19). To summarize, the Project Area is situated within the sand plains physiographic landforms of the Norfolk Sand Plain physiographic region of southern Ontario (Chapman & Putnam, 1984). The region is a wedge-shaped feature that extends from the Lake Erie shoreline and tapers northward to a point in Brantford on the Grand River (Chapman & Putnam, 1984). The region encompasses an area of 3,134 square kilometres and consists of sands and silts that were deposited as a delta in glacial Lakes Whittlesey and Warren. A massive discharge of meltwater from the Grand River area entered the lakes between the ice front and the moraines to the northwest, building the delta from west to east as the glacier withdrew, thus covering most of the area west of the Galt Moraine with sand.

Surficial geology within the Project Area consists of mostly by fine-textured glaciolacustrine deposits (silt and clay, minor sand and gravel, massive to well laminated), and to a lesser extent by older alluvial deposits (clay, silt, sand, gravel, which may contain organic remains).

The Project Area is within urban lands with no soil information (Land Resource Research Institute, 1983).

The Project Area is 150 metres east of the Lynn River and is within the Black Creek – Lynn River watershed.

1.3.3 Previously Registered Archaeological Sites

In Ontario, information concerning archaeological sites is stored in the Ontario Archaeological Sites Database maintained by the MCM. This database contains archaeological sites registered within the Borden system. Under the Borden system, Canada has been divided into grid blocks based on latitude and longitude. A Borden block is approximately 13 kilometres east to west, and approximately 18.5 kilometres north to south. Each Borden block is referenced by a four-letter designator, and sites within a block are numbered sequentially as they are found. The Project Area under review is located in Borden block *AeHb.*

According to the Ontario Archaeological Sites Database, 16 previously registered archaeological sites are located within one kilometre of the Project Area, none of which are located within 50 metres (MCM, 2025). A summary of the sites is provided below in Table 1.

Table 1: Registered Sites within One Kilometre of the Project Area

Borden Number	Site Name	Temporal/ Cultural Affiliation	Site Type	Researcher
AeHb-90	Pott's Homestead	Euro-Canadian	Homestead	Mayer Heritage Consultants (MHC), 1980
AeHb-91	Pott's 54	Pre-Contact	Findspot	MHC, 1982
AeHb-92	Pott's 92	Pre-Contact	Artifact scatter	MHC, 1981

Borden Number	Site Name	Temporal/ Cultural Affiliation	Site Type	Researcher
AeHb-93	Pott's 62	Pre-Contact	Findspot	MHC, 1982, 2008
AeHb-94	Pott's 64	Pre-Contact	Campsite	MHC, 1977, 2008
AeHb-95	Pott's 65	Pre-Contact	Campsite	MHC, 1980, 2008
AeHb-96	Pott's 69	Pre-Contact	Campsite	MHC, 1974, 2008
AeHb-97	Pott's 75	Pre-Contact	Campsite	MHC, 1980, 2008
AeHb-98	Pott's 1977	Pre-Contact	Campsite	MHC, 1982, 2008
AeHb-99	Pott's 36	Pre-Contact	Findspot	MHC, 1980, 2008
AeHb-100	Pott's 98	Middle/Late Woodland	Campsite	MHC, 1982, 2008
AeHb-103	Pott's 102	Pre-Contact	Findspot	MHC, 1981
AeHb-104	Pott's 103	Late Archaic	Findspot	MHC, 1981

Borden Number	Site Name	Temporal/ Cultural Affiliation	Site Type	Researcher
AeHb-105	Pott's 47	Pre-Contact	Findspot	MHC, 1981
AeHb-113	Pott's 82	Pre-Contact	Campsite	MHC, 2008
AeHb-114	Pott's 83	Pre-Contact	Artifact scatter	MHC, 2008

1.3.4 Previous Archaeological Assessments

ASI reviewed previous archaeological assessments that detail fieldwork within 50 metres of the Project Area.

Stage 1 Archaeological Assessment: Simcoe Wastewater Treatment Plant, 16 Oakwood Avenue (Lot 1, Concession 5, Geographical Township of Woodhouse, County of Norfolk) Town of Simcoe, Norfolk County. P094-0455-2025.

This Stage 1 Archaeological Assessment was completed for the current project. The identified areas of archaeological potential recommending Stage 2 test pit survey are the subject of the current report.

2.0 Field Methods

The Stage 2 Project Area comprises the lands within part of 16 Oakwood Avenue in the Town of Simcoe (Figure 1). It measures approximately 150 metres by 90 metres in size and covers an area of 1.17 hectares (Figure 2).

The Stage 2 property survey was conducted under the field direction of Paul Roschman (P1350) from October 29-31, and November 11, 19-20, and 24, 2025, in accordance with the *Ontario Heritage Act* and the S & G, Section 2. During the field assessments, weather and lighting conditions permitted good visibility and were in accordance with the S & G, Section 2.1, Standard 3. During the time of survey, conditions were seasonal with sunny skies and cloudy skies, and temperatures ranging between 13 to -5 degrees Celsius. Photographs of all field

conditions were taken (Image 1-Image 8), and the location and direction of each photograph is mapped in Figure 2.

As per Section 2.1 of the S & G, all lands were within areas where ploughing was not possible or viable and therefore subject to test pit survey. According to Section 2.1.2, Standard 2 of the S & G, any undisturbed areas requiring test pit survey within 300 metres of any feature of archaeological potential must be subject to systematic assessment at five metre intervals. Test pits were placed at five metre intervals until disturbance was encountered, and then judgmentally increased to 10 metre intervals as per S & G Section 2.1.8, Standard 2. Test pits were placed within one metre of built structures or until test pits demonstrated evidence of recent ground disturbance as per S & G Section 2.1.2, Standard 4. All test pits were excavated following the S & G Section 2.1.2 Standards 5-9. All test pits were excavated by hand to a minimum of 30 centimetres in diameter, and into the first five centimetres of subsoil where possible. Each test pit was examined for stratigraphy, cultural features, and evidence of fill. Test pit fill was screened through six-millimetre mesh to facilitate artifact recovery. Afterwards, all test pits were backfilled, and their locations were recorded on field maps. Any factors that precluded the excavation of test pits (e.g., excessive slope, drainage, exposed bedrock, previous disturbance) were noted, and the areas were mapped and photographed.

Fieldwork was conducted using a Samsung Galaxy A7 tablet paired with a sub-metre Trimble Catalyst Global Navigation Satellite System and ESRI Field Maps in conjunction with project mapping provided by the County of Norfolk to ensure the assessment remained within the Project Area limits.

2.1 Areas of Low Archaeological Potential

Visual assessment determined that part of the Project Area did not retain archaeological potential. Approximately one percent of the Project Area (0.01 hectare) had been previously subject to deep and extensive ground disturbance and was not subject to Stage 2 survey, as per S & G Section 2.1, Standard 2.b. The lands documented as being previously disturbed have low archaeological potential and include the footprint of a rectangular concrete pad (Figure 2; Image 4).

2.2 Test Pit Survey

Approximately 72 percent of the Project Area (0.84 hectares) was found to contain natural topsoil (A-horizon) below fill, and was subject to test pit survey at five metre intervals following S & G Section 2.1.2, Standards 1-9. The areas subject to test pit survey at five metre intervals include unmaintained meadowlands, trees, and woodlot (Figure 2; Image 2, Image 7).

Undisturbed stratigraphy in the Project Area is characterized by approximately 32 centimetres of brown (10YR 4/3) silty sand topsoil (A-horizon) overlying brownish yellow (10YR 6/6) sandy subsoil (B-horizon).

Approximately 27 percent of the Project Area (0.32 hectares) did not contain natural topsoil (A-horizon) and was subject to judgmental test pit survey at 10 metre intervals to confirm previous disturbance following S & G Section 2.1.8, Standards 1-2. The areas subject to judgmental test pit survey include unmaintained meadowlands(Figure 2; Image 6, Image 8).

Disturbed stratigraphy in the Project Area is characterized by:

- approximately 23 centimetres of redeposited very dark greyish brown (10YR 3/2) sand fill over 34 centimetres of dark yellowish brown (10YR 4/4) sand subsoil (B-horizon), atop 65 centimetres of light yellowish brown (10YR 6/4) sand C-horizon (Image 1);
- approximately 40 centimetres of dark brown (10YR 3/3) sandy over six centimetres of light reddish brown (2.5Y 6/3) sandy, atop five centimetres of brown (10YR 4/3) silty sand topsoil (A-horizon) overlying brownish yellow (10YR 6/6) sandy subsoil (B-horizon) (Image 3).

3.0 Record of Finds

No archaeological resources were encountered during the course of the Stage 2 Archaeological Assessment.

3.1 Inventory of Documentary and Material Record

The documentation related to this archaeological assessment will be curated by ASI until such a time that arrangements for their ultimate transfer to His Majesty the King in right of Ontario, or other public institution, can be made to the satisfaction of the project owner(s), the MCM, and any other legitimate interest groups.

Table 2 provides an inventory and location of the documentary and material record for the project in accordance with the S & G, Sections 6.7 and 7.8.2.3.

Table 2: Inventory of Documentary and Material Record

Material	Location	Comments
Digital field notes (three files) and GNSS generated Esri shapefiles (four files)	Archaeological Services Inc., 528 Bathurst Street, Toronto, Ontario, M5S 2P9	Stored in ASI project folder 25EA-178; GPS and digital information stored on ASI network servers
Digital field photography (56 files)	Same as above	Files stored on ASI network servers
Digital research, analysis, and reporting materials (four files)	Same as above	Files stored on ASI network servers

4.0 Analysis and Conclusions

A Stage 1 assessment for the Simcoe Wastewater Treatment Plant project was previously completed by ASI in 2025. Background research and a property inspection determined that portions of the Project Area retained archaeological potential and Stage 2 test pit survey was recommended.

The Stage 2 property survey was conducted from October 29-31, and November 11, 19-20, and 24, 2025, in accordance with the *Ontario Heritage Act* and the S & G by test pit survey. Approximately one percent of the Project Area (0.01 hectare) was found to have low archaeological potential on account of disturbance. The remaining 99 percent (1.16 hectares) was subject to test pit survey at five and judgemental 10 metre intervals.

No archaeological resources were encountered during the Stage 2 survey, and no further archaeological assessment is recommended.

5.0 Recommendations

In light of these results, the following recommendations are made:

1. The Project Area does not require further archaeological assessment; and

2. Should the proposed work extend beyond the current Project Area, or should changes to the project design or temporary workspace requirements result in the inclusion of previously un-surveyed lands, these lands should be subject to further archaeological assessment.

NOTWITHSTANDING the results and recommendations presented in this study, ASI notes that no archaeological assessment, no matter how thorough or carefully completed, can necessarily predict, account for, or identify every form of isolated or deeply buried archaeological deposit. In the event that archaeological remains are found during subsequent construction activities, the consultant archaeologist, approval authority, and the Archaeology Programs Unit of the MCM should be immediately notified.

The above recommendations are subject to Ministry approval, and it is an offence to alter any archaeological site without MCM concurrence. No grading or other activities that may result in the destruction or disturbance of any archaeological sites are permitted until notice of MCM approval has been received.

6.0 Advice on Compliance with Legislation

- This report is submitted to the Minister as a condition of licensing in accordance with Part VI of the *Ontario Heritage Act*, R.S.O. 1990, c 0.18. The report is reviewed to ensure that it complies with the standards and guidelines that are issued by the Minister, and that the archaeological fieldwork and report recommendations ensure the conservation, protection and preservation of the cultural heritage of Ontario. When all matters relating to archaeological sites within the project area of a development proposal have been addressed to the satisfaction of the Ministry of Citizenship and Multiculturalism a letter will be issued by the ministry stating that there are no further concerns with regard to alterations to archaeological sites by the proposed development.
- It is an offence under Sections 48 and 69 of the *Ontario Heritage Act* for any party other than a licensed archaeologist to make any alteration to a known archaeological site or to remove any artifact or other physical evidence of past human use or activity from the site, until such time as a licensed archaeologist has completed archaeological fieldwork on the site, submitted a report to the Minister stating that the site has no further cultural heritage value or interest, and the report has been filed in the Ontario Public Register of Archaeological Reports referred to in Section 65.1 of the *Ontario Heritage Act*.
- Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48 (1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with Section 48 (1) of the *Ontario Heritage Act*.
- The *Funeral, Burial and Cremation Services Act*, 2002, S.O. 2002, c.33 requires that any person discovering human remains must notify the police or coroner and the Registrar of Cemeteries at the Ministry of Public and Business Services Delivery.

- Archaeological sites recommended for further archaeological fieldwork or protection remain subject to Section 48 (1) of the *Ontario Heritage Act* and may not be altered, or have artifacts removed from them, except by a person holding an archaeological licence.

7.0 Bibliography and Sources

Archaeological Services Inc. (2025). Stage 1 Archaeological Assessment: Simcoe Wastewater Treatment Plant, 16 Oakwood Avenue (Lot 1, Concession 5, Geographical Township of Woodhouse, County of Norfolk) Town of Simcoe, Norfolk County. P094-0455-2025.

Brandao, J., & Starna, W. (1996). The Treaties of 1701: A Triumph of Iroquois Diplomacy. Ethnohistory, 43(2), 209–244.

Calverley, D. (2002). Rethinking Boundaries—The Albany Deed, the Great Peace of Montreal, and Iroquois Hunting Activity in Ontario. Canadian Historical Association Conference, Toronto. https://www.academia.edu/40090154/_Rethinking_Boundaries_The_Albany_Deed_the_Great_Peace_of_Montreal_and_Iroquois_Hunting_Activity_in_Ontario_?email_work_card=title

Chapman, L. J., & Putnam, F. (1984). The Physiography of Southern Ontario (3rd ed., Vol. 2). Ontario Ministry of Natural Resources.

Crown-Indigenous Relations and Northern Affairs. (2016). Saugeen Peninsula Treaty (1854) No. 72. Treaty Texts – Upper Canada Land Surrenders. https://www.rcaanc-cirnac.gc.ca/eng/1370372152585/1581293792285#ucls24

Jamieson, K. (2013, October 2). The Haudenosaunee/Six Nations and the Royal Proclamation of 1763. Active History. https://activehistory.ca/blog/2013/10/02/the-haundenosauneesix-nations-and-the-royal-proclamation-of-1763/

Jennings, F. (1984). The Ambiguous Iroquois Empire: The Covenant Chain Confederation of Indian Tribes with English Colonies. W.W. Norton and Company.

Ministry of Citizenship and Multiculturalism. (1990). Ontario Heritage Act, R.S.O. c. O.18.

Ministry of Citizenship and Multiculturalism. (2011). Standards and Guidelines for Consultant Archaeologists. Ministry of Tourism and Culture.

Ministry of Citizenship and Multiculturalism. (2022). Criteria for Evaluating Marine Archaeological Potential A Checklist for Non-Marine Archaeologists.

Ministry of Citizenship and Multiculturalism. (2025). Ontario's Past Portal. PastPortal. https://www.pastport.mtc.gov.on.ca

Ministry of the Environment. (1990). Environmental Assessment Act, R.S.O. c. E.18.

MMM Group Ltd. (2016). Norfolk County Integrated Sustainable Master Plan. https://www.norfolkcounty.ca/media/lmuibvyh/the-ismp.pdf

Municipal Engineers Association. (2023). Municipal Class Environmental Assessment.

Native Land Digital. (2018). Treaty 3, 1792. Native Land. https://native-land.ca/

Schmalz, P. S. (1984). The Role of the Ojibwa in the Conquest of Southern Ontario, 1650-1701. Ontario History, 76(4).

Surtees, R. (1984). Indian Land Surrenders in Ontario 1763-1867. Research Branch, Corporate Policy, Department of Indian and Northern Affairs Canada.

Williams, P., & Nelson, C. (1995). Kaswentha. https://publications.gc.ca/collections/collection_2022/bcp-pco/Z1-1991-1-41-114-eng.pdf

8.0 Images



Image 1: Test pit demonstrating disturbed stratigraphy



Image 2: Test pit survey at five metre intervals



Image 3: Test pit demonstrating disturbed stratigraphy



Image 4: Footprint of rectangular concrete pad is disturbed; low archaeological potential



Image 5: General conditions of the Project Area



Image 6: Test pit survey at judgemental 10 metre intervals



Image 7: Test pit survey at five metre intervals



Image 8: Test pit survey at judgemental 10 metre intervals

9.0 Maps

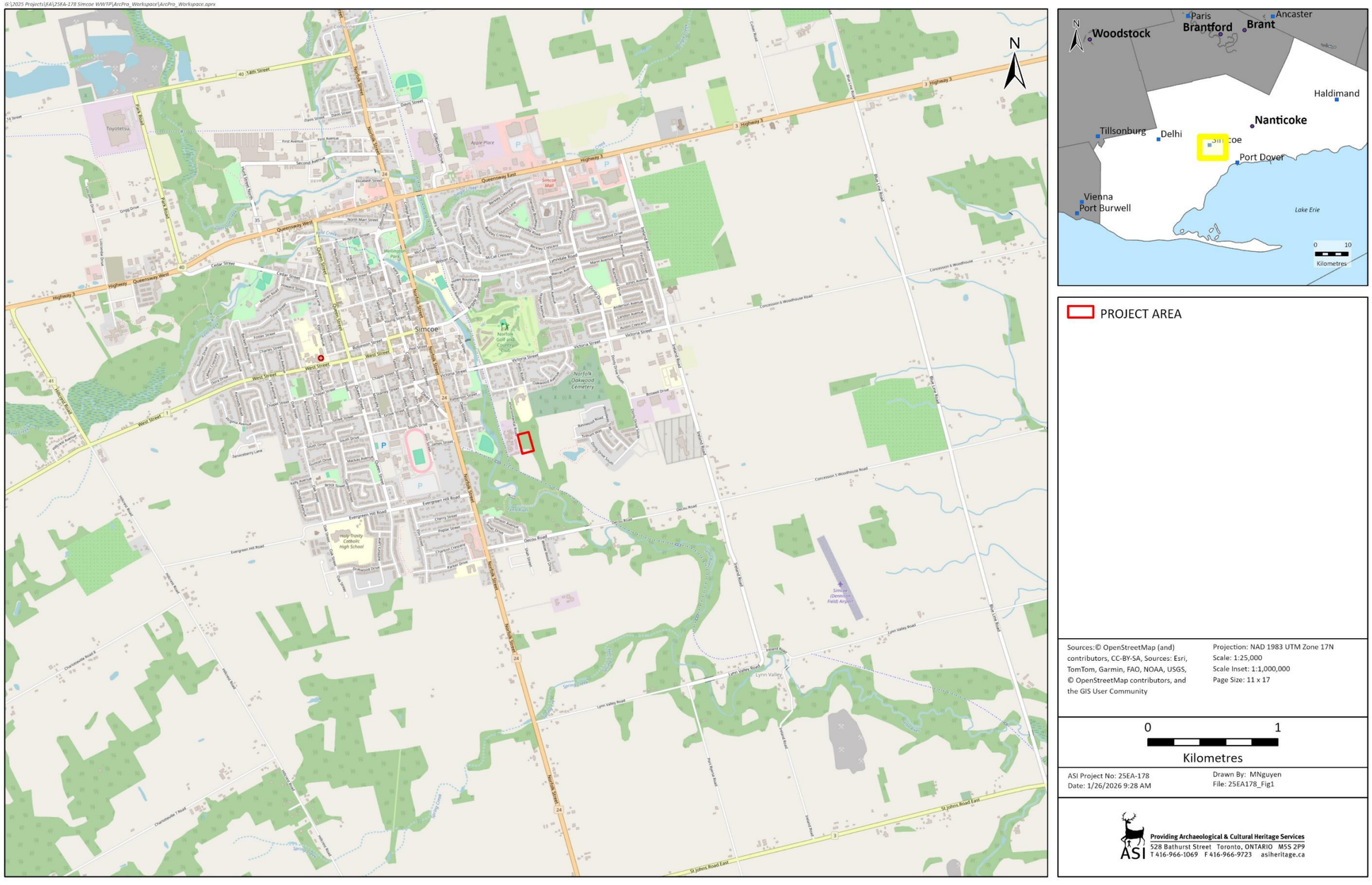
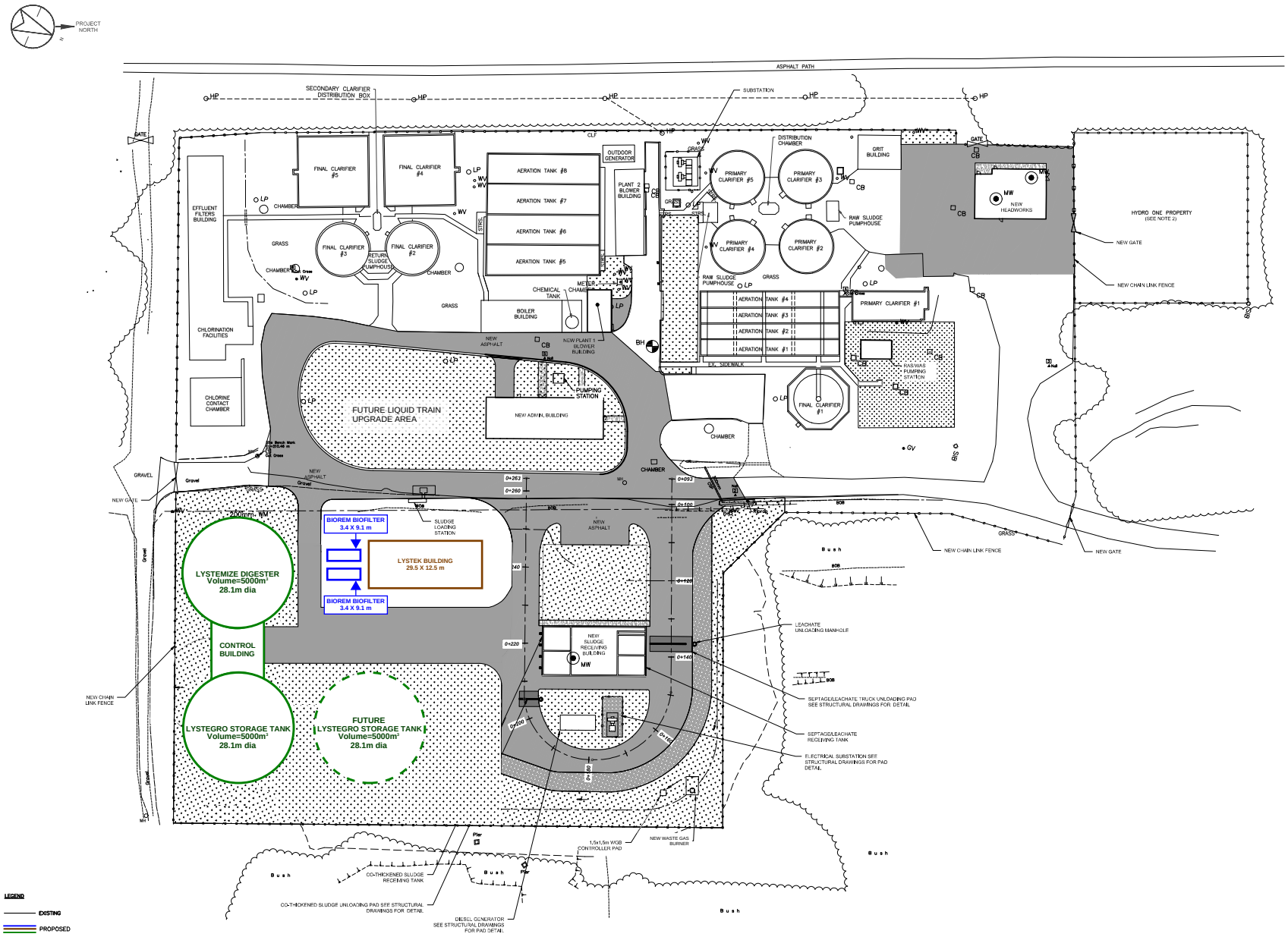


Figure 1: Location of the Project Area



Figure 2: Stage 2 Archaeological Assessment Results for the Simcoe Wastewater Treatment Plant

Appendix A: 30 Percent Conceptual Designs



no.	REVISION	DATE	INIT.
0	FOR CONCEPTUAL REVIEW OF BIOSOLIDS FACILITIES	JULY 2024	MR

NOTES
1. ONLY PROPOSED NEW STRUCTURES ARE SHOWN IN COLOUR.
2. REAL LOCATION OF WASTER GAS BURNER AND DIGESTER GAS PIPE TO REALLOCATED FOR SELECTED OPTIONS, NOT SHOWN FOR CLARITY.

ISSUE

SCALE BAR 1:500 (0 5 10 15 20m)

DRAFTING YP
DESIGN IS
DESIGN CHECKED BY MR
APPROVED BY OK

Norfolk County
HATCH

SIMCOE WWTF UPGRADES
NORFOLK COUNTY
CIVIL
PROPOSED SITE PLAN - 2051 RATED CAPACITY
Lystek Option

CONSULTANT FILE No. 353644
DATE 2024/07/08
SCALE
REF. No. EIS-ENG-22-42
DWG No.
REV. 0

Appendix M
Stage I AA Access Road

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

Stage 1 Archaeological Assessment
Simcoe Wastewater Treatment Plant
Access Road
16 Oakwood Avenue
(Lots 1-2, Concession 5, Geographical Township of Woodhouse, County of Norfolk)
Town of Simcoe, Norfolk County

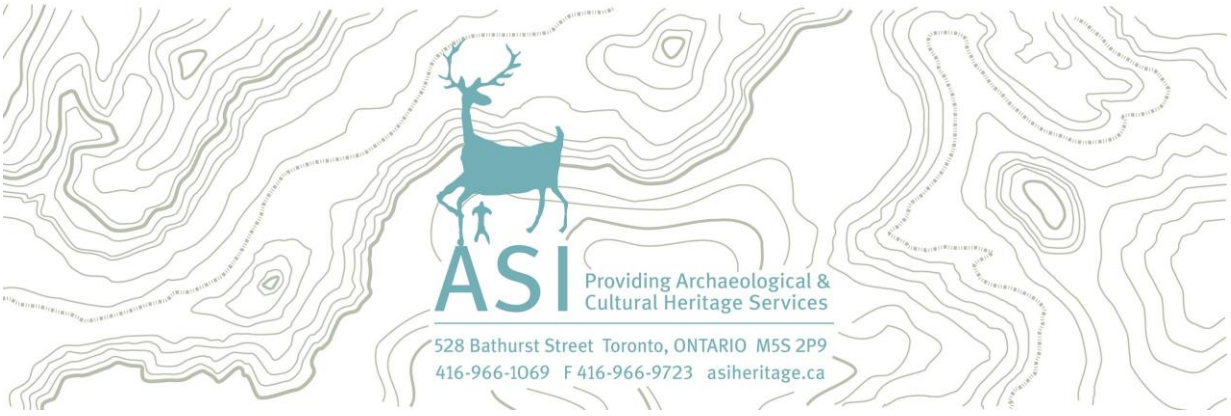
Original Report

Prepared for:

Hatch
2265 Upper Middle Road East, 5th Floor
Oakville Ontario L6H 0G5

Archaeological Licence: P094 (Merritt)
PIF P094-0491-2025
Archaeological Services Inc. File: 25EA-193

12 March 2026



Executive Summary

Archaeological Services Inc. was contracted by Hatch Ltd., on behalf of Norfolk County, to conduct a Stage 1 Archaeological Assessment (Background Research and Property Inspection) as part of the Simcoe Wastewater Treatment Plant Access Road Municipal Class Environmental Assessment. This project involves a proposed access road to connect Victoria Street to Trillium Way. It is assumed this new road will have a 15-metre-wide right-of-way. The Stage 1 Project Area comprises a L-shaped polygon south of Victoria Street and west of Trillium Way. The polygon is 740 metres by 250 metres with a width of 27-35 metres.

The Stage 1 background research determined 16 previously registered archaeological sites are located within one kilometre of the Project Area, none of which are within 50 metres. The property inspection determined part of the Project Area retains archaeological potential and requires Stage 2 survey.

The following recommendations are made:

1) Part of the Project Area exhibits archaeological potential. These lands require Stage 2 archaeological assessment by test pit survey at five metre intervals. Stage 2 is required prior to any proposed construction activities on these lands;

2) The remainder of the Project Area does not retain archaeological potential on account of deep and extensive land disturbance, low and wet conditions, or being previously assessed. These lands do not require further archaeological assessment; and,

3) Should the proposed work extend beyond the current Project Area, further archaeological assessment should be conducted to determine the archaeological potential of the surrounding lands.

ASI

Project Personnel

- **Principal**: Lisa Merritt, MSc. (P094) Principal, Infrastructure
- **Senior Project Manager**: Sarah Jagelewski, BA Hons (R405), Lead Archaeologist, Manager, Infrastructure
- **Division Coordinator**: Katrina Thach, BA Hons. (R1225), Associate Archaeologist, Assistant Manager, Infrastructure
- **Project Administrator**: Danielle Bella, BA Hons, Archaeologist, Technical Writer, Infrastructure
- **Project Director**: Lisa Merritt
- **Project Manager**: Jason Barrett, PhD, Lead Archaeologist, Project Manager, Infrastructure
- **Field Director**: Poorya Kashani, PhD (P1133) Associate Archaeologist, Assistant Manager, Field Services - Operations
- **Report Preparation**: Danielle Bella
- **Graphics**: Robin Latour, MPhil, PDip, Associate Archaeologist, Geomatics Specialist, Operations; Andrew Clish, BES (P046), Senior Archaeologist, Senior Field Director, Laboratory and Fieldwork Services, Operations
- **Report Review**: Eliza Brandy, MA (R1109), Lead Archaeologist, Project Manager, Infrastructure; Sarah Jagelewski

Table of Contents

Executive Summary 1
Project Personnel 2
Table of Contents 3
1.0 Project Context 6
1.1 Development Context 6
1.1.1 Treaties and Traditional Territories 7
1.2 Historical Context 9
1.2.1 Indigenous Land Use and Settlement 9
1.2.2 Post-Contact Settlement 12
1.2.3 Map Review 16
1.2.4 Aerial, Orthoimagery, and LiDAR Review 17
1.3 Archaeological Context 18
1.3.1 Geography 18
1.3.2 Previously Registered Archaeological Sites 20
1.3.3 Previous Archaeological Assessments 20
2.0 Property Inspection 21
2.1 Field Methods 21
2.2 Current Land Use and Field Conditions 22
3.0 Analysis of Archaeological Potential 22
3.1 Conclusions 23
4.0 Recommendations 23
5.0 Advice on Compliance with Legislation 24
6.0 Bibliography and Sources 26
7.0 Images 33
7.1 Field Photography 33
8.0 Maps 39

Appendix A: Registered Sites within One Kilometre 51

List of Images

Image 1: Area is disturbed from the former railway; low potential. 33
Image 2: Area is disturbed from the former railway; low potential. 33
Image 3: Area is disturbed from the former railway; low potential. 34
Image 4: Area is disturbed from the former railway; low potential. 34
Image 5: Area is disturbed from the former railway and culvert; low potential. 35
Image 6: Area is disturbed from the former railway; low potential. 35
Image 7: Area is disturbed from the former railway; low potential. 36
Image 8: Area is disturbed from the former railway; low potential. 36
Image 9: Area is disturbed from the former railway; low potential. 37
Image 10: Area is disturbed from the former wastewater treatment plant infrastructure; low potential. 37
Image 11: Area is disturbed from the former wastewater treatment plant infrastructure; low potential. 38
Image 12: Stage 2 survey is required. 38

List of Figures

Figure 1: Location of the Project Area. 39
Figure 2: Project Area (Approximate Location) Overlaid on the 1865 Tremaine Map of Norfolk County. 40
Figure 3: Project Area (Approximate Location) Overlaid on the 1877 Illustrated Atlas of Norfolk County. 41
Figure 4: Project Area (Approximate Location) Overlaid on the 1939 Topographic Map Simcoe Sheet. 42
Figure 5: Project Area (Approximate Location) Overlaid on the 1971 Topographic Map Simcoe Sheet. 43
Figure 6: Project Area (Approximate Location) Overlaid on the 1996 Topographic Map Simcoe Sheet. 44
Figure 7: Project Area (Approximate Location) Overlaid on the 1954 Aerial Photograph. 45

Figure 8: Project Area (Approximate Location) Overlaid on the LiDAR-Based Digital Terrain Model. 46
Figure 9: Project Area – Surficial Geology. 47
Figure 10: Results of the Stage 1 Archaeological Assessment (Sheet 1). 48
Figure 11: Results of the Stage 1 Archaeological Assessment (Sheet 2). 49
Figure 12: Results of the Stage 1 Archaeological Assessment (Sheet 3). 50

1.0 Project Context

Archaeological Services Inc. (ASI) was contracted by Hatch Ltd., on behalf of Norfolk County, to conduct a Stage 1 Archaeological Assessment (Background Research and Property Inspection) as part of the Simcoe Wastewater Treatment Plant Access Road Municipal Class Environmental Assessment. This project involves a proposed access road to connect Victoria Street to Trillium Way.

Based on corridor specifications provided by Hatch, the Stage 1 Project Area represents the extent of construction impacts within the maximum right-of-way (ROW) limits of the proposed access road (Figure 1).

All activities carried out during this assessment were completed in accordance with the *Ontario Heritage Act* (R.S.O. c. O.18, 1990, as amended in 2025) and the 2011 *Standards and Guidelines for Consultant Archaeologists* (S & G), currently administered by the Ministry of Citizenship and Multiculturalism (MCM, 2011).

1.1 Development Context

All work has been undertaken as required by the *Environmental Assessment Act* (R.S.O. c. E.18, 1990, as amended in 2025) and regulations made under the Act, and are therefore subject to all associated legislation. This project is being conducted in accordance with the *Municipal Class Environmental Assessment* process (Municipal Engineers Association, 2023).

Authorization to carry out the activities necessary for the completion of the Stage 1 archaeological assessment and property inspection was granted by Hatch Ltd. on October 8, 2025.

1.1.1 Treaties and Traditional Territories

1.1.1.1. 1701 Deed from the Five Nations to the King, of their Beaver Hunting Ground

In the late seventeenth century, the Haudenosaunee of the Five Nations Confederacy residing in upstate New York and Southern Ontario were dealing with military engagements and encroachment from French forces as well as the movement of the Mississaugas and other Anishinaabeg peoples into the area, all of which contributed to fears among the Confederacy about the loss of their beaver hunting grounds (Williams & Nelson, 1995). To address their concerns, the Confederacy met with the Province of New York's acting colonial governor John Nanfan, as well as a British representative on behalf of the Indian Affairs Department, Robert Livingston, in July 1701. The Confederacy hoped to urge the English into action in their disputes with the French and their Indigenous allies. The British hoped that an alliance with the Haudenosaunee would continue to ensure a strong trading relationship, keep French efforts to control the fur trade in check, and assert British control deeper into North America (Brandao & Starna, 1996; Jamieson, 2013).

Ultimately, the Deed from the Five Nations to the King, sometimes referred to as the Treaty of Fort Albany, the Nanfan Treaty, the Albany Deed, or Livingston's Deed, was signed by representatives of the British Crown and the Haudenosaunee Confederacy in 1701 (Williams & Nelson, 1995). The Deed established the Beaver Hunting Grounds as a vast territory spanning much of the lands surrounding the lower Great Lakes, including Southern Ontario, as well as into the Ohio River Valley (Jamieson, 2013).

There has been significant debate about the terms of the agreement. The Six Nations of the Grand River interpret the agreement as a valid treaty that recognized the Confederacy's ownership of and access to the natural resources within the Beaver Hunting Grounds, while also receiving the Crown's support and protection (Jamieson, 2013; Williams & Nelson, 1995). Others, though, note that while the Haudenosaunee fished and hunted in Southern Ontario in the late seventeenth century, these lands were not under their authority at the time and

as such, they could not negotiate a formal treaty with the British Crown for this territory (Calverley, 2002; Jennings, 1984; Schmalz, 1984). Research indicates that the British did not formally recognize the agreement, and currently neither the Canadian government nor the British Crown recognize the 1701 Deed as a treaty.

1.1.1.2. Treaty 3, Between the Lakes Purchase

Following the American Revolutionary War (1775-1783), the British Crown needed to find lands on which to settle United Empire Loyalists, including approximately 2,000 members of the Six Nations confederacy who had fought alongside British troops. Led by Sir Frederick Haldimand who was the governor of Quebec at that time, the Crown was initially planning on providing lands for Loyalist settlers in Quebec and Southeastern Ontario, including providing land in the Bay of Quinte for Six Nations refugees. This was not suitable for many of the members of Six Nations and a contingent of approximately 1,800 community members, led by Chief Joseph Brant, requested land north of Lake Erie along the Grand River. Brant felt that the location in the Bay of Quinte was too isolated and that his followers could be better served by being closer to the Six Nations communities that chose to remain in the United States in western New York (Surtees, 1984, p. 21).

Recognizing that, under the terms of the Royal Proclamation of 1763, the land needed to be purchased prior to settlement, Colonel John Butler was sent to negotiate with the Mississaugas of the Credit for lands east of Lake Ontario and north of Lake Erie. On May 22, 1784, the Mississaugas of the Credit agreed to cede approximately 3,000,000 acres (1,214,057 hectares) of land containing all or part of Brant, Elgin, Middlesex, Oxford, and Wellington Counties as well as the Regions of Haldimand-Norfolk, Halton, Hamilton-Wentworth, Niagara, and Waterloo. In exchange for these lands, the Mississaugas received £1180.74 worth of trade goods (Crown-Indigenous Relations and Northern Affairs, 2016; Surtees, 1984). Of the 3,000,000 acres (1,214,057 hectares), approximately 550,000 acres (222,577 hectares) was set aside for the settlement of Six Nations people.

However, due to uncertainties with the description of the lands in the original surrender, Treaty 3 was renegotiated on December 7, 1792, to clarify what was ceded. This largely revolved around the northern boundary of the Treaty area and in particular the area set aside for Six Nations settlement along the Grand River (see Haldimand Tract and Treaty 4). The signees on the side of the British included Lieutenant Governor John Graves Simcoe, John Butler, Robert Kerr, Peter Russell, John McGill, and Davie William Smith. The signees on the side of the Mississauga included Chiefs Wabakayne, Wabanip, Kautabus, Wabaniship and Mottotow (Crown-Indigenous Relations and Northern Affairs, 2016; Mississaugas of the Credit First Nation, 2017; Surtees, 1984).

The original text stipulated that the north-west boundary of the parcel was an imaginary line between Burlington Bay and the Thames River, which is inconsistent with the geography of the area. The boundaries of the parcel were corrected to create a polygon encompassing the Niagara peninsula up to Burlington Bay and then up north to the present-day town of Arthur then south to the present-day town of Woodstock to finally meet Lake Erie at Port Bruce. Treaty 3 lands exclude a corridor along the Grand River set aside for Six Nations (Crown-Indigenous Relations and Northern Affairs, 2016; Native Land Digital, 2018).

1.2 Historical Context

1.2.1 Indigenous Land Use and Settlement

Current archaeological evidence indicates humans were present in southern Ontario approximately 13,000 years before present (BP) (Ferris, 2013). Populations at this time would have been highly mobile, inhabiting a boreal-parkland similar to the modern sub-arctic. By approximately 10,000 BP, the environment had progressively warmed (Edwards & Fritz, 1988) and populations now occupied less extensive territories (Ellis & Deller, 1990).

Between approximately 10,000-5,500 BP, the Great Lakes basins experienced low-water levels, and many sites which would have been located on those former shorelines are now submerged. This period produces the earliest evidence of heavy wood working tools, an indication of greater investment of

labour in felling trees for fuel, to build shelter, and watercraft production. These activities suggest prolonged seasonal residency at occupation sites. Polished stone and native copper implements were being produced by approximately 8,000 BP; the latter was acquired from the north shore of Lake Superior, evidence of extensive exchange networks throughout the Great Lakes region. The earliest archaeological evidence for cemeteries dates to approximately 4,500-3,000 BP and is interpreted by archaeologists to be indicative of increased social organization and the investment of labour into social infrastructure (Brown, 1995, p. 13; Ellis et al., 1990, 2009).

Between 3,000-2,500 BP, populations continued to practice residential mobility and to harvest seasonally available resources, including spawning fish. The Woodland period begins around 2,500 BP and exchange and interaction networks broaden at this time (Spence et al., 1990, pp. 136, 138) and by approximately 2,000 BP, evidence exists for small community camps, focusing on the seasonal harvesting of resources (Spence et al., 1990, pp. 155, 164). By 1,500 BP there is macro botanical evidence for maize in southern Ontario, and it is thought that maize only supplemented people's diet. There is earlier phytolithic evidence for maize in central New York State by 2,300 BP – it is likely that once similar analyses are conducted on Ontario ceramic vessels of the same period, the same evidence will be found (Birch & Williamson, 2013, pp. 13–15). As is evident in detailed Anishinaabek ethnographies, winter was a period during which some families would depart from the larger group as it was easier to sustain smaller populations (Rogers, 1962). It is generally understood that these populations were Algonquian-speakers during these millennia of settlement and land use.

From the beginning of the Late Woodland period at approximately 1,000 BP, lifeways became more similar to that described in early historical documents. Between approximately 1000-1300 Common Era (CE), larger settlement sites focused on horticulture begin to dominate the archaeological record. Seasonal dispersal of the community for the exploitation of a wider territory and more varied resource base was still practised (Williamson, 1990, p. 317). By 1300-1450 CE, archaeological research focusing on these horticultural societies note that this episodic community dispersal was no longer practised and these

populations now occupied sites throughout the year (Dodd et al., 1990, p. 343). By the mid-sixteenth century these small villages had coalesced into larger communities (Birch et al., 2021). Through this process, the socio-political organization of these First Nations, as described historically by the French and English explorers who first visited southern Ontario, was developed. Other First Nation communities continued to practice residential mobility and to harvest available resources across landscapes they returned to seasonally/annually.

By 1600 CE, the Confederation of Nations were encountered by the first European explorers and missionaries in Simcoe County. Samuel de Champlain in 1615 reported that a group of Iroquoian-speaking people situated between the Haudenosaunee and the Huron-Wendat were at peace and remained “la nation neutre”. Like the Huron-Wendat, Petun, and Haudenosaunee, the Neutral or Attawandaron people were settled village agriculturalists.

By the 1640s, many factors but in particular, devastating epidemics, colonial expansionist pressures and warfare led to the dispersal of the Wendat (and their Algonquian allies such as the Nippissing and Odawa) from southern Ontario to Quebec. Shortly afterwards, the Haudenosaunee established a series of settlements at strategic locations along the trade routes inland from the north shore of Lake Ontario. Peace was achieved between the Haudenosaunee and the Anishinaabe Nations in August of 1701 when representatives of more than twenty Anishinaabe Nations assembled in Montreal to participate in peace negotiations. Peace was confirmed again at council held at Lake Superior when the Haudenosaunee delivered a wampum belt to the Anishinaabe Nations. This agreement between the Haudenosaunee and Anishinaabe nations is referred to as the Dish with One Spoon.

In 1763, following the fall of Quebec, New France was transferred to British control at the Treaty of Paris. The British government began to pursue major land purchases to the north of Lake Ontario in the early nineteenth century. The Crown acknowledged the Mississaugas of the Credit as the owners of the lands between Georgian Bay and Lake Simcoe and entered into negotiations for additional tracts of land as the need arose to facilitate European settlement.

1.2.2 Post-Contact Settlement

Historically, the Project Area is located in the Geographical Woodhouse Township, County of Norfolk, in Lots 1-2, Concession 5.

The S & G stipulates that areas of early Euro-Canadian settlement (pioneer homesteads, isolated cabins, farmstead complexes), early wharf or dock complexes, pioneer churches, and early cemeteries are considered to have archaeological potential. Early historical transportation routes (trails, passes, roads, railways, portage routes), properties listed on a municipal register or designated under the Ontario Heritage Act or a federal, provincial, or municipal historic landmark or site are also considered to have archaeological potential.

For the Euro-Canadian period, the majority of early nineteenth century farmsteads (i.e., those that are arguably the most potentially significant resources and whose locations are rarely recorded on nineteenth century maps) are likely to be located in proximity to water. The development of the network of concession roads and railroads through the course of the nineteenth century frequently influenced the siting of farmsteads and businesses. Accordingly, undisturbed lands within 100 metres of an early settlement road are also considered to have potential for the presence of Euro-Canadian archaeological sites.

The first Europeans to arrive in the area were transient merchants and traders from France and England, who followed Indigenous pathways and set up trading posts at strategic locations along the well-traveled river routes. All of these occupations occurred at sites that afforded both natural landfalls and convenient access, by means of the various waterways and overland trails, into the hinterlands. Early transportation routes followed existing Indigenous trails, both along the lakeshore and adjacent to various creeks and rivers (ASI 2006). Early European settlements occupied similar locations as Indigenous settlements as they were generally accessible by trail or water routes and would have been in locations with good soil and suitable topography to ensure adequate drainage.

Throughout the period of initial European settlement, Indigenous groups continued to fish, gather, and hunt within their traditional and treaty territories, albeit often with legal and informal restrictions imposed by colonial authorities and settlers. In many cases, Indigenous peoples acted as guides and teachers, passing on their traditional knowledge to settlers, allowing them to sustain themselves in their new homes. Indigenous peoples entered into economic arrangements and partnerships, and often inter-married with settlers. However, pervasive and systemic oppression and marginalization of Indigenous peoples also characterized Euro-Canadian colonization, with thousands being displaced from their lands, denied access to traditional and treaty hunting, fishing, and collecting grounds, and forced to assimilate with Euro-Canadian culture through mandatory attendance at Day and Residential Schools (Ray, 2005; Rogers & Smith, 1994).

1.2.2.1. Town of Simcoe

The Town of Simcoe is located on the Lynn River 38 kilometres south of the City of Brantford. The town was visited by Sir John Graves Simcoe, first lieutenant-governor of Upper Canada, in 1795. Governor Simcoe made this stop during his journey to establish Fort Norfolk on Fort Erie and granted land to potential settlers, including Aaron Culver with the provision that he was to build mills on the river (Ontario Heritage trust, 2025). By 1812, a settlement formed surrounding the saw and grist mills Culver had built. The mills were burnt during the War of 1812. Captain Bird, a prominent merchant in the settlement, was deeded some land by Culver and subsequently the town was initially called Birdtown (American Biographical Publishing Company, 1880). Aaron Culver further subdivided his land into village lots between 1819 and 1823, proposing the village be renamed in remembrance of the late lieutenant-governor Simcoe's visit.

The Simcoe Post Office opened in 1829 with Duncan Campbell as postmaster (American Biographical Publishing Company, 1880). In 1836 a courthouse and jail were constructed. Simcoe became the seat of the newly created Talbot District in 1837, and in 1851 was incorporated as a village and became the seat of Norfolk County. A branch of the Great Western Railway was completed from

Glencoe through Simcoe to Fort Erie in 1872. A line from Woodstock to Port Dover was built in 1875. These lines cause an increase in Simcoe's population. Simcoe was incorporated as a town in 1878. Dr. John Wilson was the first mayor of Simcoe.

In addition to saw and grist mills, Simcoe's early industries included Cable's Carriage Works and the "alligator tug" tugboat (Churcher, 2022). The alligator tug was created by John West of West, Peachy and Sons and was able to operate on both water and land using cables and winches. The alligator tug was an asset to the lumbering industry. During the Depression, the flue-cured tobacco industry was a saving factor for Simcoe, as was fruit production. These industries drew people to the area. A large tin can manufacture plant was established around 1930.

Simcoe features several historic churches. Presbyterian minister Reverend Jabez Culver held services in his own log home until his death in 1818 (Wilson, 1983). A frame church was built to hold Methodist Episcopal services by 1820. In 1868, a new brick church was completed, then known as the Windham Memorial Chapel of the New Connection Methodist Church. Its name was later changed to the Windham United Church (United Church of Canada, 1962). A church named the Old Windham Church, which stands present-day, was completed in 1962. The Methodist Church was built in 1840. The three churches eventually united to form the Methodist Church of Canada. The Old Mud Church was constructed in 1843 of clay and straw bricks by the Congregationalists of Simcoe and destroyed by a fire in 1876 (Owen, 1898). Saint Andrew's Church of Scotland, constructed in 1847, and the Canadian Presbyterian Church, built in 1868, were united in 1876. The united congregation built St. Paul's Presbyterian Church in 1886. Trinity Anglican Church was originally completed in 1850 and then renovated in 1882. Central School, constructed in 1858, was a Union School offering education to all students of Simcoe until a high school was erected in 1893-4. The South Ward Public School was erected in 1917, and the North Ward School in 1928.

In 1974, Simcoe became part of the Regional Municipality of Haldimand-Norfolk and the town was enlarged to include part of the Townships of Charlotteville, Townsend, Windham, and Woodhouse.

1.2.2.2. Railways

The Port Dover and Lake Huron Railway was incorporated in 1872 to build a rail line from Port Dover to Stratford. To save costs, they were granted permission to acquire the roadbeds and holdings of the former Woodstock and Lake Erie Railway and Harbour Company whose own efforts to build in the region had been halted when an enquiry into their business affairs found evidence of reckless spending, bad faith investments, and bribery. The Port Dover and Lake Huron Railway line from Port Dover to Woodstock opened in 1875 with a further extension to Stratford the following year. The railway company purchased Port Dover Harbour from the federal government in 1877 and in that same year, amalgamated with the Stratford and Huron Railway to form the Port Dover and Lake Huron Railway. In 1881, they amalgamated with the Stratford and Huron Railway and the Georgian Bay and Lake Erie Railway to form a new subsidiary of the Grand Trunk Railway called the Grand Trunk, Georgian Bay and Lake Erie Railway which was eventually completely absorbed into the Grand Trunk Railway in 1893 (Cooper, 2017a; Delamere, 2011). In 1923, in an effort to nationalize the railway system, the federal government acquired the Grand Trunk Railway following the acquisition of several other major rail companies, creating the Canadian National Railway System (Cooper, 2017b).

Construction of the Lake Erie and Northern Electric Railway began in May 1913. The Canadian Pacific Railway took over the rail line in 1914 and completed its construction in 1916. The Lake Erie and Northern Railway was a more direct connection to the Canadian Pacific Railway for industry, farmers, and passengers between Brantford and Galt. The Lake Erie and Northern Railway and the Grand River Railway were merged under the new organization of the Canadian Pacific Electric Lines, formed in 1931 by the Canadian Pacific Railway. Passenger service was offered until 1955, and freight transportation occurred until the line was converted to diesel in 1961 (Canada-Rail, n.d.).

The former Port Dover and Lake Huron Railway corridor is 30 metres to the south of the Project Area, and follows a northwest to southeast alignment in the area. The former Lake Erie and Northern Electric Railway is oriented generally north to south and intersects the Project Area along the main route of the proposed access road.

1.2.3 Map Review

The 1865 *Tremaine's Historical Map of Norfolk County* (Tremaine, 1856), 1877 *Illustrated Atlas of Norfolk County* (Page & Co., 1877), 1939 Topographic Simcoe Sheet (Department of National Defence, 1939), 1971 Topographic Simcoe Sheet (Department of Energy, Mines and Resources, 1971), and 1996 National Topographic System (NTS) Simcoe Sheet (Natural Resources Canada, 1996) were examined to determine the presence of historic features within the Project Area during the nineteenth and twentieth centuries (Figures 2-5).

It should be noted that not all features of interest were mapped systematically in the Ontario series of historical atlases. For instance, they were often financed by subscription limiting the level of detail provided on the maps. Moreover, not every feature of interest would have been within the scope of the atlases. The use of historical map sources to reconstruct or predict the location of former features within the modern landscape generally begins by using common reference points between the various sources. The historical maps are geo-referenced to provide the most accurate determination of the location of any property on a modern map. The results of this exercise can often be imprecise or even contradictory, as there are numerous potential sources of error inherent in such a process, including differences of scale and resolution, and distortions introduced by reproduction of the sources.

The 1865 map shown the northern portion of the Project Area within the Town of Simcoe (Figure 2). Victoria Street is shown to be a historically surveyed road. Lynn River is located within 300 metres west of the Project Area, flowing generally northwest to southeast. No structures are depicted within 100 metres of the Project Area. The 1877 map shows the Lake Huron and Port Dover Railroad within 100 metres of the southern end of the Project Area (Figure 3).

The 1939 map shows Sherman Street and Oakwood Avenue (Figure 4). One structure is depicted within 100 metres of the Project Area, fronting Victoria Street to the west of Sherman Street. Lake Huron and Port Dover Railroad is labelled "Canadian National Railways" on the 1939 map. A second railway labelled the "Lake Erie and Northern Electric Railway" intersects the Project Area through the main route of the proposed access road.

The Lake Erie and Northern Railway is indicated to be part of the Canadian Pacific Railway and to be an abandoned line on the 1971 map (Figure 5). A railway cutting is shown within the Project Area, which signifies that parts of the area were excavated to establish a level route for the railway infrastructure. Houses are shown along the eastern and southern sides of Oakwood Avenue. The Simcoe wastewater treatment sewage facilities are shown within and adjacent to the Project Area. A road connects the facilities to the residential Oakwood Avenue.

The Canadian Pacific Railway is not depicted on the 1996 map (Figure 6). The Simcoe wastewater treatment sewage facility does not extend within the Project Area.

1.2.4 Aerial, Orthoimagery, and LiDAR Review

Historical aerial imagery from 1954 (Hunting Survey Corporation Limited, 1954) shows the Lake Erie and Northern Electric Railway running generally north-south within the Project Area (Figure 7). The early stage of construction of the Simcoe wastewater treatment sewage facility is apparent within and adjacent to the southern portion of the Project Area.

A review of available Google satellite imagery indicates the Project Area remained relatively unchanged between 2003 and 2025.

Features of the Simcoe Wastewater Treatment Plant, such as the final clarifiers and aeration tanks, are visible on the LiDAR-based Digital Terrain Model (Figure 8). This includes those shown within the Project Area on the 1971 map and later decommissioned. A tributary of Lynn River intersects the Project Area through a culvert at the trail. The trail, and former railway corridor, appears evenly

depressed due to the railway cutting indicated on the 1971 map. The property of the community care access centre appears leveled.

1.3 Archaeological Context

This section provides background research pertaining to previous archaeological fieldwork conducted within and in the vicinity of the Project Area, its environmental characteristics (including drainage, soils or surficial geology and topography, etc.), and current land use and field conditions. Three sources of information were consulted to provide information about previous archaeological research: the site record forms for registered sites available online from the MCM through "Ontario's Past Portal"; published and unpublished documentary sources; and the files of ASI.

1.3.1 Geography

In addition to the known archaeological sites, the state of the natural environment is a helpful indicator of archaeological potential. Accordingly, a description of the physiography and soils are briefly discussed for the Project Area.

The S & G stipulates that primary water sources (lakes, rivers, streams, creeks, etc.), secondary water sources (intermittent streams and creeks, springs, marshes, swamps, etc.), ancient water sources (glacial lake shorelines indicated by the presence of raised sand or gravel beach ridges, relic river or stream channels indicated by clear dip or swale in the topography, shorelines of drained lakes or marshes, cobble beaches, etc.), as well as accessible or inaccessible shorelines (high bluffs, swamp or marsh fields by the edge of a lake, sandbars stretching into marsh, etc.) are characteristics that indicate archaeological potential.

Water has been identified as the major determinant of site selection and the presence of potable water is the single most important resource necessary for any extended human occupation or settlement. Since water sources have remained relatively stable in Ontario since 5,000 B.P. (Karrow & Warner, 1990, Figure 2.16), proximity to water can be regarded as a useful index for the

evaluation of archaeological site potential. Indeed, distance from water has been one of the most commonly used variables for predictive modeling of site location.

Other geographic characteristics that can indicate archaeological potential include elevated topography (eskers, drumlins, large knolls, and plateaux), pockets of well-drained sandy soil, especially near areas of heavy soil or rocky ground, distinctive land formations that might have been special or spiritual places, such as waterfalls, rock outcrops, caverns, mounds, and promontories and their bases. There may be physical indicators of their use, such as burials, structures, offerings, rock paintings or carvings. Resource areas, including; food or medicinal plants (migratory routes, spawning areas) are also considered characteristics that indicate archaeological potential (S & G, Section 1.3.1).

1.3.1.1. Physiography

The Project Area is located within the till moraines and sand plains of the Norfolk Sand Plain physiographic region of southern Ontario (Chapman & Putnam, 1984). The Norfolk Sand Plain is a wedge-shaped feature that extends from the Lake Erie shoreline and tapers northward to a point in Brantford on the Grand River (Chapman & Putnam, 1984). The region encompasses an area of 3,134 square kilometres and consists of sands and silts that were deposited as a delta in glacial Lakes Whittlesey and Warren. A massive discharge of meltwater from the Grand River area entered the lakes between the ice front and the moraines to the northwest, building the delta from west to east as the glacier withdrew, thus covering most of the area west of the Galt Moraine with sand. In the vicinity of the subject property, glaciolactustrine deep water sediments belonging to mainly glacial Lake Warren and younger deposits and consisting of stratified to varved silt and clay, minor sand, are overlain by veneer of sand (Zone 10) (Cowan, 1972).

1.3.1.2. Surficial Geology

The surficial geology mapping (Figure 9) shows the Project Area is underlain by fine-textured glaciolacustrine deposits (silt and clay, minor sand and gravel, massive to well laminated), coarse-textured glaciolacustrine deposits (sand,

gravel, minor silt, and clay), and older alluvial deposits (clay, silt, sand, gravel, which may contain organic remains).

1.3.1.3. Soil Types and Drainage

The Project Area is sitting on top of urban lands with no soil information due to rapid expansion (Land Resource Research Institute, 1983).

1.3.1.4. Water Sources

The Lynn River is approximately 10 metres west of the Project Area. A tributary of the Lynn River intersects the Project Area through a culvert.

1.3.2 Previously Registered Archaeological Sites

In Ontario, information concerning archaeological sites is stored in the Ontario Archaeological Sites Database maintained by the MCM. This database contains archaeological sites registered within the Borden system. Under the Borden system, Canada has been divided into grid blocks based on latitude and longitude. A Borden block is approximately 13 kilometres east to west, and approximately 18.5 kilometres north to south. Each Borden block is referenced by a four-letter designator, and sites within a block are numbered sequentially as they are found. The Project Area under review is located in Borden blocks *AfHb* and *AeHb.*

According to the Ontario Archaeological Sites Database, 16 previously registered archaeological sites are located within one kilometre of the Project Area, none of which are located within 50 metres (MCM 2025). A summary of the sites is provided in Appendix A.

1.3.3 Previous Archaeological Assessments

In 2025, ASI conducted previous Stage 1 (ASI, 2025a P094-0455-2025) and Stage 2 (ASI, 2025b P383-0509-2025) archaeological assessments of the existing Simcoe Wastewater Treatment Plant, and the lands overlapping the current Project Area were cleared of archaeological concern. No other reports that

detail archaeological fieldwork were identified within 50 metres of the Project Area.

2.0 Property Inspection

2.1 Field Methods

A Stage 1 property inspection must adhere to the S & G, Section 1.2, Standards 1-6, which are discussed below. The entire property and its periphery must be inspected. The inspection may be either systematic or random. Coverage must be sufficient to identify the presence or absence of any features of archaeological potential. The inspection must be conducted when weather conditions permit good visibility of land features. Natural landforms and watercourses are to be confirmed if previously identified. Additional features such as elevated topography, relic water channels, glacial shorelines, well-drained soils within heavy soils and slightly elevated areas within low and wet areas should be identified and documented, if present. Features affecting assessment strategies should be identified and documented such as woodlots, bogs or other permanently wet areas, areas of steeper grade than indicated on topographic mapping, areas of overgrown vegetation, areas of heavy soil, and recent land disturbance such as grading, fill deposits and vegetation clearing. The inspection should also identify and document structures and built features that will affect assessment strategies, such as heritage structures or landscapes, cairns, monuments or plaques, and cemeteries.

The Stage 1 archaeological assessment property inspection was conducted under the field direction of Poorya Kashani (P1133) on November 26, 2025, in order to gain first-hand knowledge of the geography, topography, and current conditions and to evaluate and map archaeological potential of the Project Area. It was a systematic visual inspection from publicly accessible lands/public rights-of-way and from inside the property grounds of the Simcoe Wastewater Treatment Plant, at 16 Oakwood Avenue, with permission from Norfolk County and did not include excavation or collection of archaeological resources. Fieldwork was conducted when weather conditions were deemed clear with good visibility (partly cloudy and temperatures of 0-5 degrees Celsius), per S & G

Section 1.2., Standard 2. Field photography is presented in Section 7.1 (Image 1-Image 12), and field observations are overlaid onto the existing conditions of the Project Area in Section 8.0 (Figure 10-Figure 12).

2.2 Current Land Use and Field Conditions

South of Victoria Street, the Project Area contains a portion of the Sherman Street ROW (Image 1-Image 2). The Project Area is also adjacent to a community care access centre building south of Victoria Street. The main route of the proposed access road includes a paved section of the Lynn Valley Trail (Image 1-Image 9). The trail is a former abandoned railway line, which was cut into the surrounding landscape. The remainder of the Project Area is within the Simcoe Wastewater Treatment Plant property (circa 1950s) and consists of an unmaintained dirt path surrounded by overgrown vegetation (Image 10-Image 12). Most of this area contained infrastructure for the wastewater treatment plant, as indicated by the 1971 map and the LiDAR-based Digital Terrain Model. This portion of the Project Area connects the main route to Trillium Way. The Project Area is bound by greenspace, a residential subdivision, a commercial property, and the existing Simcoe Wastewater Treatment Plant.

3.0 Analysis of Archaeological Potential

The S & G, Section 1.3.1, lists criteria that are indicative of archaeological potential. The Project Area meets the following criteria indicative of archaeological potential:

- Previously identified archaeological sites within 300 metres (AeHb-100; AeHb-104);
- Water sources within 300 metres: primary, secondary, or past water source (Lynn River);
- Early settlements within 100 metres (Town of Simcoe); and
- Early historic transportation routes within 100 metres (Victoria Street, Lake Huron and Port Dover Railroad)

According to the S & G, Section 1.4 Standard 1e, no areas within a property containing locations listed or designated by a municipality can be recommended

for exemption from further assessment unless the area can be documented as disturbed. The Municipal Heritage Register for Norfolk County (Norfolk County, n.d.) was consulted and no property within the Project Area is Listed or Designated under the *Ontario Heritage Act*.

The property inspection determined that parts of the Project Area at the southeast end exhibit archaeological potential. The area will require Stage 2 archaeological assessment prior to any construction activities or other proposed impacts. According to the S & G Section 2.1.2, test pit survey is required on terrain where ploughing is not viable, such as wooded areas, properties where existing landscaping or infrastructure would be damaged, overgrown farmland with heavy brush or rocky pasture, and narrow linear corridors up to 10 metres wide (Image 12; Figure 12: areas highlighted in green).

Part of the Project Area has been previously assessed (ASI, 2025b: P383-0509-2025) and does not require further archaeological assessments (Figure 12: area highlighted in red).

Part of the Project Area has been subjected to deep soil disturbance events due to railway construction, including a railway cutting through the landscape, and the construction and subsequent decommissioning of parts of the Simcoe Wastewater Treatment Plant. According to the S & G Section 1.3.2 these areas do not retain archaeological potential (Image 1-Image 2,Image 4-Image 6, Image 9; Figure 10-Figure 12: areas highlighted in yellow) and do not require further survey.

3.1 Conclusions

The Stage 1 background research determined 16 previously registered archaeological sites are located within one kilometre of the Project Area, none of which are within 50 metres. The property inspection determined part of the Project Area retains archaeological potential and require Stage 2 survey.

4.0 Recommendations

The following recommendations are made:

1) Part of the Project Area exhibits archaeological potential. These lands require Stage 2 archaeological assessment by test pit survey at five metre intervals (Figure 12: area highlighted in green). Stage 2 is required prior to any proposed construction activities on these lands;

2) The remainder of the Project Area does not retain archaeological potential on account of deep and extensive land disturbance, low and wet conditions, or being previously assessed. These lands do not require further archaeological assessment; and,

3) Should the proposed work extend beyond the current Project Area, further archaeological assessment should be conducted to determine the archaeological potential of the surrounding lands.

NOTWITHSTANDING the results and recommendations presented in this study, ASI notes that no archaeological assessment, no matter how thorough or carefully completed, can necessarily predict, account for, or identify every form of isolated or deeply buried archaeological deposit. In the event that archaeological remains are found during subsequent construction activities, the consultant archaeologist, approval authority, and the Archaeology Programs Unit of the MCM should be immediately notified.

The above recommendations are subject to MCM approval and it is an offence to alter any archaeological site without MCM concurrence. No grading or other activities that may result in the destruction or disturbance of any archaeological sites are permitted until notice of MCM approval has been received.

5.0 Advice on Compliance with Legislation

- This report is submitted to the Minister as a condition of licensing in accordance with Part VI of the *Ontario Heritage Act*, R.S.O. 1990, c 0.18. The report is reviewed to ensure that it complies with the standards and guidelines that are issued by the Minister, and that the archaeological fieldwork and report recommendations ensure the conservation, protection and preservation of the cultural heritage of Ontario. When all

matters relating to archaeological sites within the project area of a development proposal have been addressed to the satisfaction of the Ministry of Citizenship and Multiculturalism a letter will be issued by the ministry stating that there are no further concerns with regard to alterations to archaeological sites by the proposed development.

- It is an offence under Sections 48 and 69 of the *Ontario Heritage Act* for any party other than a licensed archaeologist to make any alteration to a known archaeological site or to remove any artifact or other physical evidence of past human use or activity from the site, until such time as a licensed archaeologist has completed archaeological fieldwork on the site, submitted a report to the Minister stating that the site has no further cultural heritage value or interest, and the report has been filed in the Ontario Public Register of Archaeological Reports referred to in Section 65.1 of the *Ontario Heritage Act*.
- Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48 (1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with Section 48 (1) of the *Ontario Heritage Act*.
- The *Funeral, Burial and Cremation Services Act*, 2002, S.O. 2002, c.33 requires that any person discovering human remains must notify the police or coroner and the Registrar of Cemeteries at the Ministry of Public and Business Services Delivery.
- Archaeological sites recommended for further archaeological fieldwork or protection remain subject to Section 48 (1) of the *Ontario Heritage Act* and may not be altered, or have artifacts removed from them, except by a person holding an archaeological licence.

6.0 Bibliography and Sources

American Biographical Publishing Company. (1880). *The Canadian Biographical Dictionary and Portrait Gallery of Eminent and Self-Made Men: Ontario Volume*. American Biographical Publishing Company. https://www.canadiana.ca/view/oocihm.08545/1

Archaeological Services Inc. (2006). *Historical Overview and Assessment of Archaeological Potential Don River Watershed, City of Toronto*.

Archaeological Services Inc. (2025a). *Stage 1 Archaeological Assessment: Simcoe Wastewater Treatment Plant, 16 Oakwood Avenue (Lot 1, Concession 5, Geographical Township of Woodhouse, County of Norfolk) Town of Simcoe, Norfolk County. P094-0455-2025*.

Archaeological Services Inc. (2025b). *Stage 2 Archaeological Assessment: Simcoe Wastewater Treatment Plant, 16 Oakwood Avenue (Lot 1, Concession 5, Geographical Township of Woodhouse, County of Norfolk) Town of Simcoe, Norfolk County. P383-0509-2025*.

Birch, J., Manning, S. W., Sanft, S., & Conger, M. A. (2021). Refined Radiocarbon Chronologies for Northern Iroquoian Site Sequences: Implications for Coalescence, Conflict, and the Reception of European Goods. *American Antiquity*, *86*(1), 61–89.

Birch, J., & Williamson, R. F. (2013). *The Mantle Site: An Archaeological History of an Ancestral Wendat Community*. Rowman & Littlefield Publishers, Inc.

Brandao, J., & Starna, W. (1996). The Treaties of 1701: A Triumph of Iroquois Diplomacy. *Ethnohistory*, *43*(2), 209–244.

Brown, J. (1995). On Mortuary Analysis – with Special Reference to the Saxe-Binford Research Program. In L. A. Beck (Ed.), *Regional Approaches to Mortuary Analysis* (pp. 3–23). Plenum Press.

Calverley, D. (2002). *Rethinking Boundaries—The Albany Deed, the Great Peace of Montreal, and Iroquois Hunting Activity in Ontario*. Canadian Historical

Association Conference. https://www.academia.edu/40090154/_Rethinking_Boundaries_The_Albany_Deed_the_Great_Peace_of_Montreal_and_Iroquois_Hunting_Activity_in_Ontario_?email_work_card=title

Canada-Rail. (n.d.). *Lake Erie and Northern Railway*. Canada-Rail. Retrieved January 6, 2022, from https://www.canada-rail.com/ontario/railways/LEN.html

Chapman, L. J., & Putnam, F. (1984). *The Physiography of Southern Ontario* (3rd ed., Vol. 2). Ontario Ministry of Natural Resources.

Churcher, C. (2022). *Local Railway Items from Area Papers—1895*. Colin Churcher's Railway Pages. https://churcher.crcml.org/circle/Papers%20by%20Year/1895.pdf

Cooper, C. (2017a). *25 Port Dover & Lake Huron, Stratford & Huron, Georgian Bay & Wellington and the Grand Trunk, Georgian Bay & Lake Erie Railways*. https://bzglfiles.s3.ca-central-1.amazonaws.com/u/131959/c84ee35097ed3f90ad7bd380341695bc524a0aa9/original/25-pd-lh-s-h-gb-w-gtw-le.pdf?response-content-type=application%2Fpdf&X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Credential=AKIA2AEJH4L527DJJBYE%2F20220531%2Fca-central-1%2Fs3%2Faws4_request&X-Amz-Date=20220531T171749Z&X-Amz-Expires=604800&X-Amz-SignedHeaders=host&X-Amz-Signature=446fe355bb280cb20949ff6c92036e9dfc1affabf6282883217080eec10aeed3

Cooper, C. (2017b). *The Grand Trunk Railway of Canada (GTR)*. Charles Cooper's Railway Pages. https://bzglfiles.s3.ca-central-1.amazonaws.com/u/131959/129ea791f7166b3da65a5b8a2fc99baa18df7b66/original/20-the-grand-trunk-railway-of-canada.pdf?response-content-type=application%2Fpdf&X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Credential=AKIA2AEJH4L527DJJBYE%2F20220531%2Fca-central-1%2Fs3%2Faws4_request&X-Amz-Date=20220531T191839Z&X-Amz-Expires=604800&X-Amz-SignedHeaders=host&X-Amz-

Signature=bc462301f1c32a3a97213bbc6a701403a6518d0bbd3d660f966d24ed8dc5da3f

Cowan, W. R. (1972). *Pleistocene Geology of the Brantford Area, Southern Ontario* (No. 37; Industrial Mineral Report). Ontario Department of Mines and Northern Affairs.

Crown-Indigenous Relations and Northern Affairs. (2016). *Saugeen Peninsula Treaty (1854) No. 72*. Treaty Texts – Upper Canada Land Surrenders. https://www.rcaanc-cirnac.gc.ca/eng/1370372152585/1581293792285#ucls24

Delamere, P. (2011). *The Ontario Railway Map Collection*. https://ontariomap.webs.com

Department of Energy, Mines and Resources. (1971). *Simcoe 40-I/16c* [Map].

Department of Militia and Defence. (1909). *Simcoe, Ontario. Map Sheet 040I16* (1st ed.) [Topographic]. Scholars Geoportal.

Department of National Defence. (1939). *Simcoe, Ontario. Map Sheet 040I16* (5th ed.) [Map]. Scholars Geoportal.

Dodd, C. F., Poulton, D. R., Lennox, P. A., Smith, D. G., & Warrick, G. A. (1990). The Middle Ontario Iroquoian Stage. In C. J. Ellis & N. Ferris (Eds.), *The Archaeology of Southern Ontario to A.D. 1650* (pp. 321–360). Ontario Archaeological Society Inc.

Edwards, T. W. D., & Fritz, P. (1988). Stable-Isotope Paleoclimate Records from Southern Ontario, Canada: Comparison of Results from Marl and Wood. *Canadian Journal of Earth Sciences*, *25*, 1397–1406.

Ellis, C. J., & Deller, D. B. (1990). Paleo-Indians. In C. J. Ellis & N. Ferris (Eds.), *The Archaeology of Southern Ontario to A.D. 1650* (pp. 37–64). Ontario Archaeological Society Inc.

Ellis, C. J., Kenyon, I. T., & Spence, M. W. (1990). The Archaic. In C. J. Ellis & N. Ferris (Eds.), *The Archaeology of Southern Ontario to A.D. 1650* (pp. 65–124). Ontario Archaeological Society Inc.

Ellis, C. J., Timmins, P. A., & Martelle, H. (2009). At the Crossroads and Periphery: The Archaic Archaeological Record of Southern Ontario. In T. D. Emerson, D. L. McElrath, & A. C. Fortier (Eds.), *Archaic Societies: Diversity and Complexity across the Midcontinent.* (pp. 787–837). State University of New York Press.

Ferris, N. (2013). Place, Space, and Dwelling in the Late Woodland. In M. K. Munson & S. M. Jamieson (Eds.), *Before Ontario: The Archaeology of a Province* (pp. 99–111). McGill-Queen's University Press. http://www.jstor.org/stable/j.ctt32b7n5.15

Hunting Survey Corporation Limited. (1954). *1954 Air Photos of Southern Ontario*. https://mdl.library.utoronto.ca/collections/air-photos/1954-air-photos-southern-ontario/index

Jamieson, K. (2013, October 2). *The Haudenosaunee/Six Nations and the Royal Proclamation of 1763*. Active History. https://activehistory.ca/blog/2013/10/02/the-haundenosauneesix-nations-and-the-royal-proclamation-of-1763/

Jennings, F. (1984). *The Ambiguous Iroquois Empire: The Covenant Chain Confederation of Indian Tribes with English Colonies*. W.W. Norton and Company.

Karrow, P. F., & Warner, B. G. (1990). The Geological and Biological Environment for Human Occupation in Southern Ontario. In *The Archaeology of Ontario to A.D. 1650* (pp. 5–36). London Chapter, Ontario Archaeological Society.

Land Resource Research Institute. (1983). *Soils of Haldimand-Norfolk Regional Municipality, Ontario, Sheet 1—Middleport-Caledonia* [Pedology]. Land Resource Research Institute, Research Branch, Agriculture Canada.

Lynn Valley Trail Association. (n.d.). *About The Lynn Valley Trail*. Lynn Valley Trail. Retrieved January 5, 2026, from https://lynnvalleytrail.com/about-the-trail/

Ministry of Citizenship and Multiculturalism. (1990). *Ontario Heritage Act, R.S.O. c. O.18*.

Ministry of Citizenship and Multiculturalism. (2011). *Standards and Guidelines for Consultant Archaeologists*. Ministry of Tourism and Culture.

Ministry of Citizenship and Multiculturalism. (2022). *Ontario's Past Portal*. PastPortal. https://www.pastport.mtc.gov.on.ca

Ministry of Citizenship and Multiculturalism. (2025). *Ontario's Past Portal*. PastPortal. https://www.pastport.mtc.gov.on.ca

Ministry of the Environment. (1990). *Environmental Assessment Act, R.S.O. c. E.18*.

Mississaugas of the Credit First Nation. (2017). *12 Mile Creek, 16 Mile Creek and Credit River Reserves – Treaty Nos. 22 and 23 (1820)*. Mississaugas of the New Credit First Nation. https://mncfn.ca/between-the-lakes-treaty-no-3-1792/

Municipal Engineers Association. (2023). *Municipal Class Environmental Assessment*.

Native Land Digital. (2018). *Treaty 3, 1792*. Native Land. https://native-land.ca/

Natural Resources Canada. (1996). *Simcoe NTS Topographic Sheet 040I16* [Map].

Norfolk County. (n.d.). *Heritage Designated Properties in Norfolk County*. Retrieved January 27, 2026, from https://norfolk.maps.arcgis.com/apps/Cascade/index.html?appid=b39ccdfdaa764acd953ece4e3b667467

Norfolk Pathways for People. (n.d.). *Lynn Valley Trail*. Pathways for People. Retrieved January 5, 2025, from https://norfolkpathways.ca/trails/rail-trails/lynn-valley-trail/

Ontario Heritage trust. (2025). *Founding of Simcoe*. Online Plaque Guide. https://www.heritagetrust.on.ca/plaques/founding-of-simcoe

Owen, E. A. (1898). *Pioneer Sketches of Long Point Settlement*. William Briggs.

Page & Co. (1877). *Illustrated Historical Atlas of the Counties of Haldimand and Norfolk* [Map].

Ray, A. J. (2005). *I Have Lived Here Since the World Began: An Illustrated history of Canada's Native People*. Key Porter Books.

Rogers, E. S. (1962). *The Round Lake Ojibwa*. Royal Ontario Museum.

Rogers, E. S., & Smith, D. B. (Eds.). (1994). *Aboriginal Ontario: Historical Perspectives on the First Nations*. Dundurn Press.

Schmalz, P. S. (1984). The Role of the Ojibwa in the Conquest of Southern Ontario, 1650-1701. *Ontario History*, *76*(4).

Spence, M. W., Pihl, R. H., & Murphy, C. (1990). Cultural Complexes of the Early and Middle Woodland Periods. In C. J. Ellis & N. Ferris (Eds.), *The Archaeology of Southern Ontario to A.D. 1650*. Ontario Archaeological Society Inc.

Surtees, R. (1984). *Indian Land Surrenders in Ontario 1763-1867*. Research Branch, Corporate Policy, Department of Indian and Northern Affairs Canada.

Tremaine, G. C. (1856). *Map of the County of Norfolk* [Map].

United Church of Canada. (1962). *Dedication service and history: Old Windham United Church, May 27, 1962.* United Church of Canada Archives. United Church of Canada Archives Pamphlet Collection. https://catalogue.unitedchurcharchives.ca/dedication-service-and-history-old-windham-united-church-may-27-1962

Williams, P., & Nelson, C. (1995). *Kaswentha*. https://publications.gc.ca/collections/collection_2022/bcp-pco/Z1-1991-1-41-114-eng.pdf

Williamson, R. F. (1990). The Early Iroquoian Period of Southern Ontario. In C. J. Ellis & N. Ferris (Eds.), *The Archaeology of Southern Ontario to A.D. 1650* (pp. 291–320). Ontario Archaeological Society Inc.

Wilson, B. (1983). *Dictionary of Canadian Biography: V (1801-1820)*. University of Toronto Press.

7.0 Images

7.1 Field Photography



Image 1: Area is disturbed from the former railway; low potential.



Image 2: Area is disturbed from the former railway; low potential.



Image 3: Area is disturbed from the former railway; low potential.



Image 4: Area is disturbed from the former railway; low potential.



Image 5: Area is disturbed from the former railway and culvert; low potential.



Image 6: Area is disturbed from the former railway; low potential.



Image 7: Area is disturbed from the former railway; low potential.



Image 8: Area is disturbed from the former railway; low potential.



Image 9: Area is disturbed from the former railway; low potential.



Image 10: Area is disturbed from the former wastewater treatment plant infrastructure; low potential.



Image 11: Area is disturbed from the former wastewater treatment plant infrastructure; low potential.



Image 12: Stage 2 survey is required.

8.0 Maps

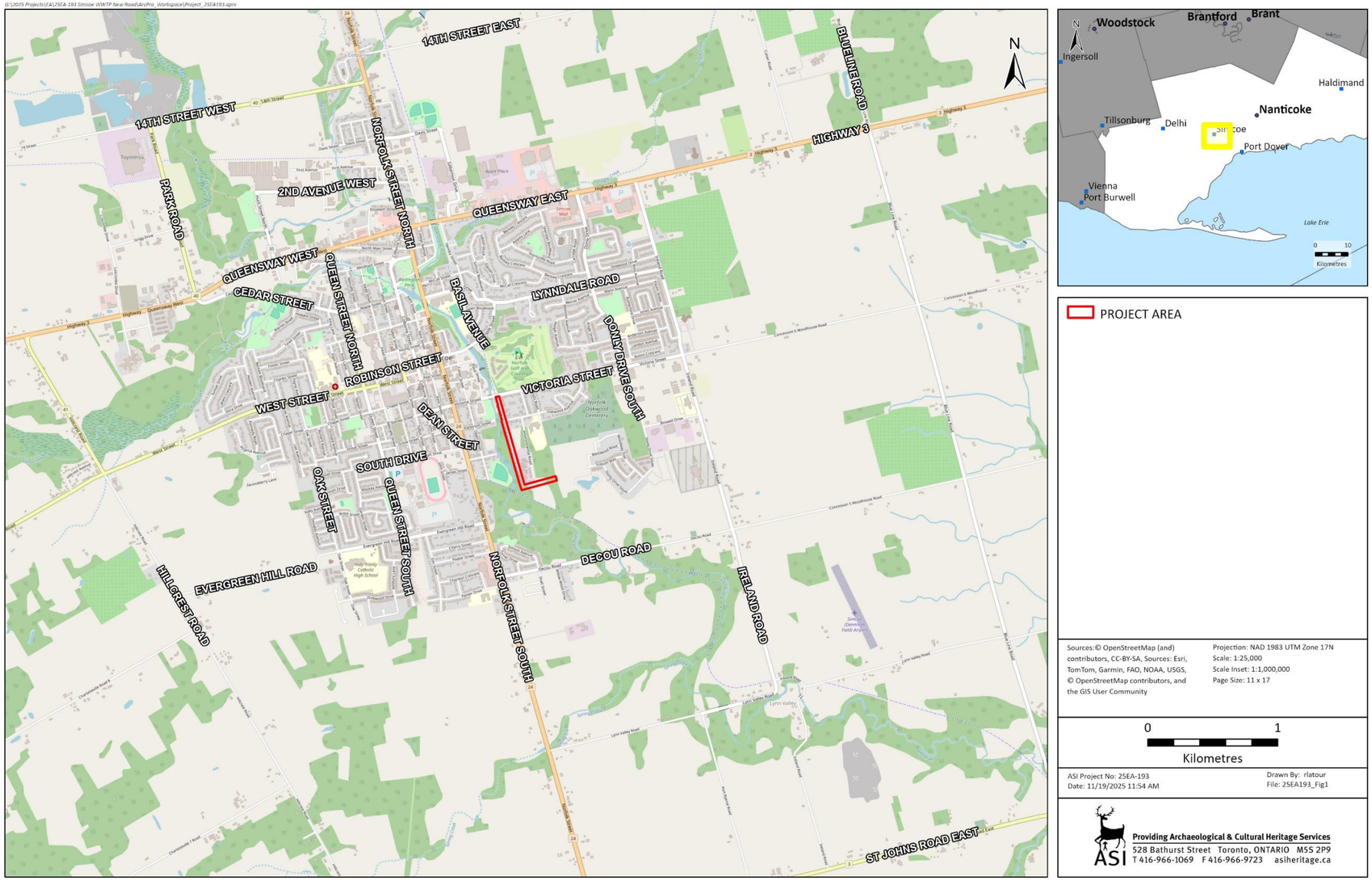


Figure 1: Location of the Project Area.



Figure 2: Project Area (Approximate Location) Overlaid on the 1865 Tremaine Map of Norfolk County.

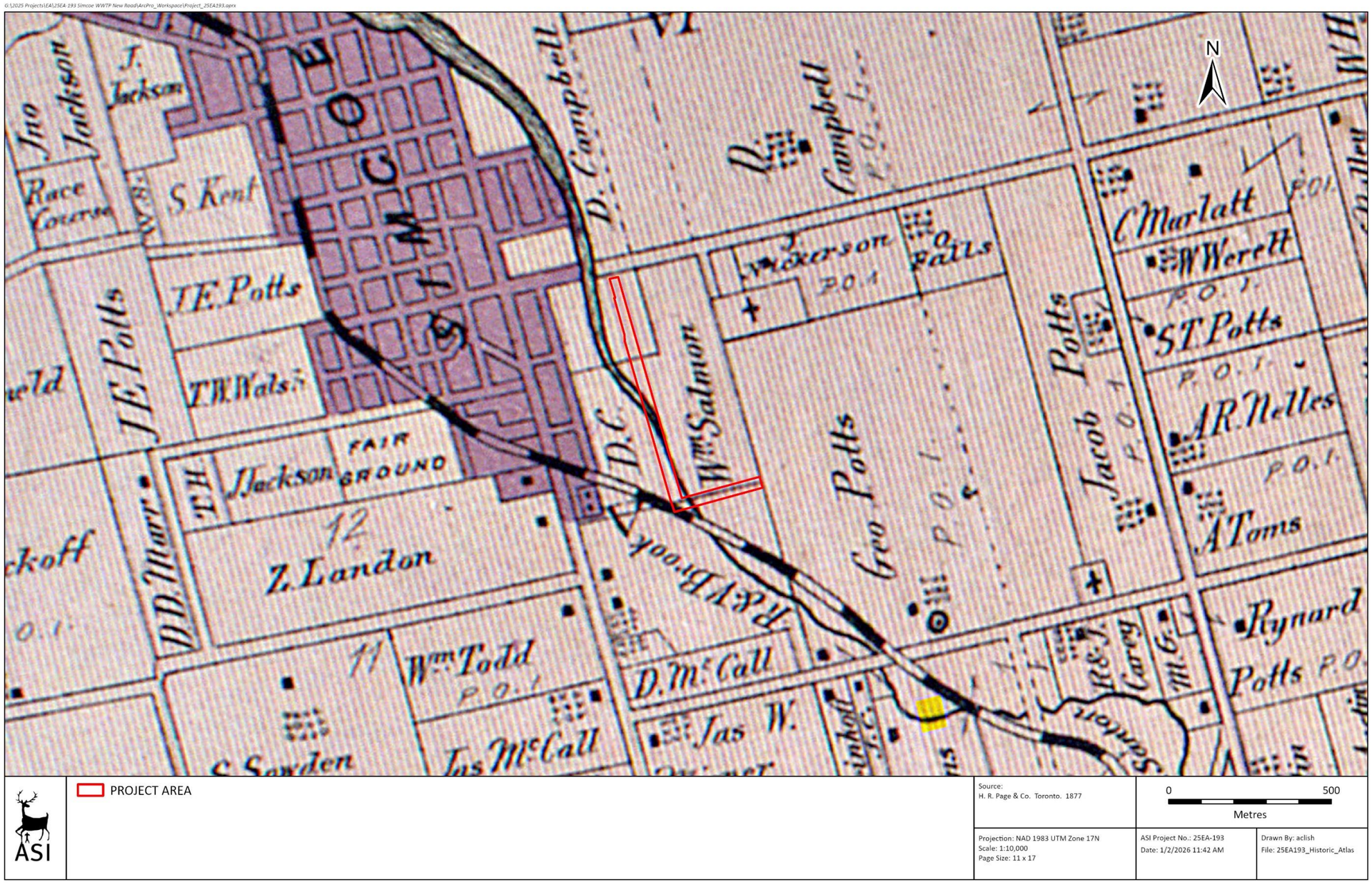


Figure 3: Project Area (Approximate Location) Overlaid on the 1877 Illustrated Atlas of Norfolk County.

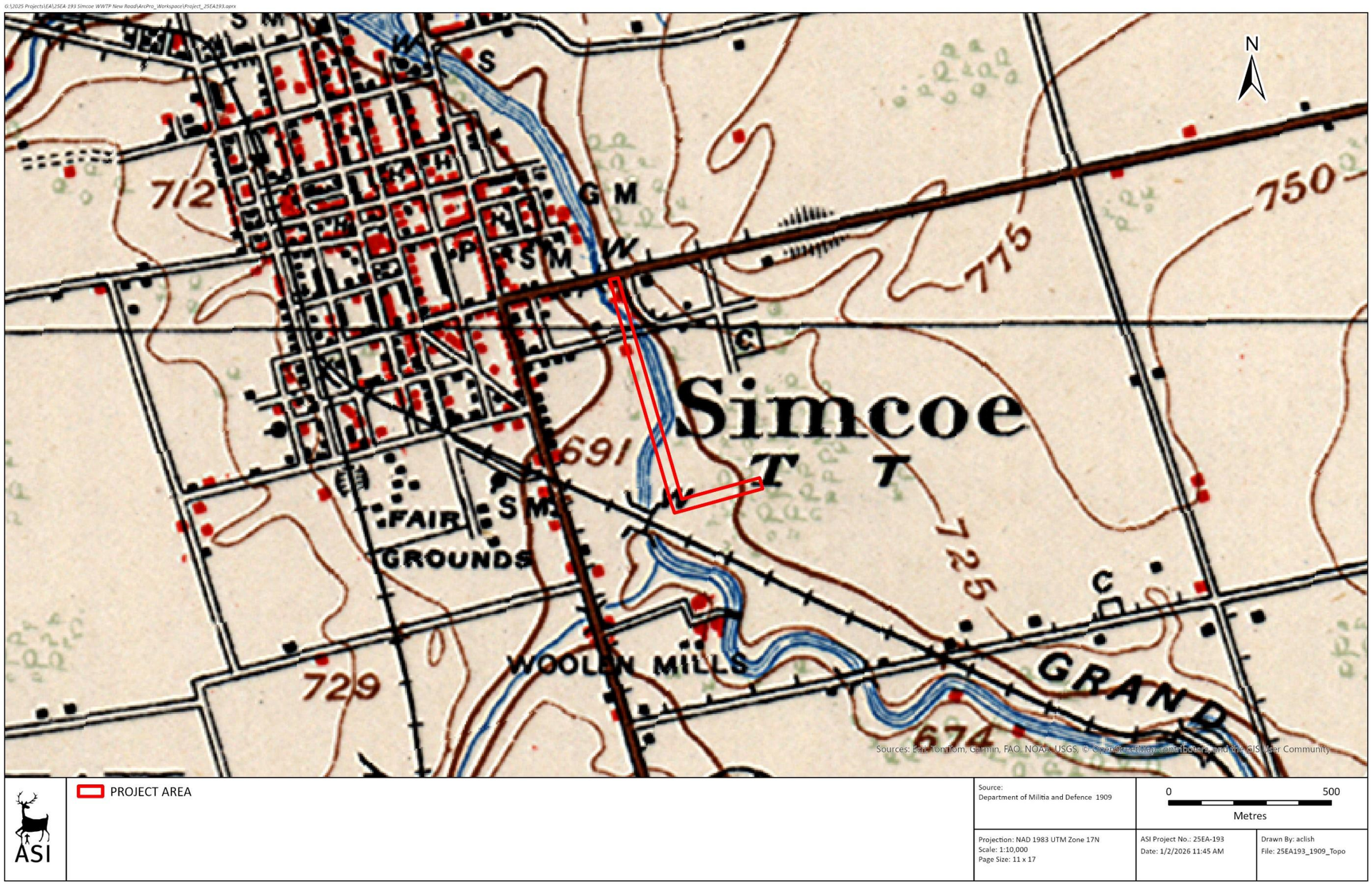


Figure 4: Project Area (Approximate Location) Overlaid on the 1939 Topographic Map Simcoe Sheet.

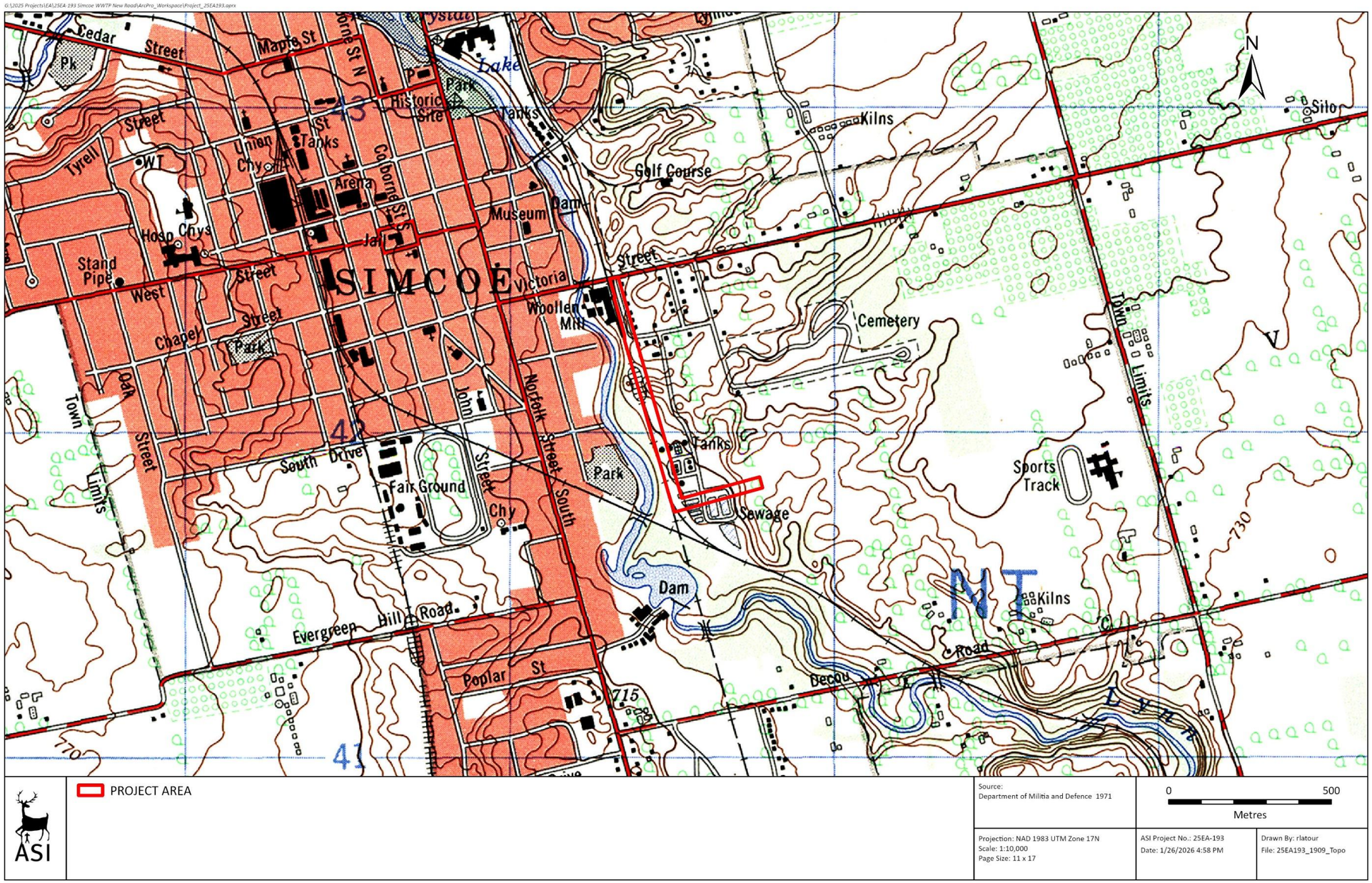


Figure 5: Project Area (Approximate Location) Overlaid on the 1971 Topographic Map Simcoe Sheet.

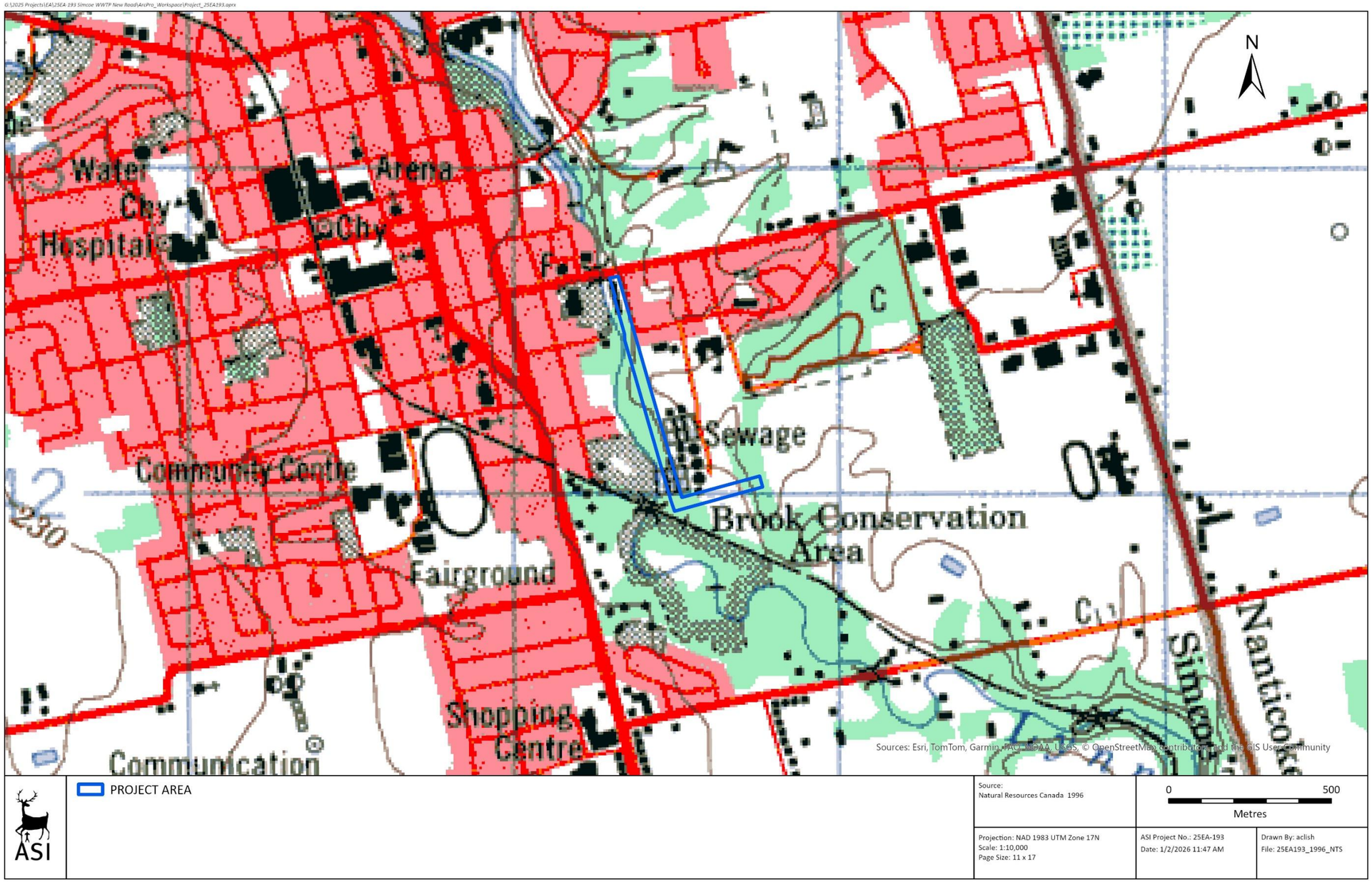


Figure 6: Project Area (Approximate Location) Overlaid on the 1996 Topographic Map Simcoe Sheet.

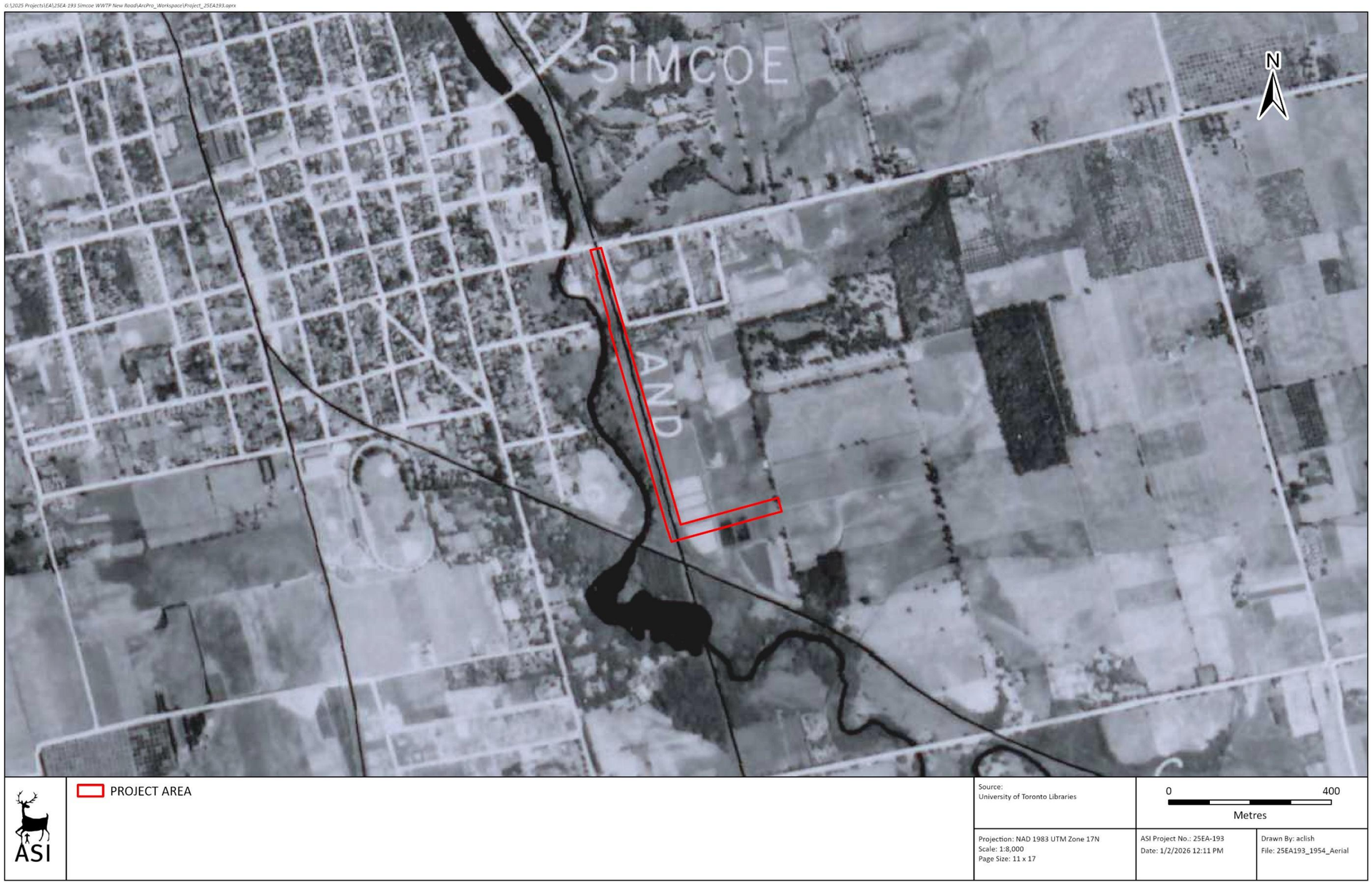


Figure 7: Project Area (Approximate Location) Overlaid on the 1954 Aerial Photograph.

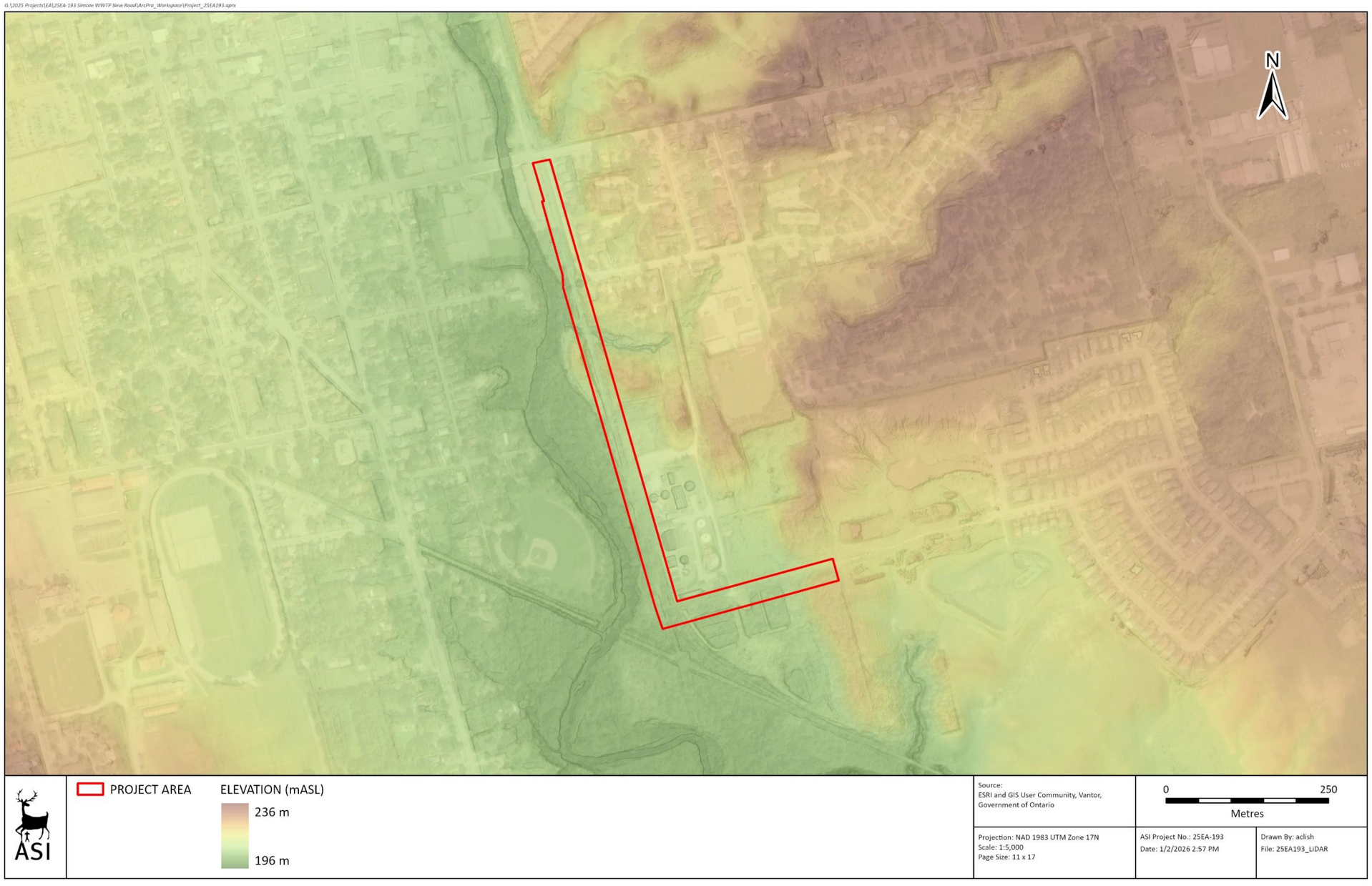


Figure 8: Project Area (Approximate Location) Overlaid on the LiDAR-Based Digital Terrain Model.

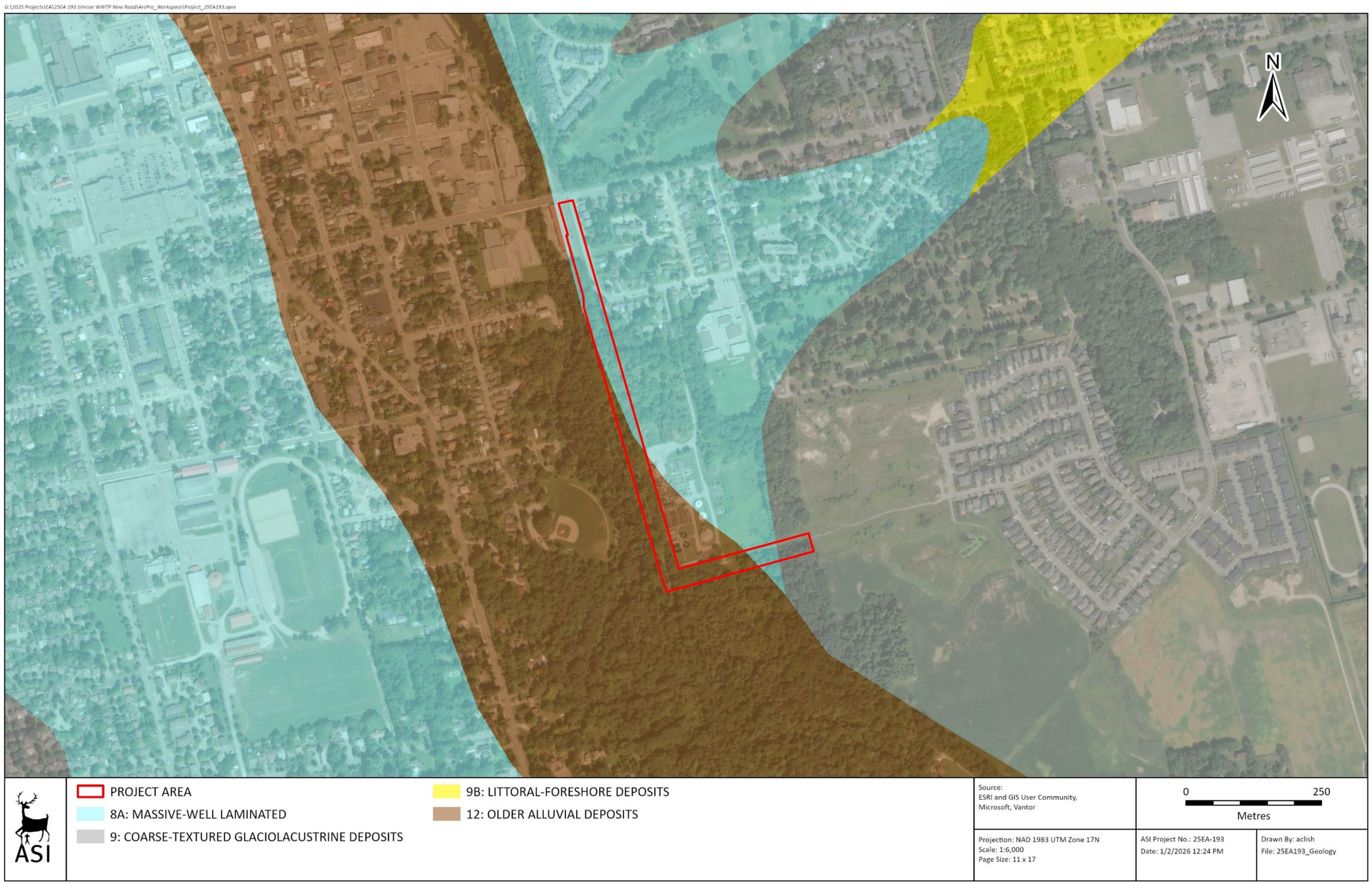


Figure 9: Project Area – Surficial Geology.



Figure 10: Results of the Stage 1 Archaeological Assessment (Sheet 1).



Figure 11: Results of the Stage 1 Archaeological Assessment (Sheet 2).



Figure 12: Results of the Stage 1 Archaeological Assessment (Sheet 3).

Appendix A: Registered Sites within One Kilometre

Table 1: Registered Sites within One Kilometre of the Project Area

Borden number	Site Name	Temporal/ Cultural Affiliation	Site type	Researcher
AeHb-90	Pott's Homestead	Euro-Canadian	Homestead	Mayer Heritage Consultants Inc. 1980
AeHb-91	Pott's 54	Pre-Contact Indigenous	Findspot	Mayer Heritage Consultants Inc. 1982
AeHb-92	Pott's 92	Pre-Contact Indigenous	Unknown	Mayer Heritage Consultants Inc. 1981
AeHb-93	Pott's 62	Pre-Contact Indigenous	Findspot	Mayer Heritage Consultants Inc. 1982
AeHb-94	Pott's 64	Pre-Contact Indigenous	Unknown	Mayer Heritage Consultants Inc. 1977

Borden number	Site Name	Temporal/ Cultural Affiliation	Site type	Researcher
AeHb-95	Pott's 65	Pre-Contact Indigenous	Unknown	Mayer Heritage Consultants Inc. 1980
AeHb-96	Pott's 69	Pre-Contact Indigenous	Unknown	Mayer Heritage Consultants Inc. 1974
AeHb-97	Pott's 75	Pre-Contact Indigenous	Unknown	Mayer Heritage Consultants Inc. 1980
AeHb-98	Pott's 77	Pre-Contact Indigenous	Unknown	Mayer Heritage Consultants Inc. 1982
AeHb-99	Pott's 36	Pre-Contact Indigenous	Findspot	Mayer Heritage Consultants Inc. 1980
AeHb-100	Pott's 98	Woodland, Late; Woodland, Middle	Unknown	Mayer Heritage Consultants Inc. 1981
AeHb-103	Pott's 102	Pre-Contact Indigenous	Findspot	Mayer Heritage Consultants Inc. 1981

Borden number	Site Name	Temporal/ Cultural Affiliation	Site type	Researcher
AeHb-104	Pott's 103	Archaic, Late	Findspot	Mayer Heritage Consultants Inc. 1981
AeHb-105	Pott's 47	Pre-Contact Indigenous	Findspot	Mayer Heritage Consultants Inc. 1981
AeHb-113	Pott's 82	Pre-Contact Indigenous	Unknown	Mayer Heritage Consultants Inc. 2008
AeHb-114	Pott's 83	Pre-Contact Indigenous	Unknown	Mayer Heritage Consultants Inc. 2008

Appendix N
MECP Response Letter

© Hatch 2026 All rights reserved, including all rights relating to the use of this document or its contents.

Andrew Grice, General Manager
Public Works, Norfolk County.

Public Works
Engineering, Gilbertson Administration Building
12 Gilbertson Drive, Simcoe, Ontario, N3Y 4N5

Mariana Balaban, Project Director
mariana.balaban@norfolkcounty.ca
519-426-5870 x8158

April 7, 2026

Kady Kaurin
Regional Environmental Planner/EA Coordinator
Project Review Unit, Environmental Assessment Branch
Ontario Ministry of the Environment, Conservation and Parks
1st Floor
135 St. Clair Avenue W
Toronto ON M4V 1P5

Subject: Response Letter: Simcoe Wastewater Treatment Plant Biosolids Management Upgrade
Norfolk County
Municipal Class Environmental Assessment - Schedule B
Project Review Unit Comments

Dear Ms Kaurin:

We would like to acknowledge receipt of the ministry's comments on the draft Project File Report for the Simcoe Wastewater Treatment Plant Biosolids Management Upgrades Class Environmental Assessment (EA) project. In response, the Project File Report has been modified, and this letter will provide a summary of how each comment has been addressed for your reference.

General

Climate Change

Ministry Comment: Section 2. *Municipal Class Environmental Assessment Process* of the PFR briefly discusses Climate Change, however more detail could be included.
Other considerations specific to climate change were not well documented in the Report. The document "Considering Climate Change in the Environmental Assessment Process" (Guide) (www.ontario.ca/page/considering-climate-change-environmental-assessment-process) is now a part of the EA program's Guides and Codes of Practice. The Guide sets out the Ministry's expectation for considering climate change in the preparation, execution and documentation of environmental assessment studies and processes. The guide provides examples, approaches, resources, and references to assist proponents with consideration of climate change in EA. The proponent should review this Guide in detail. The ministry expects proponents of Class EA projects to:

- Consider the project's expected production of greenhouse gas emissions and impacts on carbon sinks (climate change mitigation), as well as resilience or vulnerability of the undertaking to changing climatic conditions (climate change adaptation).

Public Works
Engineering, Gilbertson Administration Building
12 Gilbertson Drive, Simcoe, Ontario, N3Y 4N5

Mariana Balaban, Project Director
mariana.balaban@norfolkcounty.ca
519-426-5870 x8158

- Include a discrete section in the ESR/Report detailing how climate change was considered in the EA.

How climate change is considered can be qualitative or quantitative in nature and should be scaled to the project's level of environmental effect. In all instances, both a project's impacts on climate change (mitigation) and impacts of climate change on a project (adaptation) should be considered.

Response: *Section 3.8 has been revised from Air Quality/GHG to a discrete Climate Change Consideration section, and additional information has been included detailing how climate change was considered in the Class EA.*

Indigenous Consultation

1. ***Ministry Comment:*** The Summary provided under section *7 Public, Indigenous, and Agency Consultation Process, subsection 7.2 Indigenous Engagement* could use more detail and should provide a summary of engagement with each Nation, concerns raised and how concerns were addressed throughout the EA. Six Nations of the Grand River is referred to as Six Nations of the Grand River First Nation in the report, when in fact, there are several (6 First Nations) that comprise SNGR. The proponent should remove 'First Nation' after Six Nations of the Grand River.

   Response: *Please refer to revised Section 7.2 which includes additional details. Where concerns were raised, these have ben documented and addressed; where no concerns were raised, this is explicitly noted in the report. Six Nations of the Grand River name has been revised.*
2. ***Ministry Comment:*** For Appendix G *Engagement Tracking Log*, Indigenous communities must be separated from the general public and there must be a separate log for each community that contains all records/communication with each community. This should include all emails, meeting minutes (ex. MCFN July 28, 2025, meeting missing), phone calls, Notices (commencement, completion, PICs) in chronological order.

   Response: *Appendix G has been revised to separate the Indigenous communities, and to include the Notice of Completion and any additional communications that have taken place since the Project File Report was issued.*

Ministry Comment: All **Records** are missing and must be included. This includes all emails, phone calls, and notices sent to communities etc. These should be separated by community and in chronological order according to the community's individual tracking log. According to the information currently available, it looks as though there were only 2 points of contact with the communities, Notice of Commencement sent on June 6, 2025, and the notice for the PIC on July 28, 2025. There were a couple of additional entries for MCFN. There is no indication if the Notice of Completion was shared with the communities as the last entry was July 28, 2025.

Response: *All correspondence has been recorded in the Engagement Tracking Log. Sensitive communications between Indigenous communities and the County are confidential and should not be disclosed publicly.*

Ministry Comment: Nothing in this advice should prevent the proponent from reaching out to Indigenous communities with whom they have an established relationship or with whom they are seeking to develop a relationship to get their input/ideas associated with the projects.

Response: *Noted.*

Public Works
Engineering, Gilbertson Administration Building
12 Gilbertson Drive, Simcoe, Ontario, N3Y 4N5

Mariana Balaban, Project Director
mariana.balaban@norfolkcounty.ca
519-426-5870 x8158

Ministry Comment: This advice was based on the information provided at the time of review. As new information becomes available about how this project may impact rights, the advice provided above may also require re-evaluation.

Response: *Noted.*

Excess Materials and Waste

Ministry Comment: In December 2019, the ministry released a new regulation under the Environmental Protection Act, titled On-Site and Excess Soil Management (O. Reg. 406/19) to support improved management of excess construction soil. For more information, please visit www.ontario.ca/page/handling-excess-soil. Activities involving the management of excess soil should be completed in accordance with O. Reg. 406/19 and the ministry's current guidance document titled "Management of Excess Soil – A Guide for Best Management Practices" (2014) and "Rules for Soil Management and Excess Soil Quality Standards" (2022). All waste generated during construction must be disposed of in accordance with ministry requirements.

Response: *Please note this was included in Section 8.1.8 of the Project File Report.*

Surface Water

1. ***Ministry Comment:*** Higher volumes of sludge are expected at the Simcoe WWTP, which is proposed to be a central management facility for biosolids in Norfolk County and would receive sludge from four other WWTPs. Sludge thickening and dewatering processes for biosolid management often produce high-strength liquid streams, which are circulated back to the plant for treatment. Page 32 of the report indicates that "filtrate would be returned to the head of the Simcoe WWTP liquid treatment train". These waste streams can have an impact on the liquid train of the sewage treatment plant. The proponent is advised to refer to MECP's Design Guidelines for Sewage Works (2008), Chapter 17 Sludge thickening and dewatering | Design Guidelines For Sewage Works | ontario.ca, which states that "recycle streams (i.e., centrate and filtrate) need to be carefully considered and their impact on the liquid train of the sewage treatment plant (STP) accounted for". Has there been an assessment conducted to determine whether specific measures are needed to manage these streams, for instance equalization? Is the plant considering treatment to minimize nutrient spikes from biosolids processing? Detailed design considerations would be subject to a review by Environmental Permissions Branch during a review of the ECA application, including whether the assessment and proposed measures, as applicable, are appropriate.

   Response: *The proposed biosolids management strategy will impact internal recycle stream volumes and loadings. The impact of internal recycle streams on sludge generation rates in the Simcoe WWTP's liquid treatment train was assessed for various biosolids management options in the Hatch / Blue Sky Energy Engineering & Consulting Inc. (Blue Sky) Options Analysis Technical Memorandum finalized in 2019. For the 2025 Class EA, conservative sludge generation rates were assumed that would account for increased internal recycle loadings and uncertainty with respect to future industrial loadings in the service area. The Evaluation of Sludge Processing and Biosolids Storage Options Technical Memorandum dated November 18, 2024, which forms the basis of the 2025 Class EA, has been provided along with this letter. The County completed a Facility Optimization Study to assess the capacity and upgrade needs of the liquid treatment train.*

Public Works
Engineering, Gilbertson Administration Building
12 Gilbertson Drive, Simcoe, Ontario, N3Y 4N5

Mariana Balaban, Project Director
mariana.balaban@norfolkcounty.ca
519-426-5870 x8158

The County is planning to continue this analysis and will be incorporating the potential impact of the preferred biosolids strategy's internal recycle streams on the liquid treatment train in a separate project. Details will be provided to the Ministry when the ECA application is submitted. The Project File has been updated to add this information in Section 3.6.

2. ***Ministry Comment:*** The report states in Section 3.6 *Groundwater and Surface Water Protection* on page 23 that "Simcoe WWTP's proximity to the Lynn River poses additional concerns, especially related to phosphorus loadings". This statement needs to be clarified in the context of the proposed work to be undertaken under this Class EA. The potential for increased contaminant loading in the main waste stream as a result of the preferred biosolids management strategy needs to be assessed and characterized (as per comment 1 above). More specifically:
    a. ECA No. 5789-BDHNWH for the Simcoe WWTP states that the Total Phosphorus (TP) effluent concentration limit (0.45 mg/L) and loading limit (6.93 kg/day) are interim values only and were required to be re-assessed using the results of the monitoring plan required in Condition 44 / 45 – Receiver Surface Water Monitoring. A final report with a proposed final TP effluent limit was to be submitted to the Ministry by June 2021. This report should be submitted to the Ministry's Technical Support Section for review and acceptance prior to submission of an ECA amendment application for biosolids management.

    Response: *Hatch and Blue Sky prepared a report titled "Final Report – Simcoe WWTF – Engineering Assessment: Options to Optimize Phosphorous Removal" dated February 21, 2018. Subsequently a report titled "Final Report – Addressing ECA Special Condition Related to Receiver Monitoring and Phosphorus – Simcoe WWTP" dated July 13, 2023 was prepared that proposed amendments to the ECA effluent TP targets. The conclusions of this report were:*

    - Maintaining the current monthly average TP concentration objective (0.15 mg/L), concentration limit (0.45 mg/L), and loading limit (6.93 kg/d)

    - Defining new annual average TP targets, namely concentration limit (0.30 mg/L) and loading limit (4.62 kg/d)

    The 2018 Technical Memorandum (Feb 21, 2018) and subsequent 2023 report provide detailed assessments of TP removal, confirm ongoing compliance with interim ECA limits, and include recommendations to optimize phosphorus control and monitor effluent, addressing the Ministry's concerns regarding potential impacts of the proposed biosolids management strategy. Norfolk County submitted these reports to the Ministry as part of an ECA Amendment Request (Reference Number 3294-D9EKPF), which was acknowledged in the October 7, 2024 letter.

Public Works
Engineering, Gilbertson Administration Building
12 Gilbertson Drive, Simcoe, Ontario, N3Y 4N5

Mariana Balaban, Project Director
mariana.balaban@norfolkcounty.ca
519-426-5870 x8158

b. ***Ministry Comment:*** Did the environmental impact assessment for the proposed project consider the interim or final TP effluent limit (0.30 mg/L as per Condition 45) for the Simcoe WWTP?
Response: *Please refer to the previous reply. The design basis for the proposed project considered the final TP effluent limit of 0.30 mg/L (Condition 45) for the Simcoe WWTP. This is documented in the 2018 Technical Memorandum (Feb 21, 2018) and associated mass balance calculations, which evaluated historical performance, optimized ferrous chloride dosing, and assessed operational changes necessary to achieve the final effluent limit. These studies were completed and submitted to the MECP as part of the design documentation.*

c. ***Ministry Comment:*** The plant is currently operating at 50% of its rated design capacity and has experienced challenges with meeting its TP objectives in recent years. For example, in 2024, eleven objective exceedances were reported. Will the proposed biosolids management strategy put increased pressure on the plant and impact its ability to meet the final TP effluent limit?
Response: *The proposed biosolids management facility will not increase the TP final effluent. In addition to the biosolid management facility, a major upgrade project will be undertaken by the County to optimize and upgrade the entire liquid treatment train from headworks and septage receiving to the disinfection. The biological treatment will be upgraded from conventional aeration to advanced nutrient removal process. In the 2023 report cited above, it was noted that the biggest impacts on effluent TP concentrations were due to the use of single-point ferrous addition (vs. dual point), periods of poor mixed liquor settleability, and operational issues (e.g. plugging of ferrous dosing lines). A dual-point ferrous chloride addition was implemented as a result of the 2023 recommendations. Equalization will be added as part of the liquid train upgrades project.*

Ministry Comment: The EA report should be revised to discuss and address these concerns. This may require additional studies and engineering assessments, which would be subject to review by the Ministry.
Response: *Please refer to revised Section 3.6 of the Project File Report. The Ministry will be informed with regards to the future liquid train optimization project. The rated capacity is sufficient for long-term growth, therefore no change in the rated capacity is required.*

3. ***Ministry Comment:*** The report does not discuss the potential impacts to surface water resources associated with the proposed project, including both construction activities and biosolid management at the site. On page 23, the report identified that “preconstruction baseline water quality monitoring is critical since surface waters could be temporarily affected by construction or sludge handling”. A potential impact to surface water was identified with respect to construction and sludge handling at the site but no management or mitigation strategies were discussed or proposed.
    a. The specific concerns identified on page 23 with respect to sludge handling and biosolid management at the site need to be evaluated, and mitigation and contingency measures discussed and proposed. For example, how will biosolids storage, transfer and processing areas be managed to prevent leachate or runoff from discharging to the

Public Works
Engineering, Gilbertson Administration Building
12 Gilbertson Drive, Simcoe, Ontario, N3Y 4N5

Mariana Balaban, Project Director
mariana.balaban@norfolkcounty.ca
519-426-5870 x8158

environment? The report did not discuss whether the proposed strategy for biosolids storage, handling and processing activities have the potential to generate contact stormwater at the site.

b. Please see comments 6 and 7 with respect to the assessment of potential temporary impacts to surface water quality associated with construction activities.

Response: *The potential impacts to surface water associated with biosolids storage, transfer, and processing, as well as construction activities, will be further evaluated during the detail design. Mitigation and contingency measures to prevent leachate or runoff from discharging to the environment will be confirmed and incorporated into the design drawings and technical specifications.*

4. ***Ministry Comment:*** The report does not provide any information on the scope of or commitments with respect to the recommended baseline water quality monitoring (page 23).
   Response: *Please refer to Sections 8.1 and 8.2 of the Project File Report.*
5. ***Ministry Comment:*** Site alteration for development can have an impact on the natural environment and increased stormwater runoff from new impervious areas can impact receiving watercourses due to flooding, erosion and turbidity. The report should clearly outline potential impacts and mitigation commitments with respect to this. More specifically, the management of stormwater at the site should be assessed. Quality and quantity control measures to treat stormwater runoff should be considered for all new impervious areas and, where possible, existing surfaces. A Stormwater Management Plan should be prepared, and the Ministry's Stormwater Management Planning and Design Manual (2003) should be utilized when designing stormwater control methods. Pre-submission consultation with the Ministry may be required and the proponent is encouraged to discuss approval requirements during preliminary design with the Environmental Permissions Branch, Local District Office, and Technical Support Section, if required.
   Response: *Please refer to Section 3.6 of the Project File Report for our commitment to prepare a Stormwater Management Plan for this site. The Ministry's Stormwater Management Planning and Design Manual (2003) will be referenced when designing stormwater control methods.*
6. ***Ministry Comment:*** An erosion and sediment control plan should be developed and implemented prior to construction activities to prevent and mitigate any potential impact to surface water resources in the study area during construction activities. Best management practices and guidelines, including MECP's B-6 guideline or more recent local guidelines, should be followed to ensure protection of water resources.
   Response: *Section 8.1.7 includes a commitment to develop an erosion and sediment control plan prior to construction, however updated to add MECP's and any other local guidelines.*
7. ***Ministry Comment:*** The hydrogeological investigation report states that it is anticipated that discharge of ground water from dewatering would be directed to the sanitary sewer, given the proximity of the site to sanitary servicing. Elevated metals, suspended solids, and high total coliform concentrations in BH7a (laboratory report notes no data due to sample over-crowding microbial growth) and BH7b (13,000 CFU/100 mL) were present in groundwater sampling conducted by Terraprobe in 2017. If changes to the discharge plan are considered during detailed design and a discharge to the natural environment is considered, the potential impacts to surface

Public Works
Engineering, Gilbertson Administration Building
12 Gilbertson Drive, Simcoe, Ontario, N3Y 4N5

Mariana Balaban, Project Director
mariana.balaban@norfolkcounty.ca
519-426-5870 x8158

water quality and quantity need to be considered and assessed. The proponent is advised to refer to Water taking guidance for Environmental Activity and Sector Registry | ontario.ca with respect to regulatory and registration requirements for construction dewatering water takings, which came into effect July 1st, 2025. Please note that requirements govern the water taking activity as well as the discharge of the dewatering effluent and the effects on groundwater and surface water features, in terms of water quantity and water quality are required to be assessed and mitigated.
Response: *Noted, the discharge plans will be reviewed against current regulatory requirements and revised as necessary prior to construction. This commitment has been added to Section 3.6 of the Project File Report.*

Groundwater
Water Taking

1. ***Ministry Comment:*** Terraprobe indicated that a Permit to Take Water (PTTW) would be required for the proposed construction dewatering. However, as of July 1, 2025, all construction dewatering activities exceeding must be registered on the Environmental Activity and Sector Registry (EASR). The proponent is referred to the following website link for information on the technical requirements for EASR registry for the proposed construction dewatering activities: Environmental Activity and Sector Registry | ontario.ca
   Response: *Permit to Take Water has been added to Section 9 – Approvals and Permits of the Project File Report.*
2. ***Ministry Comment:*** A hydrogeological investigation report dated January18, 2018, prepared by Terraprobe Inc., was appended to the PFR. The assessment evaluated potential impacts to groundwater resources associated with dewatering required for construction of the headworks facility, biosolids holding tank, and sanitary sewer. Predicted dewatering rates were estimated at a maximum of 2,114m³/day, with groundwater levels potentially lowered by up to 8.5 metres to facilitate construction. The estimated radius of influence ranged from 74.5 to 336 metres. No potable water wells were identified in the vicinity, and the site is serviced by municipal water and wastewater systems. No potential local sources of groundwater contamination were identified, and the consultant did not anticipate quantity or quality impacts on groundwater resources. The predictive calculations assumed the use of sheet piling to limit lateral groundwater inflow. Section 3.7 of the PFR notes that updated geotechnical and hydrogeological assessments will be required prior to construction to confirm soil conditions and dewatering requirements. Under EASR requirements, registrants must submit a water taking report prepared by a qualified person(s). The water taking report must include a contingency plan to address the potential impact of the proposed water taking on other water users.
   Response: *Noted – Section 3.7 of the Project File Report has been revised to include this commitment. The existing geotechnical (2017) and hydrogeological (2018) reports provide the basis for design and dewatering planning. Prior to construction, these reports will need be reviewed and verified to confirm that soil conditions, groundwater levels, and dewatering requirements remain accurate. Any updates or supplemental assessments will be completed if required to support design decisions, ensure excavation stability, and satisfy the regulatory requirements, including contingency measures to protect other water users.*

Public Works
Engineering, Gilbertson Administration Building
12 Gilbertson Drive, Simcoe, Ontario, N3Y 4N5

Mariana Balaban, Project Director
mariana.balaban@norfolkcounty.ca
519-426-5870 x8158

3. ***Ministry Comment:*** Terraprobe noted that if permanent drainage is required for the structure footings, a separate long-term PTTW may be required. Should a long-term PTTW be required for site operations, the proponent should refer to the requirements set forth in the Ministry's PTTW guidance Permits to take water | ontario.ca; Guide to Permit to Take Water application | ontario.ca; Technical guidance document for hydrogeological studies in support of category 3 applications | ontario.ca. These documents outline the technical and submission requirements for long-term water-taking activities.
   Response: *Section 3.7 of the Project File Report has been revised to include this commitment.*

Biosolids Management Upgrades

4. ***Ministry Comment:*** The submission does not clearly address the potential risks to the natural environment associated with the proposed biosolids management activities. The report did not provide information on whether the storage or handling of biosolids at the site could result in contact with precipitation, stormwater, or groundwater. It also did not clarify whether underground storage of septage, raw sewage, or leachate is proposed. Additionally, no details were provided regarding spill containment, mitigation measures, or contingency plans to prevent the release of liquid biomass to the natural environment. While some of these risks may be further addressed during the engineering design phase, the proponent is directed to the Ministry's *Guide to Applying for an Environmental Compliance Approval* for requirements related to assessing risks to the natural environment, including supporting documentation and technical requirements (PartC) (https://www.ontario.ca/document/guide-applying-environmental-compliance-approval- 0).
   Response: *Noted – spill containment, storage and handling of biosolids measures were taken into consideration at the technology selection stage (TM attached) and will further be detailed during the design phase and included in the technical specifications and drawings. The Environmental Compliance Approval application will provide the required details.*
5. Please note there was no number 5 in comment letter.

Ministry Comment: It is unclear whether the proposed WWTP upgrades will require a Renewable Energy Approval (REA). If a REA is determined to be necessary, the proponent should consult the Ministry's Technical Guide to Renewable Energy Approvals. Section7 of Chapter 9 outlines the requirements for submitting a Hydrogeological Assessment Report. Technical Guide to Renewable Energy Approvals | ontario.ca.

Response: *A Renewable Energy Approval (REA) is not required. A hydrogeological report has been prepared to inform the previous design with respect to excavation and water taking. The project is an undertaking falling under the Nutrient Management Act and a copy of the hydrogeological report is attached to the Project File Report.*

Species at Risk

Ministry Comment: If activities are planned that could impact species at risk or their habitat, the proponent would need to determine if an ESA authorization is required before the activities are undertaken.

Please visit "How to avoid authorization" and "Permit types" (https://www.ontario.ca/page/how-get-endangered-species-act-permit-or-authorization) for more information.

Ministry SAR staff were not able to complete a review of this PFR in time.

Andrew Grice, General Manager
Public Works, Norfolk County.

Public Works
Engineering, Gilbertson Administration Building
12 Gilbertson Drive, Simcoe, Ontario, N3Y 4N5

Mariana Balaban, Project Director
mariana.balaban@norfolkcounty.ca
519-426-5870 x8158

Response: *Noted. No species at risk were identified within the proposed construction footprint. Therefore, an ESA authorization is not required. Standard avoidance measures, including scheduling vegetation clearing outside of wildlife avoidance periods (April 1 to September 30 for bats, March 31 to October 1 for birds), will be implemented as outlined in Section 8.1.1 of the Project File Report. Coordination with the MECP will be completed as required.*

If you require further clarifications, please do not hesitate to contact me.

Yours faithfully,

Paolo Oddi, C. Tech
Project Manager
Water and Wastewater Capital Construction, Public Works

cc: Marco Mazzuca, Supervisor, Environmental Assessment Services, MECP
Mariana Balaban, P.Eng., Ph.D., Norfolk County
Shaun Earls, C. Tech, Norfolk County
Stephanie Davis, C. Tech, Norfolk County
Oya Koç, P.Eng., Hatch
Mark Armstrong, M.E.Sc., P.Eng., PMP, Hatch
Samantha Fraser, Hatch

Norfolk County
Simcoe Wastewater Treatment Facility

Evaluation of Sludge Processing and Biosolids Storage Options

Technical Memorandum

This document has been prepared for the titled project or named part thereof and should not be relied upon or used for any other project without an independent check being carried out as to its suitability and prior written authorization of Hatch Ltd. being obtained. Hatch Ltd. accepts no responsibility or liability for the consequence of this document being used for a purpose other than the purposes for which it was commissioned. Any person using or relying on the document for such other purpose agrees, and will by such use or reliance be taken to confirm their agreement to indemnify Hatch Ltd. for all loss or damage resulting therefrom. Hatch Ltd. accepts no responsibility or liability for this document to any party other than the person by whom it was commissioned.

To the extent that this report is based on information supplied by other parties, Hatch Ltd. accepts no liability for any loss or damage suffered by the client, whether through contract or tort, stemming from any conclusions based on data supplied by parties other than Hatch Ltd. and used by Hatch Ltd. in preparing this report.

2024-11-18	C	Final	S. Fraser / C. Sosa-Miranda	M. Reza/ M. Johnson/ R. Goel	O. Koc
2024-09-17	B	Draft for Client Review	S. Fraser	M. Reza/ M. Johnson	O. Koc
2024-09-11	A	Draft for Internal Review	S. Fraser	M. Reza/ M. Johnson	O. Koc
Date	**Rev.**	**Status**	**Prepared By**	**Checked By**	**Approved By**
HATCH					

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

Table of Contents

1. Executive Summary 1

2. Introduction 3

2.1 Background 3
2.2 Purpose of this Technical Memorandum 4
2.3 Data Sources 5

3. Future Flow and Loading Projections 6

3.1 Existing Population and Projected Growth 6
3.2 Flows and Loadings Projection 6
3.2.1 Simcoe WWTF 7
3.2.2 Delhi WWTP 9
3.2.3 Port Rowan WWTP 10
3.2.4 Waterford WPCP 11
3.2.5 Port Dover WWTP 12
3.3 Projected Sludge and Biosolids Generation Rates 14

4. Conventional Sludge Digestion and Biosolids Storage Options 15

4.1 Option 1(a) – Centralized Anaerobic Digestion and Biosolids Storage without Biosolids Thickening at Simcoe WWTF 16
4.1.1 Option 1(a) – 2051 Population Growth 16
4.1.2 Option 1(a) – 2051 Rated Capacity 17
4.2 Option 1(b) – Centralized Anaerobic Digestion and Biosolids Storage with Thickening at Simcoe WWTF 19
4.2.1 Option 1(b) – 2051 Population Growth 19
4.2.2 Option 1(b) – 2051 Rated Capacity 21
4.3 Option 1(c) – Centralized Anaerobic Digestion at Simcoe WWTF with WAS Thickening for Simcoe and Waterford at Simcoe WWTF, Co-thickened sludge from other facilities 22
4.3.1 Option 1(c) – 2051 Population Growth 23
4.3.2 Option 1(c) – 2051 Rated Capacity 25
4.4 Option 1(d) – Anaerobic Digestion with WAS Thickening at Simcoe WWTF and WAS Thickening at all other facilities prior to hauling 26
4.4.1 Option 1(d) – 2051 Population Growth 27
4.4.2 Option 1(d) – 2051 Rated Capacity 29

5. Review and Evaluation of Options 1(a) to 1(d) 31

5.1 Capital and Operational Costs 31
5.2 Footprint and Land Requirements 32
5.3 Recommended Option 1 Alternative 32

6. Option 2 – Centralized THP Stabilization and Biosolids Storage at Simcoe WWTF 33

6.1 Option 2 – 2051 Population Growth 33
6.2 Option 2 – 2051 Rated Capacity 35
6.3 Option 2 – Capital and Operational Cost 36

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

7. Evaluation of Sludge Processing and Biosolids Storage for Short-listed Options (Option 1b and 2) 37

7.1 Life Cycle Costs Comparison 37
7.2 Evaluation Methodology 37
7.3 Greenhouse Gas Emissions 47
7.3.1 Basis of Calculations 47
7.3.2 GHG Emissions 50

8. Recommended Design Option 53

9. Implementation Schedule and Budget Forecast 54

10. References 55

List of Tables

Table 3.1: Current and Projected Population Growth - Norfolk County's Urban Areas 6
Table 3.2: Design Assumptions for each Facility 6
Table 3.3: Simcoe WWTF Flow and Loading Projections 8
Table 3.4: Delhi WWTP Flow and Loading Projections 9
Table 3.5: Port Rowan WWTP Flow and Loading Projection 10
Table 3.6: Waterford WPCP Flow and Loading Projections 12
Table 3.7: Port Dover WWTP Flow and Loading Projections 13
Table 3.8: Sludge Requiring Digestion at Simcoe WWTF 14
Table 4.1: Option 1(a) – Key Design Values to 2051 Population Growth 17
Table 4.2: Option 1(a) – Key Design Values to 2051 Rated Capacity 18
Table 4.3: Option 1(b) – Key Design Values to 2051 Population Growth 20
Table 4.4: Option 1(b) – Key Design Values to 2051 Rated Capacity 22
Table 4.5: Option 1(c) – Key Design Values to 2051 Population Growth 24
Table 4.6: Option 1(c) – Key Design Values to 2051 Rated Capacity 26
Table 4.7: Option 1(d) – Key Design Values to 2051 Population Growth 28
Table 4.8: Option 1(d) – Key Design Values to 2051 Rated Capacity 30
Table 5.1: Cost Summary of Options 1(a) to 1(d) 32
Table 5.2: Summary of Options 1(a) to 1(d) 32
Table 6.1: Option 2 – Key Design Values to Projected 2051 Population Growth 34
Table 6.2: Option 2 – Key Design Values to 2051 Rated Capacity 36
Table 6.3: Cost Summary of Option 2 36
Table 7.1: Life Cycle Cost Analysis 37
Table 7.2: Evaluation Criteria 39
Table 7.3: Evaluation of Options 42
Table 7.4: Summary of Evaluation of Options 45
Table 7.5: Ranking of Options Based on Evaluation Scores 47
Table 7.6: Emissions and Credit Factors used in the GHG Analysis of Biosolids Management Options 47
Table 7.7: 2051 Projected Annual GHG Emissions for Option 1B and Option 2. 51
Table 7.8: Parameters used for BEAM Calculator 51
Table 9.1: Tentative Project Milestone Schedule 54

List of Figures

Figure 2.1: Aerial Photo of the Simcoe WWTF 3
Figure 4.1: Option 1(a) – 2051 Population Growth – Process Flow Schematic 17
Figure 4.2: Option 1(a) – 2051 Rated Capacity – Process Flow Schematic 18

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

Figure 4.3: Option 1(b) – 2051 Population Growth – Process Flow Schematic 20
Figure 4.4: Option 1(b) – 2051 Rated Capacity – Process Flow Schematic 21
Figure 4.5: Option 1(c) – 2051 Population Growth – Process Flow Schematic 24
Figure 4.6: Option 1(c) – 2051 Rated Capacity – Process Flow Schematic 25
Figure 4.7: Option 1(d) – 2051 Population Growth – Process Flow Schematic 28
Figure 4.8: Option 1(d) – 2051 Rated Capacity – Process Flow Schematic 29
Figure 6.1: Option 2 – 2051 Population Growth – Process Flow Schematic 34
Figure 6.2: Option 2 – 2051 Rated Capacity – Process Flow Schematic 35

List of Appendices

Appendix A **Proposal for Lystek THP, LysteMize Digestion, and LysteGro Fertilizer Program**
Appendix B **Design Calculation Summaries**
Appendix C **Conceptual Level Site Layouts**
Appendix D **Capital Costs – Option 1b and Option 2**
Appendix E **Detailed Breakdown of Projected GHG Emissions by Hatch**

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

1. Executive Summary

The Simcoe Wastewater Treatment Facility (WWTF), along with the Waterford Water Pollution Control Plant (WPCP), Port Dover Wastewater Treatment Plant (WWTP), Port Rowan WWTP and Delhi WWTP, provide wastewater treatment services to the residents of Norfolk County (County).

The purpose of this Technical Memorandum (TM) is to evaluate various sludge digestion and biosolids storage options considering Simcoe WWTF as a centre for sludge digestion and biosolids storage for the County. Options proposed in this study use historical data from 2019 to 2023 with projected sludge and biosolids generation rates to the design year of 2051. As part of this evaluation, five different alternatives were considered, including four conventional anaerobic digestion alternatives and one alternative using thermo-chemical hydrolysis process (THP) developed and supplied by Lystek International. Each alternative was evaluated based on two future growth scenarios, including projected 2051 population growth and projected 2051 Environmental Compliance Approval (ECA) rated capacities for all five facilities.

Based on a multi-criteria analysis and a cost comparison between reviewed options, the THP alternative for stabilization and biosolids storage has been recommended. This recommendation considers several important factors including:

- Environmental Impact: The process minimizes the risk of nutrient runoff, contributing to better environmental outcomes.
- Social Benefits: THP process converts waste into valuable products like fertilizers. The product is regulated under the Nutrient Management Act (NMA) in Ontario to ensure environmental protection and sustainable agricultural practices.
- Economic Efficiency: The process can be cost-effective by reducing disposal costs and creating marketable products, which can generate revenue.
- Technical Viability: THP is a reliable and efficient process making it a technically sound choice.

The main benefits of the proposed solution include:

1. Class A Biosolids as compared to Class B, digestors only.
2. Reduced storage volume and overall facility footprint.
3. Better quality fertilizer
4. Biogas reuse for THP and plant processes.
5. Compact and flexible operations.
6. Cost Effectiveness.

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

Due to the modular nature of the THP system, the project can be implemented in a phased approach, allowing the County to reduce up-front capital costs and expand treatment capacity when required in the future.

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

2. Introduction

2.1 Background

The Simcoe WWTF is a conventional activated sludge (CAS) system with tertiary treatment for phosphorus removal, and has an ECA rated capacity of 15,400 m^3/d. The preliminary treated wastewater is further treated between two plants, each equipped with primary clarifiers, bioreactors and secondary clarifiers, with capacities as follows: Plant 1 was constructed in 1953 with a rated capacity of 2,671 m^3/d; and Plant 2 was constructed in 1979 with a rated capacity of 12,729 m^3/d. Both treatment plants discharge effluent to a common tertiary filtration (disc filters) facility and chlorination facilities prior to discharge to the Lynn River.

The Simcoe WWTF has three cylindrical concrete digesters, one primary digester and two secondary digesters. These digesters were built as part of the original plant construction. Combined raw sludge and waste activated sludge (WAS) are co-thickened in the primary clarifiers. This combined sludge is directed to a primary anaerobic digester, with an effective volume of 2,507 m^3, and digested biosolids are stored in two secondary digesters with total storage volume of 2,437 m^3. Figure 2.1 shows an aerial map of the Simcoe WWTF and surrounding residential land use.

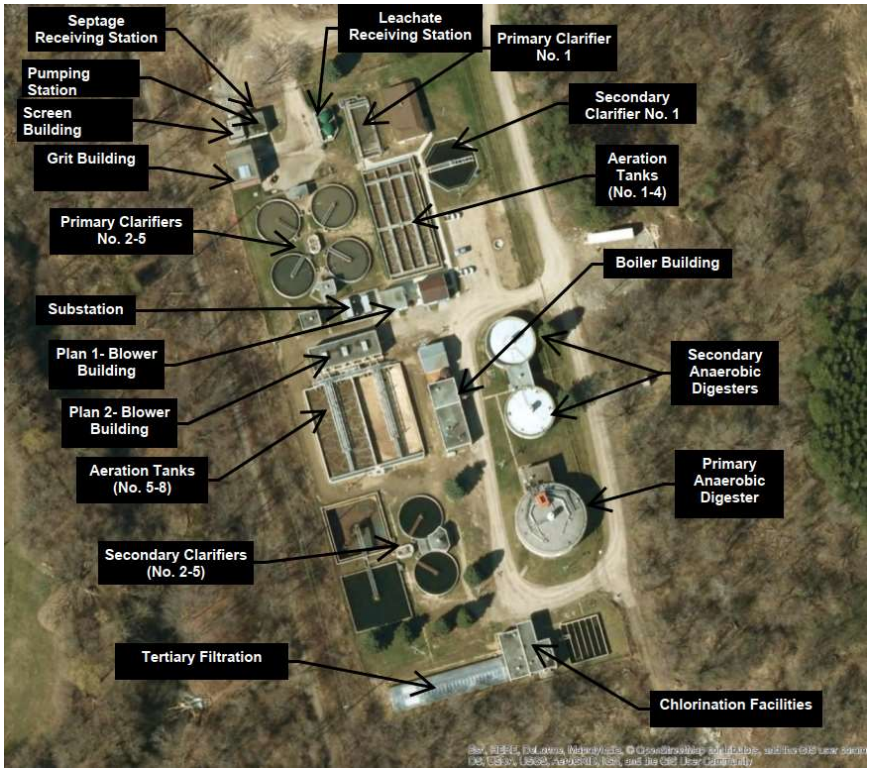


Figure 2.1: Aerial Photo of the Simcoe WWTF

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

The Norfolk County Integrated Sustainable Master Plan (ISMP), finalized in September 2016, identified upgrades to the Simcoe WWTP's solids handling processes, including utilizing biosolids storage tanks at the Simcoe WWTF to store biosolids from the Port Dover and Port Rowan WWTFs based on a planning horizon year of 2041. Subsequently, Hatch designed and tendered a Biosolids Handling Facility as part of the plant wide upgrade project in November 2022. The facility was designed to include sludge and leachate receiving building, two primary digesters and two biosolids storage tanks with space reserved for future thickening facility. The Construction contract was not awarded, due to funding issues.

The County has initiated a new phase of the project in spring of 2024 which focuses on design and construction of a new sludge and biosolids handling facility along with additional miscellaneous upgrades at the plant. Prior to initiating the design of upgrades, an options analysis has been completed to confirm the preferred upgrades to the solids treatment system considering sludge treatment and storage requirements to accommodate sludge from all the County's WWTPs.

2.2 Purpose of this Technical Memorandum

The purpose of this Technical Memorandum (TM) is to analyze various options and to confirm the treatment process design required to service population in the Norfolk County's service areas and to evaluate the preferred upgrades to the solids treatment system at the Simcoe WWTF. The two main solids treatment processes identified for the analysis and comparative evaluation include anaerobic digestion process (with and without WAS thickening) and thermo-chemical hydrolysis process (THP).

Anerobic digestion process is currently being used at the Simcoe WWTF. The THP process is a more advanced process in which the sludge is hydrolyzed in the presence of high temperature, low pressure steam, alkalinity and high-speed shearing which transforms sludge into a homogenized and more readily digestible sludge. THP process can be implemented in conjunction with anaerobic digestion producing Class A biosolids.

The following tasks were completed as part of this study and presented in this Technical Memorandum (TM):

- Developing a design basis that defines projected sludge sources, quality, flows and loadings to the design year of 2051. Two sets of design values for the 2051 design year were developed: based on the projected service population in 2051 for each facility, using the County's planning and growth projections (referred to as the 2051 Population Design Basis); and, based on the anticipated ECA rated average day flow (ADF) capacity of each facility according to the County's plan for future upgrades and expansions to each facility (referred to as the 2051 ECA Rated Capacity Design Basis).
- A comprehensive review and evaluation of process technologies to expand solids treatment train capacities at Simcoe WWTF. The review included development of conceptual level capital, O&M and life cycle cost estimates as well as conceptual site layouts and footprint requirements for each alternative to meet treatment needs

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

associated with both the 2051 Population Design Basis and the 2051 ECA Rated Capacity Basis.

- Identified recommended upgrade options for the Simcoe WWTF solids treatment using an evaluation framework that incorporates environmental, social, economic and technical indicators.
- A conceptual implementation plan for the recommended upgrades at Simcoe WWTF has been proposed, including high level schedule and capital cost estimates.

2.3 Data Sources

The County provided a number of documents and data files for review and analysis of the five (5) wastewater treatment facilities including Simcoe WWTF, Port Dover WWTP, Port Rowan WWTP, Delhi WWTP and Waterford WPCP. The following data sources were used for the purposes of developing this TM:

- Daily operating data for the Simcoe WWTF, Port Rowan WWTP, Port Dover WWTP, Delhi WWTP and Waterford WPCP over the period 2019 to 2023;
- Sludge haulage volume records for the Port Dover WWTP, Port Rowan WWTP, Delhi WWTP and Simcoe WWTF over the period 2021 to 2023.
- Monthly septage and leachate volumes for Port Dover WWTP, Port Rowan WWTP, and Simcoe WWTF over the period of 2019 to 2024, and forecasted 2051 septage and leachate volumes for Port Dover, Port Rowan, and Simcoe WWTPs.
- Annual reports over the period 2019 to 2023 for the Simcoe WWTF, Port Rowan WWTP, Port Dover WWTP, Delhi WWTP and Waterford WPCP;
- Amended Environmental Compliance Approval (ECA) No. 5789-BDHNWH dated October 10, 2019, for the Simcoe WWTF;
- Amended ECA No. 7612-9XMJ26 dated July 13, 2015, for the Port Rowan WWTP;
- Amended ECA No. 7884-C94HQT dated January 14, 2022, for the Port Dover WWTP;
- Amended ECA No. 5168-AHCJ3G dated March 17, 2017, for the Delhi WWTP;
- Amended ECA No. 7520-C7ZM73 dated November 19, 2021, for the Waterford WPCP;
- Norfolk County Service Monitoring Report – Water and Wastewater dated March 19, 2024; and
- Simcoe WWTP – Evaluation of Sludge Digestion and Biosolids Storage Options (Hatch Ltd. and Blue Sky Energy Engineering & Consulting Inc., 2019).

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

3. Future Flow and Loading Projections

3.1 Existing Population and Projected Growth

The Simcoe, Port Dover, Delhi, Waterford and Port Rowan wastewater treatment facilities currently provide wastewater treatment services to approximately 36,414 residents across Norfolk County. Table 3.1 presents the County's current service population and population growth estimates to the year 2051.

Table 3.1: Current and Projected Population Growth - Norfolk County's Urban Areas

Facility/ Servicing Population	Simcoe WWTF	Port Rowan WWTP	Delhi WWTP	Port Dover WWTP	Waterford WPCP	Total Service Population
Current Service Population	16,182	1,357	6,597	8,070	4,208	**36,414**
Projected 2051 Service Population	24,655	2,522	12,064	11,129	7,468	**57,838**
Projected Population at 2051 ECA Rated Capacity	38,790	5,988	16,750	17,212	12,777	**91,517**

Based on the projections presented in Table 3-1, the County will need to provide wastewater treatment to an additional 21,424 residents by the year 2051 as well as an additional 55,103 residents based on 2051 ECA Rated Capacity scenario.

3.2 Flows and Loadings Projection

The County provided a number of documents and data files for review and analysis of the Simcoe WWTF, Port Dover WWTP, Delhi WWTP, Waterford WPCP and Port Rowan WWTPs. For each treatment facility, future average daily flow rates were estimated for the 2051 population growth scenario using the population projections multiplied by the per capita flow rates provided by the County and presented in Table 3.2. For the 2051 rated capacity scenario, the service populations were estimated using the provided average daily flow and per capita flow rates and anticipated future ECA rated capacities (taking into consideration planned expansions of the County's wastewater treatment plants). The future loading conditions were then estimated using the average daily flow, per capita flow rates, service populations, and site-specific per capita loadings.

The assumptions made for each facility have been summarized in Table 3.2 below, and the design basis development for each treatment facility have been provided in subsequent Sections 3.2.1 to 3.2.5.

Table 3.2: Design Assumptions for each Facility

Facility	Design Assumptions
Simcoe WWTF	• Producing co-thickened sludge with 1918 kg/day of mass flow and 2.76% sludge concentration (2019-2023)

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

Facility	Design Assumptions
	• 360 L/cap/d for 2051 population growth • 2051 rated capacity of 15,400 m^3/d
Delhi WWTP (Aerobic Digestion)	• Producing co-thickened sludge containing 426 kg/day of mass flow and 2.6% sludge concentration (2019-2023) • 202 L/cap/d for 2051 population growth • 2051 rated capacity of 3,182 m^3/d
Port Rowan WWTP (Aerobic Digestion)	• Producing co-thickened sludge containing 226 kg/day of mass flow and 2.46% sludge concentration (2019-2023) • 360 L/cap/d for 2051 population growth • 2051 rated capacity of 2,280 m^3/d
Waterford WPCP	• Producing WAS (153 kg/day of mass flow at 1.5% concentration, 2019-2023) • 269 L/cap/d for 2051 population growth • 2051 rated capacity of 3,500 m^3/d • Allowance is to be made to digest sludge from Waterford at the Simcoe WWTF. It is assumed that Waterford WPCP will be upgraded to an Extended Aeration facility in the future.
Port Dover WWTP	• Producing co-thickened sludge containing 740 kg/day of mass flow and 2.08% sludge concentration (2019-2023) • 360 L/cap/d for 2051 population growth • 2051 rated capacity of 7,500 m^3/d • Existing digester will be taken offline and WAS thickening will be added in Phase 2 of Port Dover WWTP upgrades.

Finally, the County indicated that the overall preferred sludge handling approach will involve providing both digestion and storage capacity for all treatment facilities at the Simcoe WWTF. As such, the design basis focussed on developing projected volumetric and loading rates associated with undigested sludge from each of the five treatment facilities. While some facilities currently have on-site digestion, it has been assumed that these will be utilized as temporary (short-term) storage tanks prior to hauling the undigested sludges to the Simcoe WWTF for stabilization and long-term storage.

3.2.1 Simcoe WWTF

As discussed in Section 2.1, the Simcoe WWTF is a conventional activated sludge (CAS) facility with an ECA rated average day flow capacity of 15,400 m^3/d providing wastewater treatment services to approximately 16,182 population in Simcoe area along with discharges from the largest industrial contributor within the catchment area (Breyers). The facility has a common headworks, tertiary treatment and disinfection. The preliminary treated wastewater is divided between two parallel treatment plants, including Plant 1 with a rated capacity of 2,671 m^3/d and Plant 2 with a rated capacity of 12,729 m^3/d. Secondary effluent from both

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

plants recombines upstream of tertiary treatment and disinfection. Combined raw primary sludge and waste activated sludge (WAS) are co-thickened in the primary clarifiers. This combined sludge is directed to one primary anaerobic digester, with a volume of 2,507 m^3, and digested biosolids are stored in two secondary digesters, with a combined total volume of 2,437 m^3. Currently, the Simcoe WWTP only processes and stores sludge and biosolids generated within its own treatment trains.

The average historical per capita flow contribution rate in the Simcoe service area was provided by the County to be 360 L/cap/day. Future flows to the Simcoe WWTF were estimated based on service area population growth projection in addition to the volume of hauled septage and leachate. Additional volumetric loading increases to the projected 2051 ECA rated capacity were estimated by prorating the increase from current average daily flow (ADF) to the year 2051 ADF. The base loads include allowances for the hauled waste volumes currently being accepted at Simcoe WWTF.

The average day flow over the period of 2019-2023 was estimated to be 7,261 m^3/d or 47% of the facility's rated capacity of 15,400 m^3/d. Table 3.3 provides a summary of the projected flows and loadings under the 2051 Population Growth and 2051 ECA Rated Capacity scenarios. Refer to Appendix B for design calculations details.

Table 3.3: Simcoe WWTF Flow and Loading Projections

Parameter	2051 Population Growth	2051 ECA Rated Capacity
Raw Wastewater		
ADF (m^3/d)	10,311	15,400
Per capita flow for growth (L/cap/d) (1)	360	360
Service Population	24,655	38,790
Base BOD Loading (kg/d)	1,830	1,830
Base TSS Loading (kg/d)	1,401	1,401
Growth BOD Loading (kg/d) (2)	804.9	2147.8
Growth TSS Loading (kg/d)	804.9	2147.8
Total Influent BOD Loading (kg/d)	2,635	3,978
Total Influent TSS Loading (kg/d)	2,206	3,549
Projected Sludge Generation (Average)		
Raw Sludge (kg/d)	1,346	2,165
WAS (kg/d)	1,530	2,310
Co-Thickened Sludge (kg/d)	2,876	4,475
Undigested Sludge Characteristics		
Design Co-thickened Sludge (%) (3)	2.75	2.75
Design Raw Sludge (%) (4)	5	5
Sludge MMF Factor (-) (5)	1.5	1.5
TWAS Thickened Conc (%) (6)	4.5	4.5
Notes: 1. Per email from County sent on June 10, 2024		

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

2. Includes allowance for future leachate/industrial loadings
3. Based on historic operating data
4. Assumes no co-thickening of WAS in the primaries
5. Based on historic operating data. Had maximum month raw sludge flows of up to ~100 m^3/d when average was ~66 m^3/d.
6. Assumes RDT or equivalent.

The historical per capita BOD loading at the Simcoe WWTF was found to be 113 g/cap/d which is higher than the typical design value of 75 g/cap/d (MOE, 2008). This increase is likely due to discharges from the facility's largest industrial contributor (Breyers). In addition, this facility receives large volumes of leachate, approximately 137 m^3/d which is expected to increase to 235 m^3/d by 2051. To be conservative, and to allow for some additional loadings associated with both increased leachate volumes and/or potential increases in Breyers' discharges, the per capita BOD loading for new growth was estimated to be 95 g/cap/d, which is the approximate mid-point between the typical design value and the historical value. The historical per capita TSS loading was found to be 87 g/cap/d. The per capita TSS loading for new growth was estimated to be 95 g/cap/d including 10% added loading to serve as a safety factor.

3.2.2 Delhi WWTP

The Delhi WWTP was constructed and commissioned in 2015 with a rated capacity of 3,182 m^3/d. The facility currently provides wastewater treatment services to approximately 6,597 residents in Delhi. The liquid treatment train consists of screening, grit removal, primary clarification, biological treatment with provision of anoxic swing zone for denitrification, secondary clarification, tertiary filtration and UV disinfection. The treated effluent is discharged to the Big Creek which ultimately discharges into Lake Erie.

Waste Activated Sludge (WAS) is co-thickened in the primary clarifiers and the combined co-thickened sludge and scum are stabilized in two aerobic digesters, each with a volume of 660 m^3 providing a total volume of 1,320 m^3. There are no separate biosolids storage tanks available on-site. Currently, the Delhi WWTP only processes and stores sludge and biosolids generated within its own treatment train.

The average day flow over the period 2019-2023 was estimated to be 1,131 m^3/d, or 36% of the facility's rated capacity. Table 3.4 provides a summary of the projected flows and loadings under the 2051 Population Growth and 2051 ECA Rated Capacity scenarios.

Table 3.4: Delhi WWTP Flow and Loading Projections

Parameter	2051 Population Growth	2051 Rated Capacity
Raw Wastewater		
ADF (m^3/d)	2,437	3,182
Per capita flow for growth (L/cap/d) (1)	202	202
Service Population	12,064	16,750
Base BOD Loading (kg/d)	280	280
Base TSS Loading (kg/d)	299	299

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

Parameter	2051 Population Growth	2051 Rated Capacity
Growth BOD Loading (kg/d)	410	761.5
Growth TSS Loading (kg/d)	492	913.8
Total Influent BOD Loading (kg/d)	690	1,042
Total Influent TSS Loading (kg/d)	791	1,213
Projected Sludge Generation (Average)		
Co-Thickened Sludge (kg/d) (2)	1,035	1,563
Undigested Sludge Characteristics		
Design Hauled Co-thickened Sludge (%) (3)	3.0	3.0
Sludge MMF Factor (-) (4)	1.5	1.5
Raw sludge + TWAS Conc (%) (5)	4.5	4.5

Notes:
1. Per email from County sent on June 10, 2024.
2. Based on historical sludge generation rate of 1.5 kg sludge/kg BOD.
3. Based on historical operating data.
4. Average volumetric flowrate of raw sludge was found to be 16.4 m^3/d with maximum monthly flows up to ~30 m^3/d. Due to inconsistent sludge concentration data, it is difficult to determine the potential cause for this elevated peaking factor. Therefore, a peak factor of 1.5 was assumed (equivalent to the peaking factor assumed for the Simcoe WWTF).
5. Assumes RDT or equivalent for WAS thickening.

3.2.3 Port Rowan WWTP

The Port Rowan WWTP is a membrane bioreactor (MBR) treatment system, and has a rated capacity of 1,140 m^3/d. The facility currently accepts portable waste, holding tanks and septic waste in addition to incoming sewage collected through the sanitary collection system providing wastewater treatment services to approximately 1,357 residents in Port Rowan. The liquid treatment train consists of preliminary treatment including screening and grit removal, primary clarification, aeration process followed by microfiltration and disinfection. The treated effluent is discharged to the Dedrick Creek which ultimately discharges into Lake Erie.

Waste Activated Sludge (WAS) is co-thickened in the primary clarifiers and the combined co-thickened sludge and scum are digested in an aerobic digester with two compartments, providing a total volume of 602 m^3. There are no separate biosolids storage tanks available on-site. Currently, the Port Rowan WWTP only processes and stores sludge and biosolids generated within its own treatment train.

The average day flow over the period 2019-2023 was estimated to be 613 m^3/d, or 54% of the facility's rated capacity. Table 3.5 provides a summary of the projected flows and loadings under the 2051 Population Growth and 2051 ECA Rated Capacity scenarios.

Table 3.5: Port Rowan WWTP Flow and Loading Projection

Parameter	2051 Population Growth	2051 Rated Capacity
Raw Wastewater		

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

Parameter	2051 Population Growth	2051 Rated Capacity
ADF (m^3/d)	1,032	2,280
Per capita flow for growth (L/cap/d) (1)	360	360
Service Population	2,522	5,988
Base BOD Loading (kg/d)	140	140
Base TSS Loading (kg/d)	137	137
Growth BOD Loading (kg/d)	87.4	347.3
Growth TSS Loading (kg/d)	104.9	416.8
Additional Hauled Waste BOD (kg/d)(2)	2	6.4
Additional Hauled Waste TSS (kg/d) (2)	3.1	10
Total Influent BOD Loading (kg/d)	229	494
Total Influent TSS Loading (kg/d)	245	564
Projected Sludge Generation (Average)		
Co-Thickened Sludge (kg/d) (3)	366	790
Undigested Sludge Characteristics		
Design Hauled Co-thickened Sludge (%) (4)	2.7	2.7
Sludge MMF Factor (-) (5)	1.4	1.4
Raw sludge + TWAS Conc (%) (6)	4.5	4.5

Notes:
1. Per email from County sent on June 10, 2024.
2. Assumes similar mix of holding tank/septage will be used in future. Increased hauled waste volume of 860 m^3/year to 2051. Prorate increase to 2051 ECA rated capacity.
3. Based on historical sludge generation rate of 1.6 kg sludge/kg BOD.
4. Based on historic operating data.
5. Based on historic operating data. Had maximum month raw sludge flows of up to ~14 m^3/d when average was ~9.1 m^3/d.
6. Assumes RDT or equivalent for WAS thickening.

3.2.4 Waterford WPCP

The Waterford WPCP is a lagoon-based biological wastewater treatment system with an average rated capacity of 2,200 m^3/d. The facility currently serves 4,208 residents in Waterford service area. The treatment facility consists of preliminary treatment, two parallel aerated lagoons, two stage sand filtration system, chemical phosphorous removal and UV disinfection system. Headworks was added in 2023/2024 with leachate and septage receiving, screening and grit removal. Treated effluent from Waterford WPCP is discharged to Nanticoke Creek which ultimately discharges into Lake Erie.

Sludge is periodically removed from the two aerated lagoons, with a combined volume of 19,256 m^3 and being hauled off-site as required There are no separate biosolids storage tanks on-site. Currently, the Waterford WPCP processes and stores sludge generated in Waterford, Ontario.

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

The County has indicated that the Waterford WPCP will be upgraded to a mechanical plant as part of a planned future expansion. For the purposes of developing projected sludge generation rates and characteristics for both the 2051 Population Growth and 2051 ECA Rated Capacity scenarios, it was assumed that the Waterford WPCP would be upgraded to an extended aeration treatment process of equivalent. As such, the facility would produce WAS, but no raw (primary) sludge.

The average day flow over the period 2019-2023 was estimated to be 1,195 m^3/d, or 54% of the facility's rated capacity. Table 3.6 provides a summary of the projected flows and loadings under the 2051 Population Growth and 2051 ECA Rated Capacity scenarios.

Table 3.6: Waterford WPCP Flow and Loading Projections

Parameter	2051 Population Growth	2051 Rated Capacity
Raw Wastewater		
ADF (m^3/d)	2,009	3,500
Per capita flow for growth (L/cap/d) (1)	269	269
Service Population	7,468	12,777
Base BOD Loading (kg/d)	136.2	136.2
Base TSS Loading (kg/d)	399.1	399.1
Growth BOD Loading (kg/d)	244.5	642.7
Growth TSS Loading (kg/d)	293.4	771.2
Total Influent BOD Loading (kg/d)	381	779
Total Influent TSS Loading (kg/d)	693	1,170
Projected Sludge Generation (Average)		
WAS (kg/d) (2)	381	779
Undigested Sludge Characteristics		
Design Hauled WAS Conc (%) (3)	1.5	1.5
Sludge MMF Factor (-) (4)	1.5	1.5
If thickened at Simcoe, TWAS Conc (%) (5)	4.5	4.5

Notes:
1. Per email from County sent on June 10, 2024.
2. Based on typical WAS generation rate of 1 kg WAS/kg BOD.
3. Assumes holding tank with some decanting.
4. No data available. Assume same as Simcoe WWTF.
5. Assumes RDT or equivalent for WAS thickening. Includes allowance for future leachate/industrial loadings.

3.2.5 Port Dover WWTP

The Port Dover WWTP is a CAS system, and has a rated capacity of 5,400 m^3/d. The facility currently accepts septage in addition to the incoming sewage providing wastewater treatment services to approximately 8,070 residents in Port Dover servicing areas. The liquid treatment train consists of preliminary treatment, primary clarification, aeration, secondary clarification, and chlorine disinfection process.

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

Combined raw sludge and waste activated sludge (WAS) are co-thickened in the primary clarifiers. This combined sludge is directed to one egg-shaped primary anaerobic digester, with a volume of 666 m^3, and digested biosolids are stored in four underground storage tanks, each with a volume of approximately 1,000 m^3, providing a total storage capacity of 4,000 m^3. Currently, Port Dover WWTP only processes and stores sludge and biosolids generated within its own treatment train.

The average historical per capita flow contribution rate in the Port Dover service area was provided by the County to be 360 L/cap/day. Future flows to the facility were estimated based on service area population growth in addition to the volume of hauled septage and leachate. The average day flow over the period 2019-2023 was estimated to be 4,209 m^3/d (78% of the facility's rated capacity).

Table 3.7 provides a summary of the projected flows and loadings under the 2051 Population Growth and 2051 ECA Rated Capacity scenarios.

Table 3.7: Port Dover WWTP Flow and Loading Projections

Parameter	2051 Population Growth	2051 Rated Capacity
Raw Wastewater		
ADF (m^3/d)	5310	7500
Per capita flow for growth (L/cap/d) (1)	360	360
Service Population	11129	17212
Base BOD Loading (kg/d)	551	551
Base TSS Loading (kg/d)	703	703
Growth BOD Loading (kg/d)	229.4	685.7
Growth TSS Loading (kg/d)	275.3	822.8
Additional Hauled Waste BOD (kg/d)(2)	11.7	28.7
Additional Hauled Waste TSS (kg/d) (3)	18.3	45
Total Influent BOD Loading (kg/d)	792	1265
Total Influent TSS Loading (kg/d)	997	1571
Projected Sludge Generation (Average)		
Raw Sludge (kg/d)	738	1163
WAS (kg/d)	454	726
Co-Thickened Sludge (kg/d)	1192	1889
Undigested Sludge Characteristics		
Design Hauled Co-thickened Sludge (%) (4)	2.1	2.1
Sludge MMF Factor (-) (5)	1.6	1.6
Raw sludge + TWAS Conc (%) (6)	4.5	4.5

Notes:
1. Per email from County sent on June 10, 2024.
2. Assumes similar mix of holding tank/septage will be used in future. Increased hauled waste volume of 4864 m^3/year to 2051. Prorate increase to rated capacity.
3. Assumes will be similar mix of holding tank/septage in future. Increased hauled waste volume of 4864 m^3/year to 2051. Prorate increase to rated capacity.

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

4. Based on historic operating data.
5. Based on historic operating data. Had maximum month raw sludge flows of up to ~58 m^3/d when average was ~36 m^3/d.
6. Assumes RDT or equivalent for WAS thickening.

3.3 Projected Sludge and Biosolids Generation Rates

Sludge and biosolids projections for the Simcoe WWTF, Waterford WPCP, and Port Dover, Port Rowan, and Delhi WWTPs were developed for two future conditions, namely to the 2051 Population Growth and 2051 ECA Rated Capacity. The total projected sludge mass loadings from all five facilities are presented in Table 3.8.

Table 3.8: Sludge Requiring Digestion at Simcoe WWTF

Facility	2051 Population Growth	2051 Rated Capacity
Average Mass Loading (kg/d) Produced at Simcoe WWTF Co-thickened Sludge	2,876	4,475
Average Mass Loading (kg/d) Produced at Other WWTPs		
Waterford WWTP – WAS	381	779
Port Rowan WWTP – Co-thickened	366	790
Port Dover WWTP – Co-thickened	611	968
Delhi WWTP – Co-thickened	1,035	1,563
Total Sludge Requiring Digestion at Simcoe WWTF	**5,269**	**8,575**

Details regarding the development of sludge and biosolids generation rates are provided in Appendix B.

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

4. Conventional Sludge Digestion and Biosolids Storage Options

The following conventional anaerobic digestion options were considered for upgrades to the solid treatment train at the Simcoe WWTF:

- Option 1(a) – Centralized Anaerobic Digestion and Biosolids Storage without Biosolids Thickening at Simcoe WWTF;
- Option 1(b) – Centralized Anaerobic Digestion and Biosolids Storage with Thickening at Simcoe WWTF;
- Option 1(c) - Centralized Anaerobic Digestion at Simcoe WWTF with WAS Thickening for Simcoe and Waterford at Simcoe WWTF, Co-thickened sludge from other facilities; and
- Option 1 (d) - Anaerobic Digestion with WAS Thickening at Simcoe WWTF and WAS Thickening at all other facilities prior to hauling.

For each option, equipment and tank sizing requirements were considered for two design scenarios: 2051 Population Growth and 2051 Rated Capacity. In addition, sludge from other facilities is hauled to the Simcoe WWTF for anaerobic digestion and storage. Storage tank volumes for each alternative have been sized to provide 240 days of on-site storage to accommodate both non-agricultural source material (NASM) requirements and provide adequate storage during non-land application months.

For conceptual design of the sludge processing and biosolids storage at the Simcoe WWTF, the following assumptions were made:

- The Simcoe WWTF will continue the practice of co-thickening unless otherwise noted.
- The design of new digestion processes at the Simcoe WWTF will be consistent with the requirements outlined in the Design Guidelines for Sewage Works (MOE, 2008). In addition, for all conventional digestion options, a minimum of two digesters will be provided to allow for operational flexibility and to facilitate maintenance activities.
- For conventional digestion options that involve thickening, two rotary drum thickeners (RDTs) will be used for biosolids thickening in a duty/standby configuration.
- Internal recycle streams (namely biosolids thickening filtrate and/or supernatant) will be of typical quality and will be returned to the head of the Simcoe WWTF's liquid treatment train.
- Biosolids disposal via lagoons and land application were considered for conventional digestion options. Based on historic sludge disposal data, 80% of annual hauled biosolids will be taken to lagoons and 20% will be disposed of via land application.

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

4.1 Option 1(a) – Centralized Anaerobic Digestion and Biosolids Storage without Biosolids Thickening at Simcoe WWTF

Option 1(a) involves the construction of new anaerobic digesters to process sludge generated in the liquid treatment train of the Simcoe WWTF, co-thickened sludge from Port Rowan, Port Dover and Delhi WWTPs, and WAS from Waterford WPCP. The anaerobically digested sludge would then be stored in new biosolids storage tanks prior to disposal.

The conceptual level design for Option 1(a) to the design year of 2051 consists of the following:

- Co-thickened sludge from Port Rowan, Delhi, and Port Dover WWTPs as well as WAS from Waterford WPCP would be hauled to a new receiving station that would be constructed at the Simcoe WWTF.
- Co-thickened sludge from Simcoe WWTF and the hauled co-thickened sludge and WAS in the receiving station would be directed to new anaerobic digesters.
- Digested sludge from the anaerobic digesters would then be conveyed to new biosolids storage tanks. From the storage tanks, the class B biosolids would be disposed of at the Townsend lagoon and/or used for land application.
- The biosolids storage tanks would be designed to allow for periodic decanting of the storage tank contents, with supernatant directed to the head of the liquid treatment train. Due to potential for odour generation during decanting, odour control facilities would be required.

4.1.1 Option 1(a) – 2051 Population Growth

The following digester and storage tanks volumes are required to process and store biosolids to the design year of 2051 (2051 Population Growth):

- Two new anaerobic digesters, each with a volume of 2,800 m^3, providing a total volume of 5,600 m^3.
- Three new biosolids storage tanks, each with a volume of 7,600 m^3, providing a total volume of 22,800 m^3.

A process flow diagram for Option 1(a) – 2051 Population Growth is presented in Figure 4.1. A conceptual level site layout is provided in Appendix C and presents the required footprints for all tankages, process equipment and buildings to accommodate solids treatment and management for the County to the design year of 2051.

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

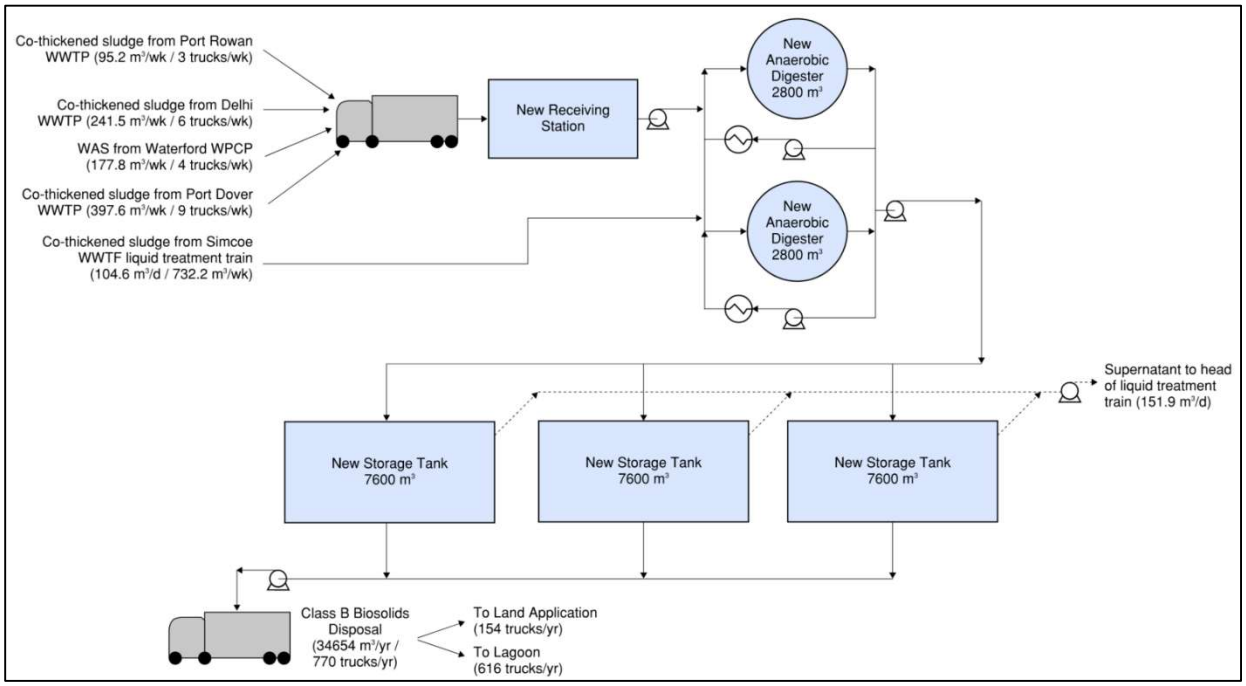


Figure 4.1: Option 1(a) – 2051 Population Growth – Process Flow Schematic

Table 4.1 presents key design values for Option 1(a) for the 2051 population growth. Details regarding the development of these values are presented in Appendix B.

Table 4.1: Option 1(a) – Key Design Values to 2051 Population Growth

Parameter	Design Value
Digesters	
Number and type	2 x anaerobic
Volume – each	2,800 m^3
Volume – total	5,600 m^3
Biosolids Storage	
Average Biosolids Concentration	3.5%
Number and Storage Volume – New Storage Tank	3 x 7,600 m^3
Storage Volume – Total	22,800 m^3

4.1.2 Option 1(a) – 2051 Rated Capacity

For the 2051 rated capacity, the following digester and storage tanks volumes are required:

- Three new anaerobic digesters, each with a volume of 3,100 m^3, providing a total volume of 9,300 m^3.
- Four new biosolids storage tanks, each with a volume of 9,300 m^3, providing a total of 37,200 m^3.

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

A process flow diagram of Option 1(a) – 2051 Rated Capacity is presented in Figure 4.2. A conceptual level site layout is provided in Appendix C and presents the required footprints for all tankage, buildings and other equipment when the facilities are operating at their ECA rated capacities in 2051.

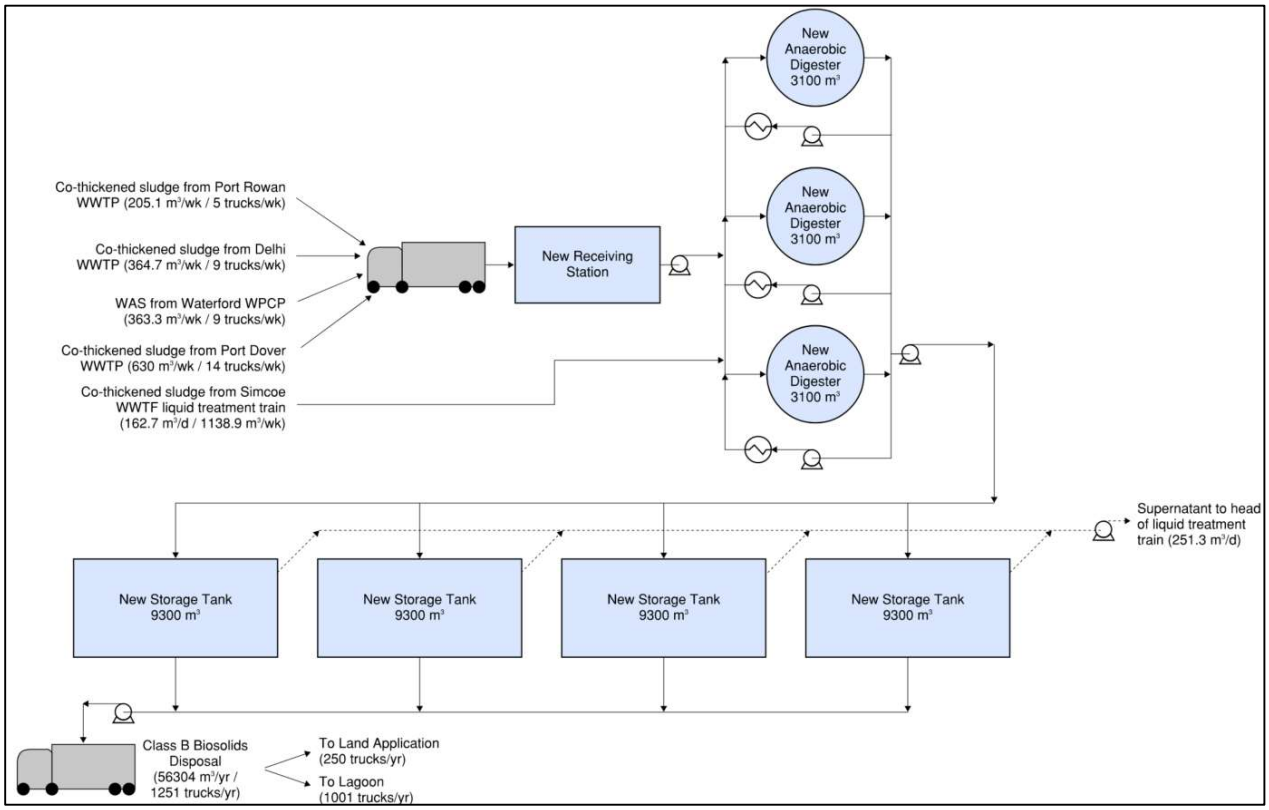


Figure 4.2: Option 1(a) – 2051 Rated Capacity – Process Flow Schematic

Table 4.2 presents key design values for Option 1(a) to the design year of 2051 with all facilities operating at their rated capacities. Details regarding the development of these values are presented in Appendix B.

Table 4.2: Option 1(a) – Key Design Values to 2051 Rated Capacity

Parameter	Design Value
Digesters	
Number and type	3 x anaerobic
Volume – each	3,100 m^3
Volume – total	9,300 m^3
Biosolids Storage	
Average Biosolids Concentration	3.5%
Number and Storage Volume – New Storage Tank	4 x 9,300 m^3
Storage Volume – Total	37,200 m^3

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

4.2 Option 1(b) – Centralized Anaerobic Digestion and Biosolids Storage with Thickening at Simcoe WWTF

Option 1(b) involves the construction of new anaerobic digesters to digest sludge generated in the liquid treatment train of the Simcoe WWTF, co-thickened sludge from Port Rowan, Port Dover and Delhi WWTPs, and WAS from Waterford WWTP. The anaerobically digested sludge would then be thickened and transferred to new biosolids storage tanks prior to disposal.

The conceptual level design for Option 1(b) to the design year of 2051 consists of the following:

- Co-thickened sludge from Port Rowan, Delhi, and Port Dover WWTPs as well as WAS from Waterford WPCP would be hauled to a new receiving station that would be constructed at the Simcoe WWTF.
- Co-thickened sludge from Simcoe WWTF and the hauled co-thickened sludge and WAS in the receiving station would be directed to the new anaerobic digesters.
- Digested sludge (class B biosolids) from the anaerobic digesters would then be conveyed to the thickening facility. The biosolids thickening process would include a RDT feed tank, polymer dosing system, flocculation tank, two RDT units (one duty/one standby), a filtrate equalization tank, and polymer make-down system. Filtrate would be returned to the head of the Simcoe WWTF liquid treatment train.
- The thickened biosolids would then be conveyed to the new biosolids storage tanks. From storage, the class B biosolids would be disposed to Townsend lagoon or used for application.
- The biosolids storage tanks would be designed to allow for periodic decanting of the storage tank contents, with supernatant directed to the head of the liquid treatment train. Due to the potential for odour generation during decanting, odour control facilities would be provided.

4.2.1 Option 1(b) – 2051 Population Growth

For the projected population growth for 2051, the following digester and storage tanks volumes are required:

- Two new anaerobic digesters, each with a volume of 2,800 m^3, providing a total volume of 5,600 m^3.
- Thickening facility includes one below grade RDT feed tank with estimated volume of 725 m^3, two RDTs with required capacity of 54 m^3/hr operating on duty/standby mode (operating 5 days a week, 6 hours per day) and one below grade filtrate tank with estimated volume of 570 m^3.
- Two new biosolids storage tanks, each with a volume of 6,400 m^3, providing a total volume of 12,800 m^3.

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

A process flow diagram of Option 1(b) – 2051 Population Growth is presented in Figure 4.3. A conceptual level site layout is provided in Appendix C and presents the required footprints for all tankage, buildings and other equipment to the projected population growth for 2051.

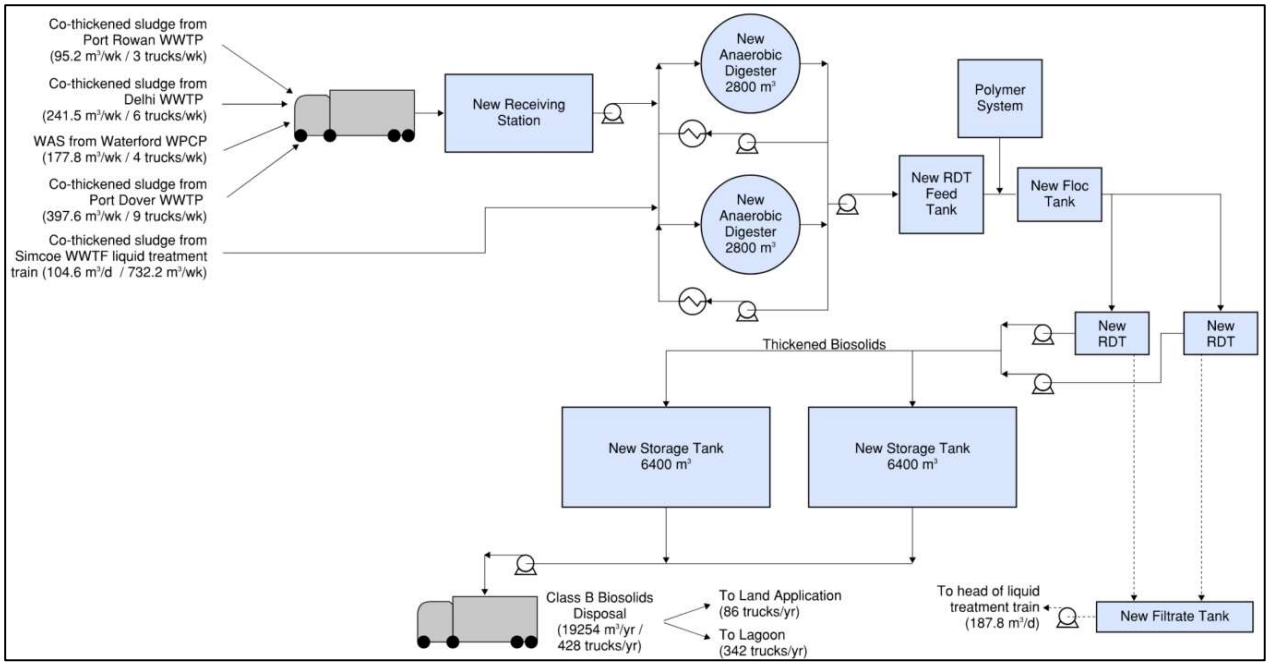


Figure 4.3: Option 1(b) – 2051 Population Growth – Process Flow Schematic

Table 4.3 presents key design values for Option 1(b) for the 2051 projected population growth. Details regarding the development of these values are presented in Appendix B.

Table 4.3: Option 1(b) – Key Design Values to 2051 Population Growth

Parameter	Design Value
Digesters	
Number and type	2 x anaerobic
Volume – each	2,800 m^3
Volume – total	5,600 m^3
Thickening Building	
Footprint of Building	18 m x 21 m (total 378 m^2)
Number of Rotary Drum Thickeners	2 x 54 m^3/hr (one duty/one standby)
Biosolids Storage	
Average Thickened Biosolids Concentration	6%
Number and Storage Volume – New Storage Tank	2 x 6,400 m^3
Storage Volume – Total	12,800 m^3

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

4.2.2 *Option 1(b) – 2051 Rated Capacity*

For the 2051 rated capacity scenario, the following digester and storage tanks volumes are required:

- Three new anaerobic digesters, each with a volume of 3,000 m^3, providing a total volume of 9,000 m^3.
- Thickening facility includes one below grade RDT feed tank with estimated volume of 1,200 m^3, two RDTs with required capacity of 91 m^3/hr operating on duty/standby mode (operating 5 days a week, 6 hours per day) and one below grade filtrate tank with estimated volume of 930 m^3.
- Three new biosolids storage tanks, each with a volume of 6,900 m^3, providing a total of 20,700 m^3.

A process flow diagram of Option 1(b) – 2051 Rated Capacity is presented in Figure 4.4. A conceptual level site layout is provided in Appendix C and presents the required footprints for all tankage, buildings and other equipment when the facilities are operating at their rated capacities in 2051.

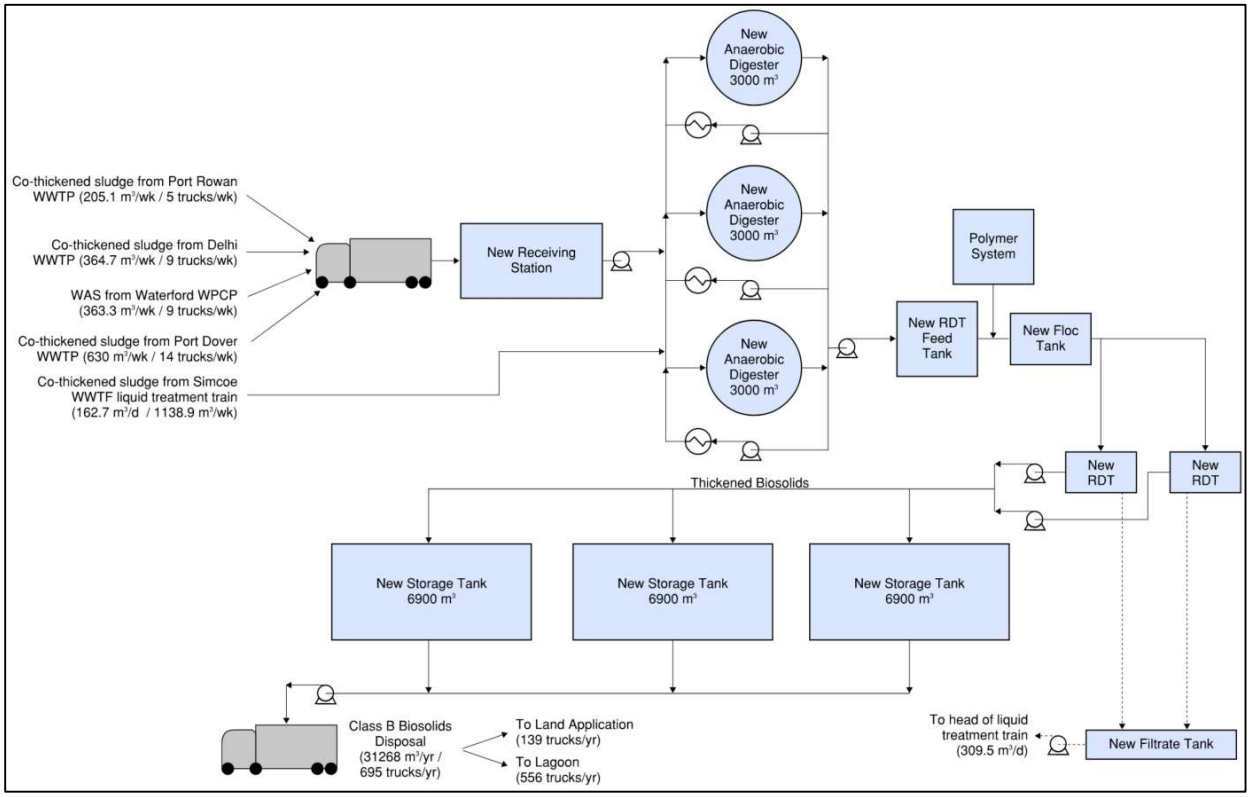


Figure 4.4: Option 1(b) – 2051 Rated Capacity – Process Flow Schematic

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

Table 4.4 presents key design values for Option 1(b) to the design year of 2051 with all facilities operating at their rated capacities. Details regarding the development of these values are presented in Appendix B.

Table 4.4: Option 1(b) – Key Design Values to 2051 Rated Capacity

Parameter	Design Value
Digesters	
Number and type	3 x anaerobic
Volume – each	3,000 m^3
Volume – total	9,000 m^3
Thickening Building	
Footprint of Building	18 m x 21 m (total 378 m^2)
Number of Rotary Drum Thickeners	2 x 91 m^3/hr (one duty/one standby)
Biosolids Storage	
Average Thickened Biosolids Concentration	6%
Number and Storage Volume – New Storage Tank	3 x 6,900 m^3
Storage Volume – Total	20,700 m^3

4.3 Option 1(c) – Centralized Anaerobic Digestion at Simcoe WWTF with WAS Thickening for Simcoe and Waterford at Simcoe WWTF, Co-thickened sludge from other facilities

Option 1(c) involves the construction of new anaerobic digesters to digest primary sludge generated in the liquid treatment trains of the Simcoe WWTF, co-thickened sludge from Port Rowan, Port Dover and Delhi WWTPs, and WAS from Simcoe WWTF and Waterford WPCP that would be thickened prior to anaerobic digestion. The anaerobically digested sludge would then be stored in new biosolids storage tanks prior to disposal.

The conceptual level design for Option 1(c) to the design year of 2051 consists of the following:

- WAS from Waterford WPCP would be hauled to a new receiving station at Simcoe WWTF and conveyed to the thickening system along with WAS from Simcoe WWTF. The thickening process would include a RDT feed tank, polymer dosing system, flocculation tank, two RDT units (one duty/one standby), a filtrate equalization tank, and polymer make-down system. Filtrate would be returned to the head of the Simcoe WWTF liquid treatment train.
- Co-thickened sludge from the Port Rowan, Port Dover, and Delhi WWTPs would be hauled to a separate new receiving station that would be constructed at Simcoe WWTF.
- Hauled co-thickened sludge in the receiving station and the thickened WAS from the thickening facility would be directed to the new anaerobic digesters.

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

- Digested sludge (class B biosolids) from the anaerobic digesters would then be conveyed to the new biosolids storage tanks. From storage, the class B biosolids would be disposed to Townsend lagoon or used for land application.
- The biosolids storage tanks would be designed to allow for periodic decanting of the storage tank contents, with supernatant directed to the head of the liquid treatment train. Due to the potential for odour generation during decanting, odour control facilities would be provided.

4.3.1 Option 1(c) – 2051 Population Growth

For the projected population growth for 2051, the following thickening process units, digesters and storage tanks volumes are required:

- Thickening facility contains one below grade RDT feed tank with estimated volume of 350 m^3, two RDTs with required capacity of 10 m^3/hr operating on duty/standby mode (operating 5 days a week, 6 hours per day) and one below grade filtrate tank with estimated volume of 260 m^3.
- Two new anaerobic digesters, each with a volume of 2,200 m^3, providing a total volume of 4,400 m^3.
- Three new biosolids storage tanks, each with a volume of 7,500 m^3, providing a total volume of 22,500 m^3.

A process flow diagram of Option 1(c) – 2051 Population Growth is presented in Figure 4.5. A conceptual level site layout is provided in Appendix C and presents the required footprints for all tankage, buildings and other equipment to the projected population growth for 2051.

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

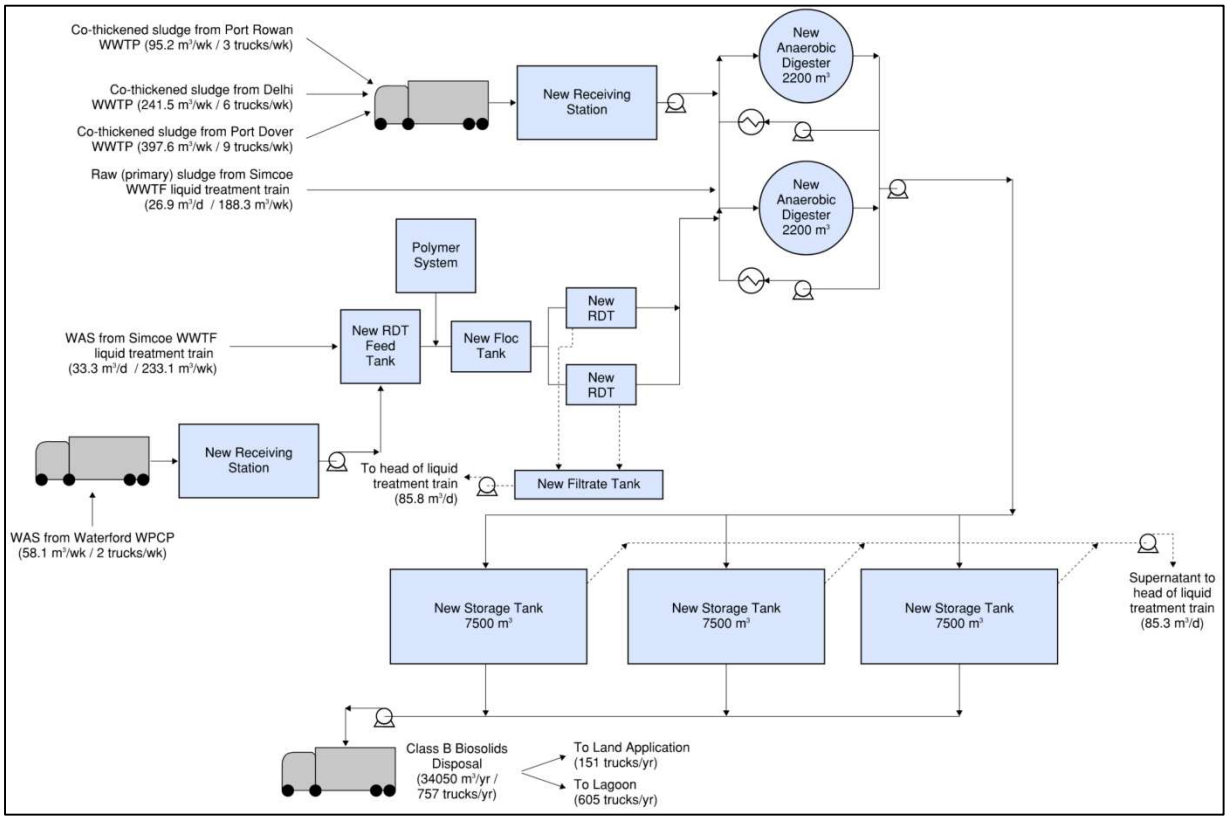


Figure 4.5: Option 1(c) – 2051 Population Growth – Process Flow Schematic

Table 4.5 presents key design values for Option 1(c) for the 2051 projected population growth. Details regarding the development of these values are presented in Appendix B.

Table 4.5: Option 1(c) – Key Design Values to 2051 Population Growth

Parameter	Design Value
Digesters	
Number and type	2 x anaerobic
Volume – each	2,200 m^3
Volume – total	4,400 m^3
Thickening Building	
Footprint of Building	18 m x 21 m (total 378 m^2)
Number of Rotary Drum Thickeners	2 x 10 m^3/hr (one duty/one standby)
Biosolids Storage – Anaerobically Digested Sludge	
Average Thickened Biosolids Concentration	3.5%
Number and Storage Volume – New Storage Tank	3 x 7,500 m^3
Storage Volume – Total	22,500 m^3

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

4.3.2 *Option 1(c) – 2051 Rated Capacity*

For the 2051 ECA rated capacity, the following digester and storage tanks volumes are required:

- Thickening facility contains one below grade RDT feed tank with estimated volume of 610 m^3, two RDTs with required capacity of 20 m^3/hr operating on duty/standby mode (operating 5 days a week, 6 hours per day) and one below grade filtrate tank with estimated volume of 420 m^3.
- Three new anaerobic digesters, each with a volume of 2,400 m^3, providing a total volume of 7,200 m^3.
- Four new biosolids storage tanks, each with a volume of 9,100 m^3, providing a total of 36,400 m^3.

A process flow diagram of Option 1(c) – 2051 Rated Capacity is presented in Figure 4.6. A conceptual level site layout is provided in Appendix C and presents the required footprints for all tankage, buildings and other equipment when the facilities are operating at their rated capacities in 2051.

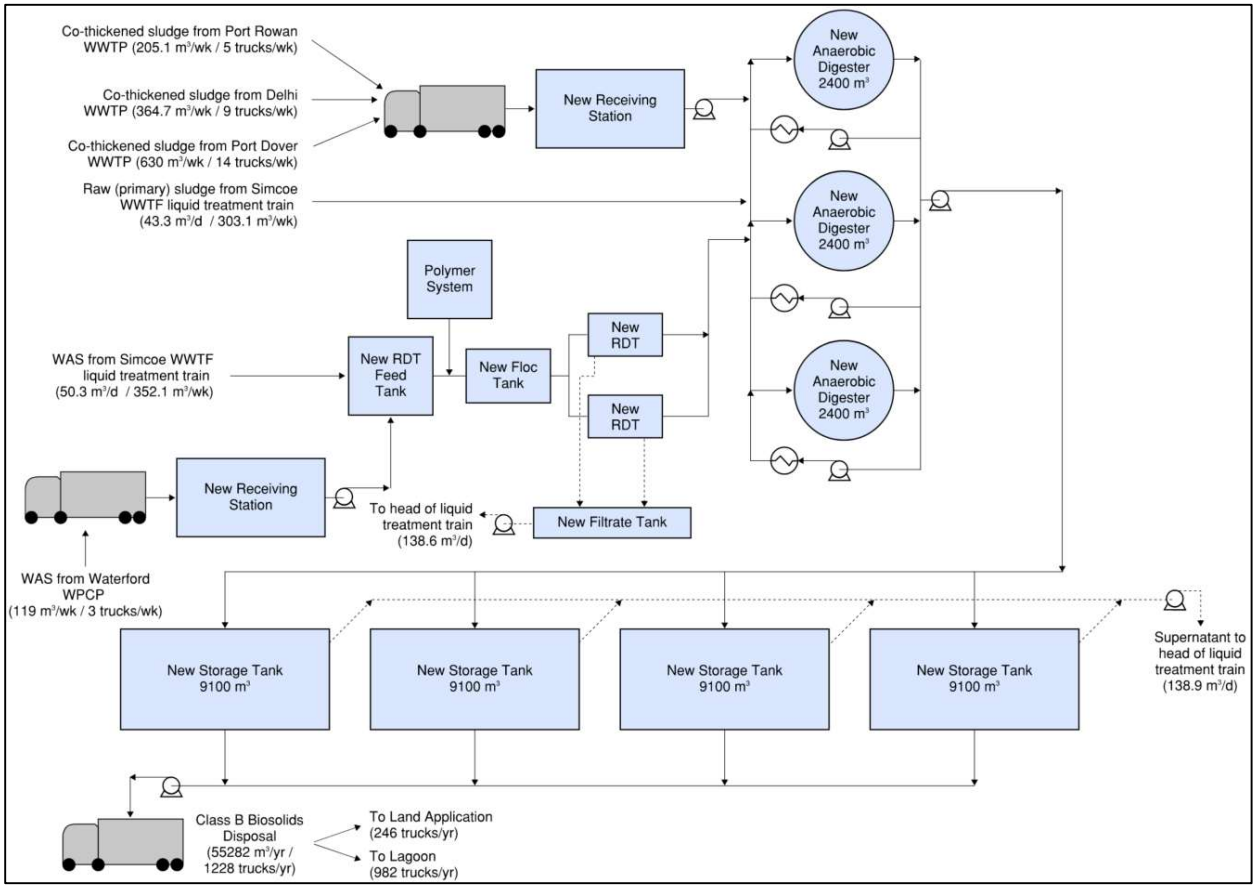


Figure 4.6: Option 1(c) – 2051 Rated Capacity – Process Flow Schematic

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

Table 4.6 presents key design values for Option 1(c) to the design year of 2051 with all facilities operating at their rated capacities. Details regarding the development of these values are presented in Appendix B.

Table 4.6: Option 1(c) – Key Design Values to 2051 Rated Capacity

Parameter	Design Value
Digesters	
Number and type	3 x anaerobic
Volume – each	2,400 m^3
Volume – total	7,200 m^3
Thickening Building	
Footprint of Building	18 m x 21 m (total 378 m^2)
Number of Rotary Drum Thickeners	2 x 20 m^3/hr (one duty/one standby)
Biosolids Storage – Anaerobically Digested Sludge	
Average Thickened Biosolids Concentration	3.5%
Number and Storage Volume – New Storage Tank	4 x 9,100 m^3
Storage Volume – Total	36,400 m^3

4.4 Option 1(d) – Anaerobic Digestion with WAS Thickening at Simcoe WWTF and WAS Thickening at all other facilities prior to hauling

The conceptual level design for Option 1(d) would be similar to that presented in Option 1(c), however the WAS from Port Rowan, Port Dover, Delhi WWTPs and Waterford WPCP would be thickened at their respective sites before being hauled to Simcoe WWTF. For Port Rowan, Port Dover and Delhi WWTPs new thickening process would involve constructing a new RDT system or similar. For Waterford WPCP that would involve ensuring the upgraded and expanded WPCP includes WAS thickening.

Option 1(d) involves the construction of new anaerobic digesters to digest primary sludge generated in the liquid treatment train of the Simcoe WWTF, raw sludge and thickened WAS from Port Rowan, Port Dover and Delhi WWTPs, thickened WAS from Waterford WPCP, and WAS from Simcoe WWTF that would be thickened prior to entering the anaerobic digesters. The anaerobically digested sludge would then be stored in new biosolids storage tanks prior to disposal.

The conceptual level design for Option 1(d) to the design year of 2051 consists of the following:

- Raw sludge and TWAS from Port Rowan, Delhi, and Port Dover WWTPs, as well as TWAS from Waterford WPCP would be hauled to a new receiving station that would be constructed at the Simcoe WWTF.

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

- WAS from Simcoe WWTF would be thickened through a new thickening system. The thickening process would include a RDT feed tank, polymer addition system, flocculation tank, two RDT units (one duty/one standby), a filtrate equalization tank, and polymer make-down system. Filtrate would be returned to the head of the Simcoe WWTF liquid treatment train.
- Raw sludge from Simcoe WWTF, the thickened WAS from Simcoe WWTF and the hauled raw sludge and TWAS from the other facilities would be directed to the new anaerobic digesters.
- Digested sludge (biosolids) from the anaerobic digesters would then be conveyed to the new biosolids storage tanks. From storage tanks, the class B biosolids would be disposed to Townsend lagoon or used for land application.
- The biosolids storage tanks would be designed to allow for periodic decanting of the storage tank contents, with supernatant directed to the head of the liquid treatment train. Due to the potential for odour generation during decanting, odour control facilities would be provided.

4.4.1 Option 1(d) – 2051 Population Growth

For the projected population growth for 2051, the following digester and storage tanks volumes are required:

- Thickening facility contains one below grade RDT feed tank with estimated volume of 400 m^3, two RDTs with required capacity of 27.5 m^3/hr operating on duty/standby mode (operating 5 days a week, 6 hours per day) and one below grade filtrate tank with estimated volume of 210 m^3.
- Two new anaerobic digesters, each with a volume of 2,200 m^3, providing a total volume of 4,400 m^3.
- Three new biosolids storage tanks, each with a volume of 7,500 m^3, providing a total volume of 22,500 m^3.

A process flow diagram of Option 1(c) – 2051 Population Growth is presented in Figure 4.7. A conceptual level site layout is provided in Appendix C and presents the required footprints for all tankage, buildings and other equipment to the projected population growth for 2051.

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

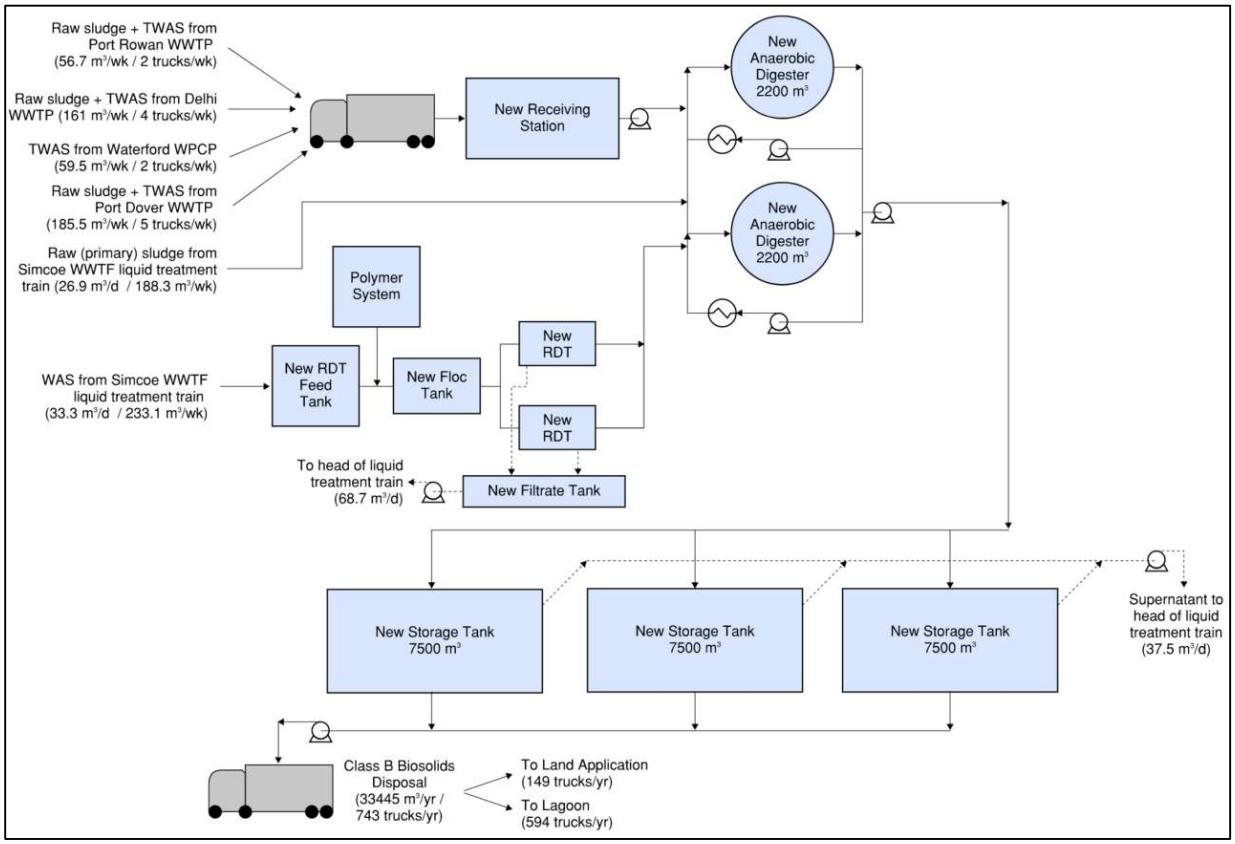


Figure 4.7: Option 1(d) – 2051 Population Growth – Process Flow Schematic

Table 4.7 presents key design values for Option 1(d) for the 2051 projected population growth. Details regarding the development of these values are presented in Appendix B.

Table 4.7: Option 1(d) – Key Design Values to 2051 Population Growth

Parameter	Design Value
Digesters	
Number and type	2 x anaerobic
Volume – each	2,200 m^3
Volume – total	4,400 m^3
Thickening Building	
Footprint of Building	18 m x 21 m (total 378 m^2)
Number of Rotary Drum Thickeners	2 x 27.5 m^3/hr (one duty/one standby)
Biosolids Storage	
Average Thickened Biosolids Concentration	3.5%
Number and Storage Volume – New Storage Tank	3 x 7,500 m^3
Storage Volume – Total	22,500 m^3

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

4.4.2 *Option 1(d) – 2051 Rated Capacity*

For the rated capacity for 2051, the following digester and storage tanks volumes are required:

- Thickening facility contains one below grade RDT feed tank with estimated volume of 630 m^3, two RDTs with required capacity of 50.3 m^3/hr operating on duty/standby mode (operating 5 days a week, 6 hours per day) and one below grade filtrate tank with estimated volume of 320 m^3.
- Three new anaerobic digesters, each with a volume of 2,400 m^3, providing a total volume of 7,200 m^3.
- Four new biosolids storage tanks, each with a volume of 9,000 m^3, providing a total of 36,000 m^3.

A process flow diagram of Option 1(c) – 2051 Rated Capacity is presented in Figure 4.8. A conceptual level site layout is provided in Appendix C and presents the required footprints for all tankage, buildings and other equipment when the facilities are operating at their rated capacities in 2051.

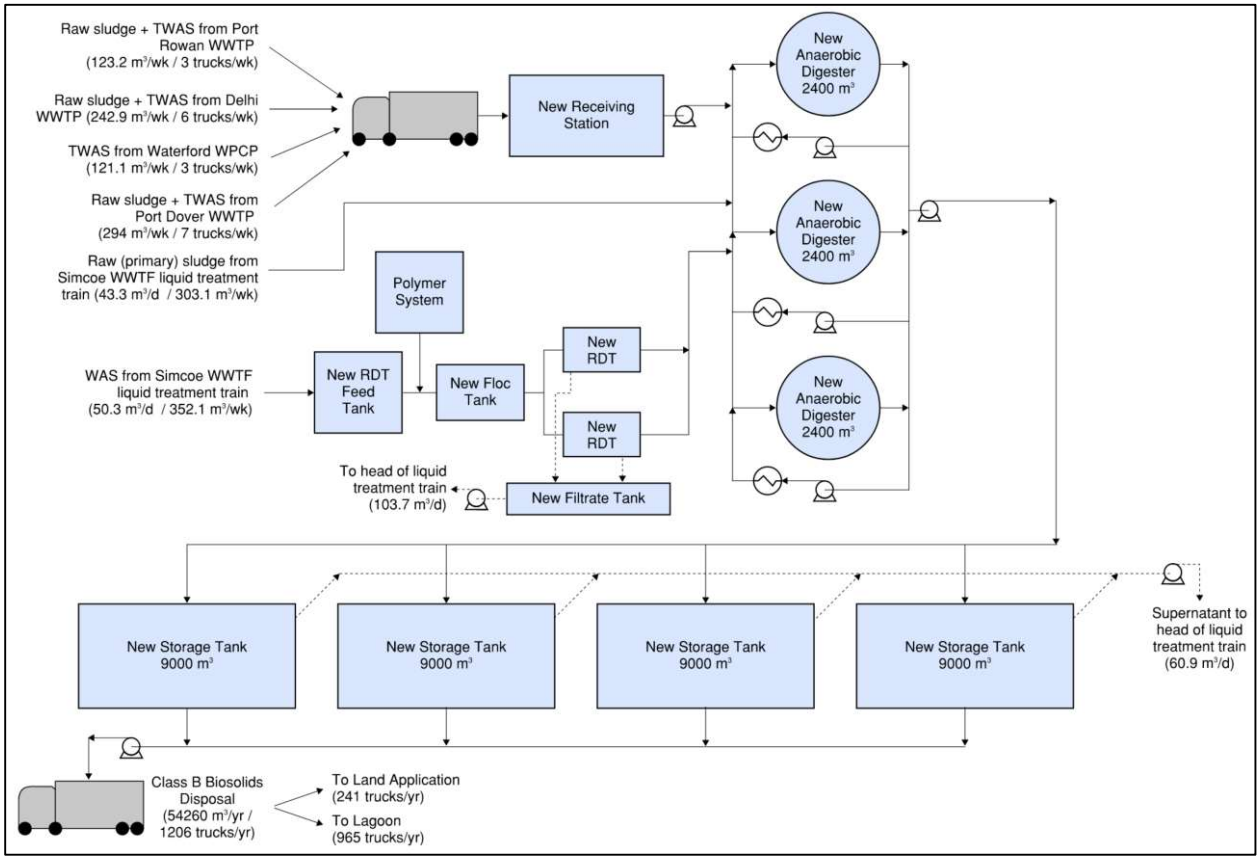


Figure 4.8: Option 1(d) – 2051 Rated Capacity – Process Flow Schematic

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

Table 4.8 presents key design values for Option 1(d) to the design year of 2051 with all facilities operating at their rated capacities. Details regarding the development of these values are presented in Appendix B.

Table 4.8: Option 1(d) – Key Design Values to 2051 Rated Capacity

Parameter	Design Value
Digesters	
Number and type	3 x anaerobic
Volume – each	2,400 m^3
Volume – total	7,200 m^3
Thickening Building	
Footprint of Building	18 m x 21 m (total 378 m^2)
Number of Rotary Drum Thickeners	2 x 50.3 m^3/hr (one duty/one standby)
Biosolids Storage	
Average Thickened Biosolids Concentration	3.5%
Number and Storage Volume – New Storage Tank	4 x 9,000 m^3
Storage Volume – Total	36,000 m^3

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

5. Review and Evaluation of Options 1(a) to 1(d)

Option 1 consisted of four conventional anaerobic sludge digestion and biosolids storage options as detailed above in Section 3.3, each including anaerobic digesters and biosolids storage tanks, with options 1(b) to 1(d) including biosolids thickening at various process stages. The options reviewed considered both 2051 population growth projected flows and 2051 rated capacity scenarios. The Option 1 alternatives have been evaluated based on estimated costs, including capital costs, O&M costs, and 27-year life cycle costs considering their footprint and land requirements.

5.1 Capital and Operational Costs

Class D capital cost estimate (+50%/-35%) for each alternative were calculated considering all major equipment and tankages, including the digesters, biosolids storage tanks, digester and biosolids control rooms, and thickening building. The capital costs also included site works, including excavation required for tanks and additional land requirements. The estimated capital costs excluded common elements between the alternatives, electrical substation, existing facility upgrades such as headworks or administration building, yard piping, or Division 1 costs such as mobilization, demobilization, bonding and insurance. Additionally, a 35% contingency has been applied, as requested by the County. Therefore, the estimated Class D capital costs should be used to assess the difference in capital costs between proposed options, rather than as an estimate of total construction capital costs.

Operational costs include energy, chemical, labour, and annual maintenance costs, as well as sludge disposal costs. No allowances were included for the operation of the liquid treatment train. Similarly to the capital costs, the estimated O&M costs were used to assess the difference in annual operating costs between all four options, rather than as an estimate of total O&M costs for proposed upgrades. All costs are in 2024 dollars.

The County requested that a 25-year life cycle cost analysis to be provided. As the options were considering the design year of 2051, a 27-life cycle cost analysis was calculated to consider all costs incurred until 2051. To cover the increases in operational costs due to equipment degradation over time, a 5% increase in annual operational costs was included in the life cycle cost calculation. The life cycle cost has been presented in terms of net present value.

A cost summary for Option 1 alternatives has been presented in Table 5.1, including the breakdown of capital, operational, and life cycle costs. For the 2051 population growth scenario, option 1(b) presented the lowest capital cost, while option 1(d) presented the lowest capital cost for the 2051 rated capacity scenario. It should be noted that costs associated with WAS thickening at the other four facilities were not considered in the comparative capital cost estimate for option 1d. Option 1(b) presented the lowest operational costs for both scenarios. Despite not having the lowest capital cost for the 2051 rated capacity scenario, due to the lowest O&M costs, option 1(b) was found to have the lowest life cycle costs for both scenarios.

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

Table 5.1: Cost Summary of Options 1(a) to 1(d)

Option 1 - Summary	Capital Cost ($) (1)	Annual O&M Costs ($)	27-year Life Cycle Cost ($)
2051 Population Growth			
Option 1(a)	64,400,000	423,000	81,150,000
Option 1(b)	58,133,000	350,000	72,000,000
Option 1(c)	63,278,000	502,000	83,130,000
Option 1(d)	65,100,000	494,000	84,661,000
2051 Rated Capacity			
Option 1(a)	87,123,000	666,000	113,492,000
Option 1(b)	87,340,000	530,000	108,312,000
Option 1(c)	87,450,000	774,000	118,064,000
Option 1(d)	84,691,000	761,300	114,820,000

Notes:
(1) Capital costs do not include common elements such as sludge receiving facility, waste gas burner, power supply upgrade and standby generator.

5.2 Footprint and Land Requirements

A summary of the digester and biosolids storage tank quantities and volumes, as well as any additional land requirements has been presented in Table 5.2. Due to the configuration of the proposed site location, options 1(a), 1(c) and 1(d) would require additional land to accommodate the proposed new digesters, biosolids storage tanks, control buildings, electrical substation, and thickening building for the 2051 rated capacity scenario.

Table 5.2: Summary of Options 1(a) to 1(d)

Option 1 - Summary	Digester Vol. (m^3)	Biosolids Storage Tank Vol. (m^3)	Additional Land Required (m^2)
2051 Population Growth			
Option 1(a)	2 x 2,800	3 x 7,600	0
Option 1(b)	2 x 2,800	2 x 6,400	0
Option 1(c)	2 x 2,200	3 x 7,500	0
Option 1(d)	2 x 2,200	3 x 7,500	0
2051 Rated Capacity			
Option 1(a)	3 x 3,100	4 x 9,300	1,625
Option 1(b)	3 x 3,000	3 x 6,900	0
Option 1(c)	3 x 2,400	4 x 9,100	1,920
Option 1(d)	3 x 2,400	4 x 9,000	1,920

5.3 Recommended Option 1 Alternative

As presented in Table 5.1, among Option 1 alternatives, Option 1(b) produced the lowest life cycle cost and annual O&M costs for both 2051 population growth and 2051 rated capacity scenarios. Capital cost for Option 1(b) 2051 population growth was found to be the lowest among other Option 1 alternatives whereas capital costs for 2051 rated capacity was within

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

the same range as Options 1(a) and 1(c). In addition, Option 1(b) did not require land acquisition to accommodate the proposed facility footprint for either scenario. As such, Option 1(b) was selected for comparison with Option 2 which included using the THP technology and biosolids stabilization and storage at the Simcoe WWTF discussed in the next section.

6. Option 2 – Centralized THP Stabilization and Biosolids Storage at Simcoe WWTF

Option 2 involves implementing the thermal-chemical hydrolysis process (THP) system, including a polymer system, dewatering system, alkali system, THP reactor, an anaerobic digestion tank, and a fertilizer storage tank. For both scenarios, an odour control system was considered.

Similarly to the conventional anaerobic digestion options, Option 2 was evaluated for both the 2051 population growth and 2051 rated capacity scenarios, and details for each have been presented below.

The conceptual level design for Option 2 consists of the following:

- Co-thickened sludge from Port Rowan, Port Dover and Delhi WWTPs, and WAS from Waterford WPCP would be hauled to a blend tank in the new receiving station at the Simcoe WWTF, where it would be combined with co-thickened sludge from Simcoe WWTF.
- The contents of the blend tank would then be conveyed to centrifuges, from where each centrifuge would send the dewatered sludge to the dewatered cake tank. Filtrate would be returned to the head of the Simcoe WWTF liquid treatment train.
- The cake from each dewatered cake tank would then be sent to one THP module, for a total of two THP modules, where it would be combined with alkali (Potassium Hydroxide) and low-pressure steam and sheared prior to being conveyed to the anaerobic digestion tank. Two THP modules would be required for both the 2051 Population Growth and 2051 ECA Rated Capacity scenarios. The difference between the two scenarios is the required run time of the units, where 2051 population growth scenario requires 30 hours of operations per week with two THP Modules operating. Treating the 2051 rated capacity max month flows will require two THP modules with processing times of up to 40 hours weekly.
- From the anaerobic digestion tank, the class A biosolids would be conveyed to the fertilizer storage tanks prior to disposal via land application.

6.1 Option 2 – 2051 Population Growth

For the projected population growth for 2051, the following anaerobic digestion tank and fertilizer tank volumes are required:

- One new anaerobic digestion tank with a volume of 5,000 m^3.

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

- One new fertilizer storage tank with a volume of 5,000 m^3.

A process flow diagram of Option 2 – 2051 Population Growth is presented in Figure 6.1. A conceptual level site layout is provided in Appendix C and presents the required footprints for all tankages, buildings and other equipment to the projected population growth for 2051.

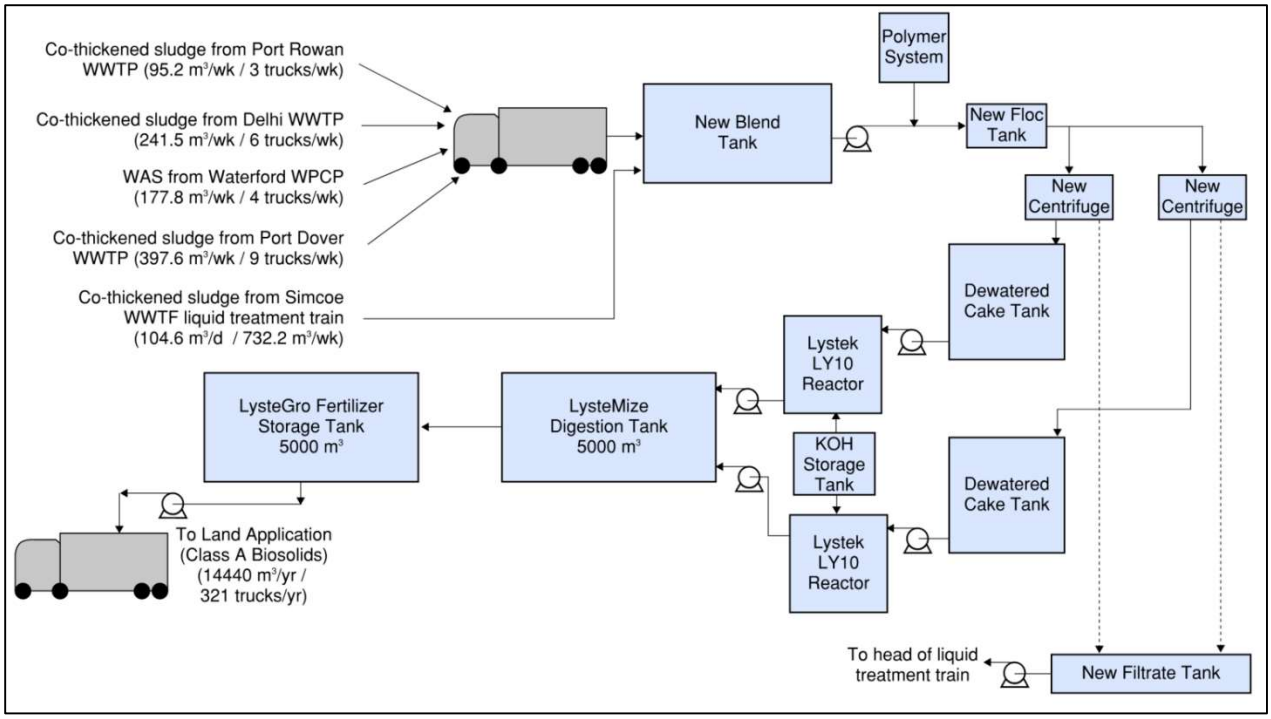


Figure 6.1: Option 2 – 2051 Population Growth – Process Flow Schematic

Table 6.1 presents key design values for Option 2 for the 2051 projected population growth. Details regarding the development of these values are presented in Appendix B.

Table 6.1: Option 2 – Key Design Values to Projected 2051 Population Growth

Parameter	Design Value
THP Building	
Required Footprint	29.5 m x 12.5 m (total 369 m^2)
Number of Centrifuges	2
Number of Dewatered Biosolids Tanks	2
Number of THP Modules	2
Number of KOH Tanks	1
Biosolids Storage	
Storage Volume – Anaerobic Digestion Tank	5,000 m^3
Storage Volume – Fertilizer Storage Tank	5,000 m^3
Storage Volume – Total	10,000 m^3

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

6.2 Option 2 – 2051 Rated Capacity

For the rated capacity for 2051, the following anaerobic digestion and fertilizer storage tank volumes are required:

- One new digestion tank with a volume of 5,000 m^3.
- Two new fertilizer storage tanks, each with a volume of 5,000 m^3, providing a total of 10,000 m^3.

A process flow diagram of Option 1(c) – 2051 Rated Capacity is presented in Figure 6.2. A conceptual level site layout is provided in Appendix C and presents the required footprints for all tankages, buildings and other equipment when the facilities are operating at their rated capacities in 2051.

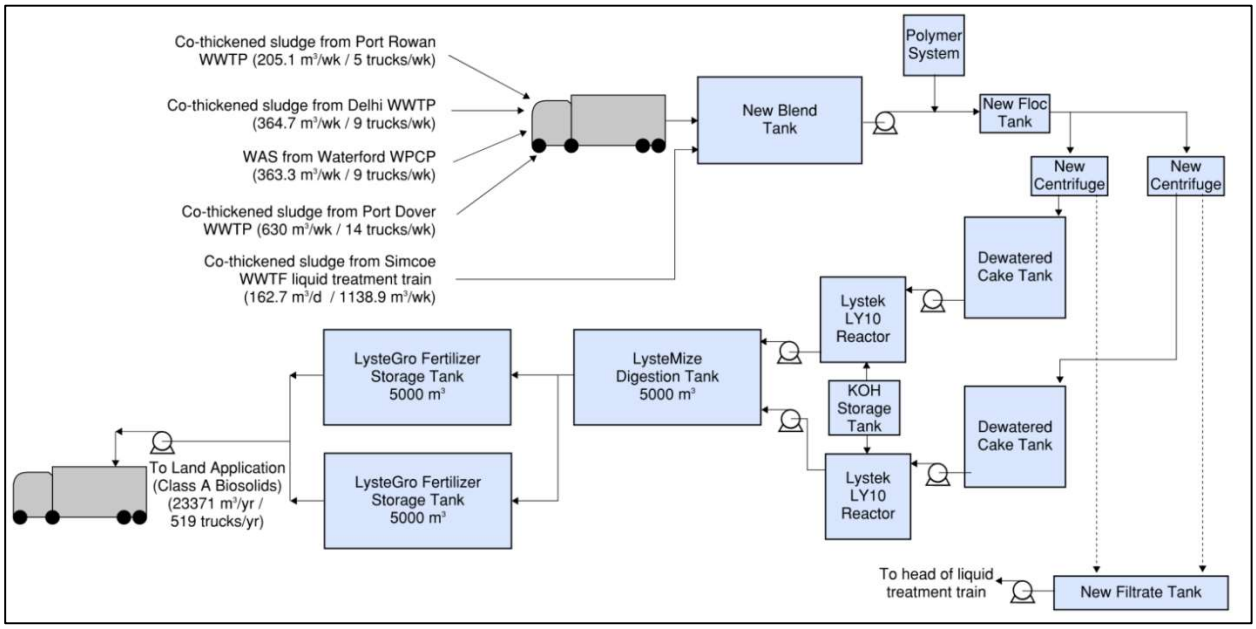


Figure 6.2: Option 2 – 2051 Rated Capacity – Process Flow Schematic

Table 6.2 presents key design values for Option 1(d) to the design year of 2051 with all facilities operating at their rated capacities. Details regarding the development of these values are presented in Appendix B.

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

Table 6.2: Option 2 – Key Design Values to 2051 Rated Capacity

Parameter	Design Value
THP Building	
Required Footprint	29.5 m x 12.5 m (total 369 m^2)
Number of Centrifuges	2
Number of Dewatered Cake Tanks	2
Number of THP Modules	2
Number of KOH Tank	1
Biosolids Storage	
Storage Volume – Anaerobic Digestion Tank	5,000 m^3
Storage Volume – Fertilizer Storage Tank	2 x 5,000 m^3
Storage Volume – Total	15,000 m^3

6.3 Option 2 – Capital and Operational Cost

Class D capital cost estimate (+50%/-35%) for option 2 includes all major equipment and tankages, including centrifuges, macerator/grinder, dewatered cake tanks, THP Modules, KOH tank, anaerobic digestion tank and fertilizer storage tank. The estimated capital costs exclude common elements between the alternatives, including sludge receiving facility, electrical substation, existing facility upgrades such as headworks or administration building, yard piping, or Division 1 costs such as mobilization, demobilization, bonding and insurance. Additionally, a 35% contingency has been applied, as requested by the County. Therefore, the capital costs should be used to assess the difference in capital costs between options, rather than as an estimate of total construction capital costs.

Operational costs include energy, chemical, labour, and annual maintenance costs, as well as sludge disposal costs. The County requested that a 25-year life cycle cost analysis to be provided. As the options were considering the design year of 2051, a 27-year life cycle cost analysis was calculated to consider all costs incurred until 2051. To cover the increases in operational costs due to equipment degradation over time, a 5% increase in annual operational costs was included in the life cycle cost calculation. The life cycle cost has been presented in terms of net present value.

A cost summary for Option 2 has been presented in Table 6.3, including the breakdown of capital, operational, and life cycle costs. For the 2051 population growth scenario, option 2 presented the lowest capital, O&M costs and found to have the lowest life cycle costs.

Table 6.3: Cost Summary of Option 2

Option 2- Summary	Capital Cost ($)	Annual O&M Costs ($)	27-year Life Cycle Cost ($)
2051 Population Growth	$31,267,000	$601,000	$55,044,000
2051 Rated Capacity	$34,043,000	$915,000	$70,233,000

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

7. Evaluation of Sludge Processing and Biosolids Storage for Short-listed Options (Option 1b and 2)

7.1 Life Cycle Costs Comparison

A life cycle cost (LCC) analysis was completed to estimate the net present value of options 1b, discussed in previous section, and option 2. The results of the LCC analysis along with O&M and capital costs for both options are presented in Table 7.1.

Table 7.1: Life Cycle Cost Analysis

Option	Rank	27-year LCC ($) (1)	Annual O&M Costs ($)	Capital Cost ($) (2)
Option 2 – 2051 Population Growth	1	55,044,000	$601,000	$31,267,000
Option 2 – 2051 Rated Capacity	2	70,233,000	$915,000	$34,043,000
Option 1(b) – 2051 Population Growth	3	72,000,000	$350,000	$58,133,000
Option 1(b) – 2051 Rated Capacity	4	108,312,000	$530,000	$87,340,000

Notes:
1. Life cycle cost analyses based on an inflation rate of 5% and interest rate of 3%.

Capital costs do not include common elements between the alternatives, including sludge receiving facility, electrical substation, yard piping, or Division 1 costs such as mobilization, demobilization, bonding and insurance. Refer to Appendix D for overall capital costs breakdown for each option.

Based on the results presented in Table 7.1, Option 2 – 2051 population growth has the lowest 27-year LCC, annual O&M and capital costs.

7.2 Evaluation Methodology

The evaluation criteria described in Table 7.2 were used to evaluate the sludge digestion and biosolids storage options. Based on the evaluation of Option 1 conducted in Section 5, only Option 1(b) was carried forward for further evaluation with Option 2. The options were each evaluated considering the environmental, social, economic and technical impacts.

Table 7.3 presents the information matrix for the evaluation of the options, while Table 7.4 presents the results of the evaluation of the sludge processing and biosolids storage options. Capital costs include a 35% contingency, as requested by the County. Operational costs include energy, chemical, labour, and annual maintenance costs, as well as sludge disposal costs. No allowances were included for the operation of the liquid treatment train. Therefore, these O&M costs should be used to assess the difference in annual operating costs between options, rather than as an estimate of total O&M costs. All costs are in 2024 dollars.

As show in Table 7.3, an information matrix was prepared to present details on each design option. The information included impacts associated with each option, potential mitigation measures to reduce the predicted impacts, and the net impacts (i.e. those impacts that remain after mitigation).

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

The evaluation matrix provides a score between 1 and 5 for the two alternatives meeting each criteria, as follows:

- Score of 1 – Meets criterion objectives/positive impact/lowest cost.
- Score of 2 – Meets most aspects of the criterion/little to no negative impact.
- Score of 3 – Meets some aspects of the criterion/potential for negative impact.
- Score of 4 – Meets few aspects of the criterion/high potential for negative impact.
- Score of 5 – Does not meet criterion/negative impact/highest cost.

Criterion weighting was completed in collaboration with the County during a workshop held on June 26, 2024. The option scoring was conducted by Hatch using the criteria noted in Table 7.2 and characteristics of each option noted in Table 7.3. For each option, a total score was calculated as the sum of the individual criteria scores and the options were ranked according to the total scores. The option with the lowest total score was selected as the preferred option.

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

Table 7.2: Evaluation Criteria

Criteria	Score = 1	Score = 2	Score = 3	Score = 4	Score = 5
Environmental					
Air Quality Impacts (emissions, traffic)	Reduction in current emissions	Emissions will be similar to current emissions.	Slight increase in emissions, will require added emissions management capacity, but no new emissions technology.	Emissions will require additional emissions treatment technologies such as RTO, particulate filters and scrubbers.	Significant emissions potential, requires EIA, emissions modeling, and extensive treatment for particulates, dioxins, mercury, NOX, SOX, VOCs, H2S etc.
Resource Recovery (biogas, fertilizer)	Preserves or converts to useable form most of the energy, nutrient and organics in the biosolids	Preserves or converts to useable form some of the energy, nutrient and organics in the biosolids	Reduces the energy or nutrient value of the end product.	Reduces the energy and nutrient value of the end product.	Minimal residual energy or nutrient value in the end product.
Risk of negative impacts (nutrient, metals, CECs)	Risks are reduced through treatment (reduced CECs, PFAS, metals, pathogens)	Risks are partially reduced	No change in risks	Slightly increased risk of negative impacts (e.g. concentration of metals)	Elevated risk of negative impacts (e.g. concentration of metals)
Social					
Public Perception of Facility	Improves public perception through addressing 3 or more public concerns: perception of odour, footprint, land use, visual, environmental sustainability	Improves public perception through addressing 2 or more public concerns: perception of odour, footprint, land use, visual, environmental sustainability	No impact to public perception (no impact or impact not visible to public)	May create public opposition through 2 or more public concerns: perception of odour, footprint, land use, visual, environmental impacts, and emissions.	Will likely create public opposition through 3 or more public concerns: perception of odour, footprint, land use, visual, environmental impacts, and emissions.
Traffic Impacts	3 of: # of trucks reduced due to solids/volume reduction; traffic is not seasonal (i.e., distributed evenly); transport routes are not in proximity to many stakeholders.	2 of: # of trucks reduced due to solids/volume reduction; traffic is not seasonal (i.e., distributed evenly); transport routes are not in proximity to many stakeholders.	No change to traffic	1 of: traffic is increased due to solids/volume increase; traffic is increased due to added materials/chemicals; traffic is seasonal; transport routes are in proximity to many stakeholders.	>2 of: traffic is increased due to solids/volume increase; traffic is increased due to added materials/chemicals; traffic is seasonal; transport routes are in proximity to many stakeholders.
Potential for Odour Nuisance	Reduces odours from two or more sources (processing, thickening, dewatering, storage, final product)	Reduces odours from one source (processing, thickening, dewatering, storage, final product)	No change in odour	Increases odours from one source (processing, thickening, dewatering, storage, final product)	Increases odours from two or more sources (processing, thickening, dewatering, storage, final product)
Economic					
Cost to the Norfolk County	Lowest net cost in the group	Second lowest net cost in the group	Third highest net cost in the group	Second highest net cost in the group	Highest net cost in the group;
Facility Risk	No change to current facilities risk profile.	Risk from 1 of: emerging technology, safety risks (e.g. potential fires), financing risk, process upset risk, equipment risk, product acceptability risk, public opposition risk.	Risk from 2 factors: emerging technology, safety risks (e.g. potential fires), financing risk, process upset risk, equipment risk, product acceptability risk, public opposition risk.	Risk from 3 factors: emerging technology, safety risks (e.g. potential fires), financing risk, process upset risk, equipment risk, product acceptability risk, public opposition risk.	Risk from 4 or more factors: emerging technology, safety risks (e.g. potential fires), financing risk, process upset risk, equipment risk, product acceptability risk, public opposition risk.
Potential for Cost Recovery	Cost recovery may cover O&M costs and capital cost with simple payback < 5yrs	Cost recovery may cover O&M costs and capital cost with simple payback < 10 yrs	Cost recovery may cover O&M costs.	No potential for cost recovery	Product will cost the County to manage
Technical					
Compatibility with Existing Facilities	Improves existing facilities by three of: reducing footprint required; increasing capacity of existing facilities; reducing load; improving effluent; re-purposing for greater benefit; off-setting future capital costs.	Improves existing facilities by two of: reducing footprint required; increasing capacity of existing facilities; reducing load; improving effluent; re-purposing for greater benefit; off-setting future capital costs.	Minimal impact on existing facilities.	Impacts existing facilities by two of: increasing footprint required; reducing capacity of existing facilities; increasing load; increasing future capital costs.	Impacts existing facilities by three of: increasing footprint required; reducing capacity of existing facilities; increasing load; increasing future capital costs.

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

Criteria	Score = 1	Score = 2	Score = 3	Score = 4	Score = 5
Regulatory Compliance	Three of: Fits within existing Provincial and Federal biosolids related regulations. Less susceptible to future regulatory changes related to CEC, nutrients, metals etc. Will not require additional permits for emissions or waste streams. Will not impact regulatory compliance of existing facilities (such as effluent quality).	Two of: Fits within existing Provincial and Federal biosolids related regulations. Less susceptible to future regulatory changes related to CEC, nutrients, metals etc. Will not require additional permits for emissions or waste streams. Will not impact regulatory compliance of existing facilities (such as effluent quality).	One of: Fits within existing Provincial and Federal biosolids related regulations. Less susceptible to future regulatory changes related to CEC, nutrients, metals etc. Will not require additional permits for emissions or waste streams. Will not impact regulatory compliance of existing facilities (such as effluent quality).	Technology and product are established in other jurisdictions but have not been permitted in Ontario.	Two of: Current significant regulatory constraints. Regulators not familiar with technology and product. Effort to permit facility likely to require significant effort.
Industry Experience	>100 installations	>10 installations	>5 installations	< 5 installations	Emerging - pilot/demonstration scale only.
Process Operability and Reliability	Simple process with flexible process parameters; low potential of equipment fouling and failure; low risk of upset conditions; can handle feedstock variability; redundant equipment installed.	Minimum process complexity with flexible process parameters; medium potential of equipment fouling and failure; medium risk of upset conditions; requires feedstock with lower variability; redundant equipment installed.	Medium process complexity with flexible process parameters; medium potential of equipment fouling and failure; medium risk of upset conditions; requires feedstock with lower variability; redundant equipment installed.	Complex process with narrow process parameters; equipment with high fouling potential; high risk of upset conditions; requires specialized operations knowledge training and experience; requires consistent feedstock; redundant equipment expensive to install.	Highly complex process with narrow process parameters; equipment with high fouling potential; high risk of upset conditions; requires specialized operations knowledge training and experience; requires consistent feedstock; redundant equipment expensive to install.
Maintenance	Lower equipment and I/O count; operating conditions are ambient or mesophilic (< 40C), low pressure (< 7 bar); typical WW equipment (pumps, blowers etc.); no large high-speed rotating equipment; no new heat exchangers and boilers required; no additional power or boiler technicians required.	Low equipment and I/O count; operating conditions are thermophilic (< 60C), low pressure (< 7 bar); no large high-speed rotating equipment; no additional power or boiler technicians required.	Medium equipment and I/O count; operating conditions are below boiling point (< 100C), low pressure (< 7 bar); large high-speed rotating equipment; new heaters and heat exchangers required; no additional power or boiler technicians required.	Higher equipment and I/O count; operating conditions are above boiling point (> 100C), higher pressure (> 7 bar); large high-speed rotating equipment; new heaters and heat exchangers required; additional power or boiler technicians required.	High equipment and I/O count; operating conditions are high temperature (> 300C), high pressure (>20 bar); large high-speed rotating equipment; new heaters and heat exchangers required; power or boiler technicians required.
Footprint and Expandability	No additional footprint required AND increases capacity of existing facilities, reducing overall net footprint. Easy to expand - footprint, cost, economies of scale, constructability, modular, suitable for project phasing and expandability	No change in net footprint. Three of: footprint, cost, economies of scale, constructability, modular, suitable for project phasing and expandability	Will require additional footprint, but can be accommodated with minimal impact. Small footprint required < 1 acres. Two of: footprint, cost, economies of scale, constructability, suitable for project phasing and expandability	Medium footprint required <2 acres. Two of: footprint, cost, economies of scale, constructability, are not suitable for project phasing and expandability	Footprint required will have significant impact, requiring relocation of facilities or preventing further expansion. Large footprint required > 2 acres. Footprint, cost, economies of scale, constructability, are not suitable for project phasing and expandability
Ease of Implementation	This score will require less effort for implementation by meeting minimum four of the following features: No pilot studies required; regulatory process is predictable; siting and tie-ins are straightforward; equipment selection is established; easy to construct; funding/capital straightforward; no stakeholder engagement required.	This score will require less effort for implementation by meeting minimum three of the following features: No pilot studies required; regulatory process is predictable; siting and tie-ins are straightforward; equipment selection is established; easy to construct; funding/capital straightforward; no stakeholder engagement required.	This score will require minimum two of the following features: Pilot studies required; regulatory process is extensive and unknown; siting and tie-ins are complex; equipment selection is complex/proprietary; complex to design and construct; funding/capital complex; extensive stakeholder engagement required.	This score will require minimum three of the following features: Pilot studies required; regulatory process is extensive and unknown; siting and tie-ins are complex; equipment selection is complex/proprietary; complex to design and construct; funding/capital complex; extensive stakeholder engagement required.	This score will require minimum four of the following features: Pilot studies required; regulatory process is extensive and unknown; siting and tie-ins are complex; equipment selection is complex/proprietary; complex to design and construct; funding/capital complex; extensive stakeholder engagement required.
Product Sustainability (risk)	This score will require minimum three of the following features: Product can be used in a wide range of diverse markets; product can be used in a market that is large and very stable; product does not have levels of CECs that could impact future use; product quality (e.g. nutrient,	This score will require minimum two of the following features: Product can be used in a wide range of diverse markets; product can be used in a market that is large and very stable; product does not have levels of CECs that could impact future use; product quality (e.g. nutrient, metal levels,	Product can be used in a market that is large, but for which the biosolids products will need to be developed; product does not have levels of CECs that could impact future use; product quality (e.g. nutrient, metal levels, calorific value) will not restrict	This score will require minimum two of the following features: Product suited for a single market; product market has been restricted by regulations and/or public perception in other jurisdictions; product may have levels of CECs that could impact future use; product quality (e.g.	This score will require minimum two of the following features: Product suited for a single market; product market has been restricted by regulations and/or public perception in other jurisdictions; product may have levels of CECs that could impact future use; product quality (e.g.

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

Criteria	Score = 1	Score = 2	Score = 3	Score = 4	Score = 5
	metal levels, calorific value) will not restrict its use.	calorific value) will not restrict its use.	its use.	nutrient, metal levels, calorific value) will restrict its use.	nutrient, metal levels, calorific value) will restrict its use.
O&M Safety	Safety considerations <2 of: Temperature< 40 degree C, Gas emissions; volatiles; ignitability; explosion risk; high speed rotating equipment; high power/voltage systems; chemical use.	Safety considerations <3 of: Temperature <70 degree C, gas emissions; volatiles; ignitability; explosion risk; high speed rotating equipment; high power/voltage systems; chemical use.	Safety considerations four of: high temperature < 100 degree C; gas emissions; volatiles; ignitability; explosion risk; high speed rotating equipment; high power/voltage systems; chemical use.	Safety considerations four of: High pressure > 7 bar; high temperature> 100 degree C; gas emissions; volatiles; ignitability; explosion risk; high speed rotating equipment; high power/voltage systems; chemical use.	Safety considerations four of: High pressure > 20 bar; high temperature> 300 degree C; gas emissions; volatiles; ignitability; explosion risk; high speed rotating equipment; high power/voltage systems; chemical use.
End product storage requirements	Minimal storage required as product can be delivered to market rapidly and continuously. No special storage precautions required.	Short-term storage required to manage product supply chain. No special storage precautions required.	End product requires limited storage (< 2 days), but requires precautions for product safety such as nitrogen blanket, cooling, dust suppression, emissions management.	End product use has seasonal variability, but can be used most of the year. Product volume is reduced through treatment.	End product is seasonal and weather dependent. Requires significant storage volume due to product volume and seasonal restrictions.
Schedule	Shortest construction schedule.	Second shortest construction schedule.	Third longest construction schedule.	Second longest construction schedule.	Longest construction schedule.

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

Table 7.3: Evaluation of Options

Criteria	Option 1(b) – 2051 Population Growth	Option 1(b) - 2051 Rated Capacity	Option 2 – 2051 Population Growth	Option 2 – 2051 Rated Capacity
Environmental				
Air Quality Impacts (emissions, traffic)	• Reduction in current emissions (-423 tonne CO_2e)	• Reduction in current emissions (-423 tonne CO_2e)	• Reduction in current emissions (-465 tonne CO_2e) with potential for additional reduction due to excess biogas.	• Reduction in current emissions (-465 tonne CO_2e) with potential for additional reduction due to excess biogas.
Resource Recovery (biogas, fertilizer)	• Biogas produced can be used to meet heating demands. Heating demands will consume majority of produced biogas. • Seasonal land application limitations for Class B biosolids	• Biogas produced can be used to meet heating demands. Heating demands will consume majority of produced biogas. • Seasonal land application limitations for Class B biosolids	• Biogas produced in digestion tank can be recycled and used by boiler to produce steam of THP reactor, and remaining biogas can be used to offset electrical or natural gas requirements in other areas of Simcoe WWTF. • Class A biosolids used as fertilizer for local farms.	• Biogas produced in digestion tank can be recycled and used by boiler to produce steam of THP reactor, and remaining biogas can be used to offset electrical or natural gas requirements in other areas of Simcoe WWTF. • Class A biosolids used as fertilizer for local farms.
Risk of negative impacts (nutrient, metals, CECs)	• Risks are partially reduced through treatment (reduced CECs, PFAS, metals, pathogens)	• Risks are partially reduced through treatment (reduced CECs, PFAS, metals, pathogens)	• Risks are reduced through treatment (reduced CECs, PFAS, metals, pathogens)	• Risks are reduced through treatment (reduced CECs, PFAS, metals, pathogens)
Social				
Public Perception of Facility	• Lower quality of biosolids (Class B) for land use • Odour control implemented to reduce odour nuisance for public • No additional land required (fits within current site boundaries) • Second largest footprint, minimal room for expansion	• Lower quality of biosolids (Class B) for land use • Odour control implemented to reduce odour nuisance for public • No additional land required (fits within current site boundaries) • Largest footprint, no room for expansion	• Higher quality of biosolids (Class A) for land use • No additional land required (fits within current site boundaries) • Odour control implemented to reduce odour nuisance for public • Smallest footprint, room for expansion	• Higher quality of biosolids (Class A) for land use • No additional land required (fits within current site boundaries) • Odour control implemented to reduce odour nuisance for public • Second smallest footprint, room for expansion
Traffic Impacts	• Higher biosolids volume to be hauled • 240 days of on-site storage	• Higher biosolids volume to be hauled • 240 days of on-site storage	• Lower biosolids volume to be hauled • 239 days of on-site storage	• Lower biosolids volume to be hauled • 221 days of on-site storage
Potential for Odour Nuisance	• Odour control implemented at thickening	• Odour control implemented at thickening	• Odour control implemented for dewatering, thickening and storage	• Odour control implemented for dewatering, thickening and storage
Economic				
Cost to the Norfolk County	• Second highest capital cost - $58M • Lowest operating cost - $350K • Second highest lifecycle cost - $72M	• Highest capital cost - $87M • Second lowest operating cost - $530K • Highest lifecycle cost - $108M	• Lowest capital cost - $31M • Second highest operating cost - $600K • Lowest lifecycle cost - $55M	• Second lowest capital cost - $34M • Highest operating cost - $914K • Second lowest lifecycle cost - $70M
Facility Risk	• No change to current facility risk profile	• No change to current facility risk profile	• No change to current facility risk profile	• No change to current facility risk profile
Potential for Cost Recovery	• No potential for cost recovery	• No potential for cost recovery	• Revenue sharing program provides opportunity for fertilizer sales to offset suppliers' management fees	• Revenue sharing program provides opportunity for fertilizer sales to offset suppliers' management fees

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

Criteria	Option 1(b) – 2051 Population Growth	Option 1(b) - 2051 Rated Capacity	Option 2 – 2051 Population Growth	Option 2 – 2051 Rated Capacity
		Technical		
Compatibility with Existing Facilities	• Benefits to other facilities (repurposing existing digestion area, reducing loads, offsetting future capital costs)	• Benefits to other facilities (repurposing existing digestion area, reducing loads, offsetting future capital costs)	• Benefits to other facilities (repurposing existing digestion area, reducing loads, offsetting future capital costs)	• Benefits to other facilities (repurposing existing digestion area, reducing loads, offsetting future capital costs)
Regulatory Compliance	• NASM regulatory requirements	• NASM regulatory requirements	• CFIA regulated fertilizer • Meets all local, provincial and federal requirements	• CFIA regulated fertilizer • Meets all local, provincial and federal requirements
Industry Experience	• Common industry application	• Common industry application	• Newer and few treatment technology applications (19 THP Modules operating world-wide)	• Newer and few treatment technology applications (19 THP Modules operating world-wide)
Process Operability and Reliability	• Higher risk of upset conditions • Requires feedstock with minimal variability • Redundant equipment included.	• Higher risk of upset conditions • Requires feedstock with minimal variability • Redundant equipment included.	• Low risk of upset conditions • Can handle feedstock variability	• Low risk of upset conditions • Can handle feedstock variability
Maintenance	• Typical wastewater equipment • Operating conditions <40C • Low pressure	• Typical wastewater equipment • Operating conditions <40C • Low pressure	• Low pressure • Large high speed rotating equipment • Operating conditions <100C • No additional power or boiler technician required	• Low pressure • Large high speed rotating equipment • Operating conditions <100C • No additional power or boiler technician required
Footprint and Expandability	• Second largest required footprint • Difficult to expand	• Largest required footprint • Difficult to expand	• Smallest required footprint • Suitable for project phasing and expandability • Modular • Easy to expand	• Smallest required footprint • Suitable for project phasing and expandability • Modular • Easy to expand
Ease of Implementation	• No pilot study required • Regulatory process is predictable • Equipment selection is established • Stakeholder engagement required	• No pilot study required • Regulatory process is predictable • Equipment selection is established • Stakeholder engagement required	• No pilot study required • Equipment selection established and proprietary • Easy to construct • Stakeholder engagement required • Regulatory process is predictable	• No pilot study required • Equipment selection established and proprietary • Easy to construct • Stakeholder engagement required • Regulatory process is predictable
Product Sustainability (risk)	• Product (class B biosolids) can be used in a market that is large, but for which the biosolids products will need to be developed • Product quality will restrict its use	• Product (class B biosolids) can be used in a market that is large, but for which the biosolids products will need to be developed • Product quality will restrict its use	• Product (class A biosolids) can be used in a market that is large and stable. • Product quality will not restrict its use.	• Product (class A biosolids) can be used in a market that is large and stable.
O&M Safety	• Temperature <40C • Gas emissions • Explosion risk	• Temperature <40C • Gas emissions • Explosion risk	• Temperature <100C • Gas emissions • High speed rotating equipment • Chemical use • Low pressure • Explosion risk	• Temperature <100C • Gas emissions • High speed rotating equipment • Chemical use • Low pressure • Explosion risk

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

Criteria	Option 1(b) – 2051 Population Growth	Option 1(b) - 2051 Rated Capacity	Option 2 – 2051 Population Growth	Option 2 – 2051 Rated Capacity
End product storage requirements	• End product has seasonal variability • End product has 240 days of storage • Second largest storage requirement • No special storage precautions required.	• End product has seasonal variability • End product has 240 days of storage • Largest storage requirement • No special storage precautions required.	• End product has seasonal variability • End product has 239 days of storage • Product volume is reduced through treatment • Smallest storage requirement • No special storage precautions required.	• End product has seasonal variability • End product has 211 days of storage • Product volume is reduced through treatment • Smallest storage requirement • No special storage precautions required.
Schedule (Design and Construction)	• Second longest project completion timeline.	• Longest project completion timeline.	• Shortest . project completion timeline.	• Second shortest project completion. timeline.

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

Table 7.4: Summary of Evaluation of Options

Evaluation Criteria	Score 1 +ve; 5 -ve	Criterion Weighting (%)	Option							
			1(b) 2051 Population Growth		1(b) 2051 Rated Capacity		2 2051 Population Growth		2 2051 Rated Capacity	
			Wtd Score	Score	Wtd Score	Score	Wtd Score	Score	Wtd Score	Score
Environmental		**20%**	**6.6**		**6.6**		**4.0**		**4.0**	
Air Quality Impacts	1 – low; 5 – high	7	7	1	7	1	7	1	7	1
Resource Recovery	1 – high; 5 – low	6	12	2	12	2	6	1	6	1
Risk of negative impacts	1 – low; 5 – high	7	14	2	14	2	7	1	7	1
Social		**20%**	**12.0**		**12.0**		**5.4**		**5.4**	
Public Perception of Facility	1 – easier; 5 – difficult	6	18	3	18	3	6	1	6	1
Traffic Impacts	1 – low; 5 – high	7	28	4	28	4	14	2	14	2
Potential for Odour Nuisance	1 – low; 5 – high	7	14	2	14	2	7	1	7	1
Economic		**30%**	**14.0**		**20.0**		**10.0**		**12.0**	
Cost to the Norfolk County	1 – low; 5 – high	10	20	2	50	5	10	1	20	2
Facility Risk	1 – low; 5 – high	10	10	1	10	1	10	1	10	1
Potential for Cost Recovery	1 – easier; 5 – difficult	10	40	4	40	4	30	3	30	3
Technical		**30%**	**13.2**		**13.2**		**12.0**		**12.0**	
Compatibility with Existing Facilities	1 – easier; 5 – difficult	3	3	1	3	1	3	1	3	1
Regulatory Compliance	1 – high; 5 – low	3	6	2	6	2	3	1	3	1
Industry Experience	1 – extensive; 5 – limited	2	2	1	2	1	4	2	4	2
Process Operability and Reliability	1 – good; 5 – poor	3	9	3	9	3	3	1	3	1
Maintenance	1 – low; 5 – high	3	3	1	3	1	9	3	9	3

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

Evaluation Criteria	Score 1 +ve; 5 -ve	Criterion Weighting (%)	Option							
			1(b) 2051 Population Growth		1(b) 2051 Rated Capacity		2 2051 Population Growth		2 2051 Rated Capacity	
			Wtd Score	Score	Wtd Score	Score	Wtd Score	Score	Wtd Score	Score
Footprint and Expandability	1 – compact; 5 – large	3	6	2	6	2	3	1	3	1
Ease of Implementation	1 – easier; 5 – difficult	3	6	2	6	2	6	2	6	2
Product Sustainability	1 – sustainable; 5 – at risk	3	9	3	9	3	6	2	6	2
O&M Safety	1 – high; 5 – less safe	3	6	2	6	2	9	3	9	3
End product storage requirements	1 – high; 5 – low	2	10	5	10	5	8	4	8	4
Schedule	1 – shortest; 5 - longest	2	8	5	10	4	2	1	4	2
Total Score (/500)			231		263		153		165	
Total Weighted Score (/100)			**46.2**		**52.6**		**30.6**		**33.0**	

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

The ranking of options were based on the scores presented in Table 7.4 and is summarized in Table 7.5.

Table 7.5: Ranking of Options Based on Evaluation Scores

Option	Score	Rank
Option 2 – 2051 Population Growth	**30.6**	**1**
Option 2 – 2051 Rated Capacity	33.0	2
Option 1(b) – 2051 Population Growth	46.2	3
Option 1(b) – 2051 Rated Capacity	52.6	4

Based on the evaluation results, it can be seen that the two options that involve using THP technology (Option 2) are the highest ranked options, while the two conventional anaerobic digestion options (1b) are lowest ranked. These results support the conclusion that the preferred option for digestion is Option 2 – Centralized THP Stabilization and Biosolids Storage at Simcoe WWTF.

As Option 2 – 20251 population growth was the highest ranked option in Table 7.5, Option 2 – 2051 population growth was selected as the preferred option for sludge digestion and biosolids storage at the Simcoe WWTF.

7.3 Greenhouse Gas Emissions

A comparison of the greenhouse gas emissions for Options 1(b) and 2 was conducted by Lystek International and the full analysis has been provided in Section 7 of the Proposal for Lystek THP, LysteMize Digestion, and LysteGro Fertilizer Program included in Appendix A of this TM.

This section summarizes the greenhouse gas (GHG) emissions associated with the 2051 Population Growth scenario for both Option 1B and Option 2, focusing on key components and their contributions to overall emissions. Overall, the analysis in this section is a comprehensive overview of the GHG emissions associated with both biosolids management options, highlighting the key components and their respective contribution. The GHG emission estimates were prepared for the Year 2051 population growth scenario. The methodology used for estimating GHG emissions for each option is described below.

7.3.1 Basis of Calculations

The GHG estimation factors used in the study are listed in Table 7.6.

Table 7.6: Emissions and Credit Factors used in the GHG Analysis of Biosolids Management Options

Item	Factor	Unit	Value
1.	Electricity carbon intensity factor (Average Province of Ontario)	g CO_2e/kWh	38 (Environment and Climate Change Canada, 2024)

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

2.	Global warming potential of methane	kg CO_2e/kg CH_4	25 (California Air Resources Board , 2027)
3.	Carbon intensity for diesel	kg CO_2e /L diesel	2.7 (Natural Resources Canada, 2014)
4.	Biosolids carbon sequestration rate	kg CO_2e/tonne Dry Solid	250 (North East Biosolids & Residulas Association, 2022)

7.3.1.1 Option 1B: Centralized Anaerobic Digestion and Biosolids Storage

The basis for calculation for Option 1B are listed below.

1. **Digestion:** The digestion process contributes to GHG emissions from fugitive emissions of methane during biogas burning. The electricity consumption for digester mixing is another source of GHG. The estimated GHG emission from fugitive methane emissions were estimated using the annual methane production from the anaerobic digester and assuming a flaring efficiency. Methane production rate of 395,460 m³/year and a flare efficiency of 99.75% was used in the calculations (California Air Resources Board , 2027). For electricity consumption during digester mixing, electricity consumption of 0.0065 kW/m³ of digester volume was used. A design total digester volume of 5,500 m³ for the two digesters was used (North East Biosolids & Residulas Association, 2022).
2. **Thickening / dewatering:** Polymer is utilized in rotary drum thickeners (RDTs) to enhance the thickening process of biosolids. The polymer uses of 5 kg per dry tonne of biosolids and an emission factor of 1.6 kg CO_2e per kg of polymer produced was used in the calculations. The electricity consumption in dewatering was estimated by using an electricity usage of 6 kWh per dry tonne of biosolids (North East Biosolids & Residulas Association, 2022). The dewatering in Option 1B will also produce a liquid centrate recycling nitrogen and phosphorus to the liquid treatment. This additional load of nitrogen and phosphorus will add to the GHG emissions for this option. As the resulting GHG emissions will depend on the treatment technologies for these additional loads, these were not considered in this analysis.
3. **Transportation:** Emissions for transporting biosolids to land application are determined by factors such as biosolids production, vehicle capacity, distance traveled, and vehicle fuel efficiency. Thickened biosolids production of 19,254 m³/year, a vehicle capacity of 40 m³/truck, a round-trip distance of 40 km to the landfill site and truck efficiency of 0.48 L/km, was assumed for the calculation. The GHG emissions related to transporting polymer to the Simcoe WWTF were estimated based on polymer requirements of 5 kg per dry tonne of biosolids, polymer density of 1,350 kg/m³ (Scientific Polymer Products Inc., 2024), 300 km round trip from the Greater Toronto Area to the Simcoe WWTF and a truck capacity of 20 m³. Truck fuel efficiency of 0.48 L/km was used (North East Biosolids & Residulas Association, 2022).

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

4. **Land application:** In addition to GHG emissions during land application, the fertilizer credits were also estimated. The tractors used during land application consume diesel. The diesel consumption and associated emissions were estimating using thickened biosolids flow of 19,254 m^3/year and a tractor load capacity of 13 m^3 consuming around 8 liters of diesel per load. The application of thickened biosolids also provides fertilizer offset credits due to nitrogen, phosphorus in biosolids. The credits are also applied for carbon sequestration potential of biosolids. The nitrogen and phosphorus content of dewatered anaerobic digested biosolids was assumed to be 6.2% and 1.6% respectively. For carbon sequestration credits, a carbon sequestration rate of 250 kg CO2e per dry tonne of biosolids was used (North East Biosolids & Residulas Association, 2022).

7.3.1.2 Option 2: Lystek's Advanced Treatment System

The basis for calculation for Option 2 are listed below.

1. **Thickening / dewatering:** A polymer usage of 10 kg per dry tonne of biosolids and an emission factor of 1.6 kg CO_2e per kg of polymer was used. The electrical consumption was estimated based on an energy use of 35 kWh per dry tonne of biosolids as reported by the vendor (North East Biosolids & Residulas Association, 2022).

2. **THP module:** Lystek's THP reactor involves electrical consumption for the shearing and mixing of biosolids. An energy consumption of 38 kWh per dry tonne of solids as provided by vendor was used. A design annual biosolid flow rate of 2,135 tonne/year was used. The THP module adds 45% potassium hydroxide (KOH) solution to elevate the pH of biosolids in the THP reactor. A consumption factor of 0.095 tonne of 45% KOH per dry tonne was used to estimate the annual consumption of 45% KOH solution. An emissions factor of 1.9 kg CO_2e/kg KOH was used.

3. **Digestion:** Lystek's digestion process generates GHG emissions primarily through fugitive methane emissions from biogas combustion and flaring. The GHG fugitive emissions were estimated based on methane production of 395,460 m^3/year, a flaring efficiency of 99.75%.

4. **Transportation:** GHG emissions associated with transporting processed biosolids estimate are based on hauled sludge production of 14,440 m^3/year, vehicle capacity of 40 m^3/truck, and a 40 km round trip to the landfill site. The GHG emissions related to transporting polymer to the Simcoe WWTF were estimated based on a polymer usage of 10 kg per dry tonne of biosolids, a polymer density of 1,350 kg/m^3, a truck capacity of 20 m^3, and a 300 km round trip from the Greater Toronto Area the Simcoe WWTF. Additionally, the GHG emissions associated with transporting KOH to the Simcoe WWTF were estimated based on the consumption of 203 tonne/year of 45% KOH solution, and a density of 1500 kg/m^3 for a 45% KOH solution. A truck capacity of 16 m^3, and a 190 km round trip from Guelph to the Simcoe WWTF was used (Fisher Scientific, 2024).

5. **Land application:** The estimated emissions from tractor diesel consumption were estimated based on the projected total hauled sludge is 14,440 m^3/year. A tractor load

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

capacity of 13 m³ and consumption of 8 liters of diesel per load was used. Due to dewatering of biosolids before anaerobic digestion, the nitrogen and phosphors content of Lystek anaerobic digested solids is anticipated to be higher. A nitrogen and phosphorus content of 10% and 2.0% was used for GHG credit calculation. These values were estimated based using process model with default influent characterization. It is recommended that these values are further verified through sampling. Furthermore, 40% of biosolid nitrogen was assumed to be available to plants. Additionally, the use of potassium in Lystek process provides additional nutrient during land application. The potassium credits depend on the local farming practices. The fertilizer potassium demands are dependent on local soil conditions, crop type and schedule. For some farmers, their crop potassium demands are greater than what is supplied in the LysteGro they receive, meaning the potassium received in LysteGro fully displaces the mineral fertilizer that would have been used. In some instances, agricultural potassium demands are lower than what is applied via LysteGro, meaning that not all of the mass of potassium displaces the farmer's use of mineral fertilizer. Considering the lack of fertilizer usages strategies in Simcoe area, the potassium credits are applied in the present analysis. However, it is recommended that County verifies, if full or only partial credit shall apply depending on the fertilizer usage practices in Simcoe area. For carbon sequestration credits, a carbon sequestration rate of 250 kg CO2e per dry tonne of biosolids was used (North East Biosolids & Residulas Association, 2022).

7.3.2 GHG Emissions

Table 7.7 shows a summary of the GHG emissions for both options. Option 2 with Lystek process results in 48 tCO2e/yr higher offset of CO2e emission than Option 1B.

The GHG emissions from the THP module of Lystek process were estimated to be 177 CO2e/year. A significant fraction of these emissions was estimated to be from addition of KOH solution in the THP process.

The emissions from polymer manufacturing for Lystek process were estimated to be higher than the Option 1B due to higher polymer dosage requirement and higher mass of dry solids processed in pre-thickening.

Transportation emissions for the biosolids were estimated to be higher for the Option 1B. This is due to the higher amount of hauled sludge at lower solid content.

For land application, Biosolids Emissions Assessment Model (BEAM), developed for the Canadian Council of Ministers of the Environment was used. Table 7.8 shows the input parameters used in the BEAM v2.2 calculator.

In addition to the GHG fertilizer credits for nitrogen, phosphorus and carbon sequestrations, the BEAM tool also estimates fugitive emission of N2O and CH4 during sludge storage prior to land application. For both Option 1B and Lystek process, the sludge storage tanks are covered with off-gas passed to the odor removal facility. Therefore, fugitive emissions of N2O and CH4 from storage were not included in the present analysis.

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

The GHG emissions from Lystek process were lower than the Option 1B. The higher nitrogen, phosphorus and potassium fertilizer credits appears to be the main reason for lower GHG footprint for the Lystek process. The fertilizer credits are highly sensitive to the nitrogen and phosphorus content in biosolids from the two options. It is recommended to verify the N and P contents of the biosolids through experimental means. Moreover, the % availability of N and P contents in biosolids also will have effect on the estimated offset credits. As described previously, the validity of potassium credits needs to be further confirmed based on the local fertilizer usage practices at Simcoe County. Appendix E contains Table E.1 and Table E.2, which lists the GHG parameters and design basis used in estimating the GHG emissions.

Table 7.7: 2051 Projected Annual GHG Emissions for Option 1B and Option 2.

2051 GHG Emissions (tonneCO_2e)		
	Option 1B	**Option 2**
THP MODULE		
Electrical consumption	N/A	3
45% KOH solution manufacturing	N/A	174
CONVENTIONAL/LYSTEMIZE DIGESTION		
Fugitive emissions from biogas combustion and flaring	16	16
Digester mixing electrical consumption	12	N/A
THICKENING/DEWATERING		
Polymer manufacturing	9	34
Electrical consumption	0.3	3
TRANSPORTATION		
Biosolids to land application	25	19
Polymer to Simcoe WWTP	0.1	0.3
KOH to Simcoe WWTP	N/A	2
LAND APPLICATION		
Tractor diesel consumption	33	25
Fertilizer offset credit for nitrogen	-144	-218
Fertilizer offset credit for phosphorus	-37	-55
Fertilizer offset credit for potassium	N/A	-61
Fertilizer offset credit for carbon sequestration	-292	-339
TOTAL	**-348**	**-396**

Table 7.8: Parameters used for BEAM Calculator

Land application BEAM parameters		
Biomass Characteristics	**Option 1B**	**Option 2**
Quantity of treated biosolids going to land application (Mg/day-wet)	53	40.5
Solids content of treated biosolids going to land application (%)	6%	9%
Quantity going to land application (Mg/day-dry)	3.18	3.726

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

Land application BEAM parameters		
Biomass Characteristics	**Option 1B**	**Option 2**
Density of treated biosolids (kg/m^3)	1000	1000
Type of biosolids to be land applied	digested	digested
Total nitrogen (%-dry weight)	6%	10%
Total phosphorus (%-dry weight)	2%	2%
Total volatile solids (TVS) (%-dry weight)	61%	61%
Organic carbon (%-dry weight)	34%	34%
CaCO3 equivalence (%-dry weight)	0	0
Average number of days biosolids are stored prior to land application	239	239

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

8. Recommended Design Option

Based on the results of the evaluation, **Option 2 – Centralized THP Stabilization and Biosolids Storage** was selected as the preferred option for the solids treatment facility upgrades at the Simcoe WWTF. Due to the modular nature of the Lystek system, the 2051 population growth scenario was chosen as the preferred scenario, allowing the County to reduce up-front capital costs, with additional storage to be added as required in the future. Details regarding design assumptions and unit process sizing are provided in Section 6.1 while details of the evaluation are presented in Section 7.

This option includes:

- Construction of a new sludge receiving facility.
- Construction of a new THP building (29.5m x 12.5m) to house THP equipment including:
  - Two dewatering centrifuge systems (polymer system, centrifuges, and dewatered cake tanks).
  - Two THP LY10 Modules (dewatered biosolids tanks, dewatered biosolids pumps, LY10 reactors, KOH storage tank, KOH dosing skids, and dual-fuel boilers).
  - Electrical/instrumentation and controls panels.
- Construction of two BIOREM odour control systems.
- Construction of one digestion tank.
- Construction of one storage tank and truck loading systems.

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

9. Implementation Schedule and Budget Forecast

Due to the modular nature of the THP system, and the projected flow and loading conditions for both the 2051 population growth and 2051 rated capacity scenarios, the implementation of the second THP module and centrifuge would not be required around the year 2041. In addition, the only difference between the two scenarios is the addition of a second fertilizer product storage tank for the 2051 rated capacity, which would be required to maintain 210 days capacity at the ECA capacity flows. As such, the THP system approach allows for a straightforward phasing approach to construction, allowing Norfolk County to lower up-front capital costs in the immediate future and implement the second phase of equipment as required.

Additionally, the cost evaluations completed throughout this report do not capture the potential for revenue sharing with THP supplier, which would offset a small portion of the sludge disposal fees, in turn slightly reducing the annual operation and maintenance fees. The high-level estimated implementation schedule associated with detailed design and construction of THP facility is provided in Table 9.1.

Table 9.1: Tentative Project Milestone Schedule

Project Milestone	Tentative Milestone Completion Date
Start of Detailed Design	December 2024
Pre-tender Stage & Design and Build	October 2025
Tender Period	November and December 2025
Tender Awarded	January 2026
Construction Completion	Q3/4 of 2027
Post Construction Services	January 2030

The capital cost for the project, including the THP facility for biosolids management, related tankages, sludge receiving facility, site works, electrical substations and waste gas burner is estimated at approximately $53M, including material and installation costs, and a 35% contingency as requested by Norfolk County. A detailed breakdown of area costs for the recommended option, as well as for Option 1b, can be found in Appendix D.

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

10. References

Metcalf & Eddy (2003). Wastewater Engineering: Treatment and Reuse, 4th Ed.

MMM Group, RVA and XCG (2016). Norfolk County Integrated Sustainable Master Plan.

MOE (2008). Design Guidelines for Sewage Works.

RVA (2016). Review of Alternative Sludge Handling Options for the Simcoe WWTP.

WEAO, MOE, EC (2010). Optimization Guidance Manual for Sewage Works.

WEF (2005). Manual of Practice No. 11, 6th edition.

Environment and Climate Change Canada, "Emission factors and reference values," Government of Canada, May 2024.

California Air Resources Board , "METHOD FOR ESTIMATING GREENHOUSE GAS EMISSION REDUCTIONS FROM," California Environmental Protection Agency, 2027.

Natural Resources Canada, "Learn the facts: Emissions from your vehicle," Natural Resources Canada, 2014.

North East Biosolids & Residulas Association, "Biosolids Emission Assesment Model," 20 September 2022.

Scientific Polymer Producs Inc., "Density of Polymers (by density)," Scientific Polymer Producs Inc.

Fisher scientific, "Potassium Hydroxide Solution, 45% w/w (Certified), Fisher Chemical," Thermo Fisher Scientific.

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

Appendix A

Proposal for Lystek THP, LysteMize Digestion, and LysteGro Fertilizer Program

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.



Norfolk County and Hatch Ltd

Proposal for Lystek THP, LysteMize Digestion, and LysteGro Fertilizer Program at the Simcoe Wastewater Treatment Plant

Lystek

Nothing wasted.
Everything to gain.



Lystek
Nothing wasted.
Everything to gain.

Norfolk County and Hatch Ltd

Proposal for Lystek THP, LysteMize Digestion, and LysteGro Fertilizer Program at the Simcoe Wastewater Treatment Plant

Prepared For:

Mariana Balaban, PhD, PEng
Project Director, Environmental and Infrastructure Services

Norfolk County

mariana.balaban@norfolkcounty.ca

Paolo Oddi
Project Manager, Engineering

Norfolk County

paolo.oddi@norfolkcounty.ca

Maryam Reza, PhD., PMP, P.Eng.
Process Mechanical Lead, Western Canada/ Infrastructure/Water

Maryam.Reza@Hatch.com
416-421-6064

Hatch Ltd

Prepared By:

Lystek International

125 McGovern Dr.
Cambridge ON N3H 4R7

226-444-0186
888-501-6508

Contact Person:

Sarah Mason-Renton, PhD

Business Development Manager

519-465-1294
smasonrenton@lystek.com

Submitted: August 2, 2024
Revised: November 14, 2024

CONTENTS

1 Introduction 1

2 About Lystek 2

2.1 Lystek THP® 3

2.2 Process Description 3

3 Proposed Lystek Solution for the Norfolk County Simcoe WWTP 4

3.1 Integration of the Lystek Module 5

3.2 THP Module Major Mechanical Equipment 7

3.3 THP Operations 8

3.4 THP Maintenance 8

4 LysteMize Digestion 9

4.1 How it Works 9

4.2 LysteMize Digestion Tank 10

5 Module Integration and Project Considerations 10

5.1 Lystek Building 10

5.2 Dewatering 12

5.3 LysteGro Storage 13

5.4 LysteGro Truck Loading 15

5.5 Debris and Contaminant Management 15

5.6 Odour Management 16

5.7 Site Considerations 17

6 Fertilizer Management 17

6.1 LysteGro® Fertilizer 17

6.2 Marketing and Sales 19

7 Reducing Norfolk County's Carbon Emissions 20

8 Quotation 23

8.1 Lystek THP Technology and Equipment Supply 23

8.2 Technology and Equipment Supply Scope – Budgetary Summary 23

8.3 LysteGro® Management Fee 25

9 Summary 26

LIST OF FIGURES

Figure 2-1 Map of Lystek's Ontario customers 3
Figure 2-2 Lystek process flow 4
Figure 3-1 Integration of Lystek THP at the Norfolk County Simcoe WWTP 6
Figure 5-1 Examples of Lystek THP installed in metal buildings. Left – Innisfil ON, Centre – Southgate OMRC, Right – SHVUA, MI 11
Figure 5-2 Mezzanine styles. Left – concrete at Southgate OMRC. Right – steel at Commerce Township, MI 11
Figure 5-3 Innisfil manual bridge crane 12
Figure 5-4 Example installations with dewatering centrifuge installed directly above the Lystek THP dewatered biosolids tank (Left – Elora, ON / Right – South Huron Valley Utility Authority, MI) 12
Figure 5-5 Examples of truck loading platform infrastructure installed at both our Centre Wellington (left) and St. Thomas (right) deployments in Ontario 15
Figure 5-6 Biofilter at Innisfil, ON installation 16
Figure 5-7 Conceptual site illustration to show footprint of Lystek Building and tanks. Actual site locations to be determined. 17
Figure 6-1 Examples of LysteGro hauling and application equipment 19

LIST OF TABLES

Table 3-1 Project design parameters 5
Table 3-2 THP Module major mechanical equipment 7
Table 3-3 Estimated THP processing parameters 8
Table 3-4 Per dry tonne and annual THP input estimates 8
Table 3-5 THP Module wear item overview 9
Table 5-1 Centrifuge maintenance items and frequency 13
Table 5-2 Summary of total LysteMize and LysteGro tank volumes 14
Table 7-1 2051 greenhouse gas emissions summary 22
Table 8-1 Budgetary capital estimates for Lystek THP, LysteMize, and LysteGro facility 23
Table 8-2 LysteGro revenue sharing example scenarios 25

LIST OF APPENDICES:

Appendix A – Lystek Installations

Appendix B – Case Studies

Appendix C – Lystek THP Block Flow Diagrams

Appendix D – Draft Example Lystek THP Services Agreement

Appendix E – Draft Example Maintenance Schedule Excerpt from Lystek O&M Manual

Appendix F – Conceptual Drawings

Appendix G – Advantages of LysteGro

Appendix H – Draft Example LysteGro Services Agreement

1 INTRODUCTION

The Norfolk County Simcoe Wastewater Treatment Plant (WWTP) anaerobically digests biosolids and land applies the residuals locally as a dilute liquid Non-Agricultural Source Material (NASM). We understand that the aging anaerobic digestion infrastructure is nearing end of life and the County is evaluating alternative means of biosolids management. The County intends to transport co-thickened sludges from its four WWTPs in Port Dover, Port Rowan, Delhi, and Waterford to the Simcoe WWTP for centralized processing and management. The County is planning for substantial community growth and the resultant increase in wastewater flows is accounted for in this design.

The County is working with Hatch Engineering to complete this evaluation. In response to Hatch's request and the County's continued interest we are excited to offer our proven Thermal Chemical Hydrolysis Process, **Lystek THP®**, as an alternative to conventional anaerobic digestion and dilute NASM liquid management. This award-winning technology leverages an innovative and proprietary combination of thermal, chemical, and physical inputs to transform biosolids and organic residuals into a concentrated liquid fertilizer, **LysteGro®**, at low life cycle costs compared to alternatives. We also propose **LysteMize®** digestion as an affordable and efficient alternative to conventional anaerobic digestion. LysteMize digestion will further enhance operations and reduce the County's carbon emissions by optimizing recovery and beneficial use of these renewable resources.

The Lystek THP technology has a small footprint and is modular and scalable. This will enable the County to effectively scale to meet high flow demands during peak-flow periods and increase capacity as the community grows. Lystek THP and LysteMize digestion are simple to operate and maintain with minimal operator intervention required. This proposed solution will reduce the capital and operating expenses associated with these facility upgrades.

LysteGro is regulated as a commercial fertilizer product by the Canadian Food Inspection Agency (CFIA). This fertilizer has proven market in Ontario and provides the County with the opportunity to offset management costs with fertilizer sales revenues. Producing a concentrated fertilizer material will reduce biosolids volumes by up to 90% compared to current operations. This dramatic volume reduction translates to reduced equipment footprint, capital costs, operational expenses related to trucking and application, as well as dramatically improved efficiencies surrounding the management of these residuals.

We are also pleased to offer comprehensive LysteGro management services that include product marketing, best practice application works, and a fertilizer revenue sharing agreement. These services will provide the County with program stability and peace of mind.

The details of this solution including equipment quotation, operating parameters, conceptual building layout, and project considerations are described below.

One Technology. Multiple Benefits.

- ✓ Up to 90% reduction in biosolids volumes to be digested, stored, and land applied
- ✓ Minimal site footprint required
- ✓ Low life-cycle costs
- ✓ Efficient and affordable alternative to conventional anaerobic digestion
- ✓ Production of saleable fertilizer, LysteGro, provides a valuable resource to the local agricultural community
- ✓ Comprehensive fertilizer management services with revenue sharing
- ✓ Operational simplicity – no special operators, certifications, or licenses required
- ✓ Modular and scalable system allowing for future growth

2 ABOUT LYSTEK

Lystek is North America's leading provider of thermal hydrolysis solutions for biosolids and organics management. We work in partnership with municipalities, utilities, and private sector clients to recover valuable nutrients from biosolids and other organic feedstocks.

Development of the patented Lystek THP® technology began in 1998, spearheaded by industrial microbiologists at the University of Waterloo. Lystek now provides resource recovery solutions to over 60 utilities world-wide, with more being added each year.

- ✓ **More than 60 generators serviced**
- ✓ **19 Lystek THP Modules operating world-wide**
- ✓ **4 NEW projects in design / construction**
- ✓ **Over 1.9 million tonnes of LysteGro biosolids produced and sold**

Lystek services a range of small, medium, and large generators across 15 installations globally with both on- and off-site solutions.

Our in-plant installations, such as in Elora, Erin, and St. Thomas ON, are fully integrated with the existing WWTP solids processing. These installations provide on-site, easy to-operate solutions that are economical and offer long-term program security. These facilities process biosolids into LysteGro fertilizer for sale locally for beneficial use and enhanced resource recovery. At the new WWTP in Erin, Ontario, Lystek THP and LysteMize digestion were selected to optimize resource recovery with the production of a fertilizer product while also generating renewable biogas. Our proven Product Management Team provides the LysteGro fertilizer sales and management services for these customers as well.

Lystek proudly operates two large regional Organic Materials Recovery Centers (OMRC) in the Township of Southgate, Ontario and Fairfield, California. The Southgate OMRC was commissioned in 2013 and services south-central Ontario with the capacity to process 150,000 tonnes of dewatered biosolids annually. The OMRC was awarded the 2023 Water Environment Federation of Ontario (WEAO) Exemplary Biosolids Management Award for a Full-Scale Operating Facility. The Southgate OMRC manages solid and liquid biosolids from many utilities in Ontario including the Town of Shelburne, Toronto, Waterloo, Guelph, Halton, Peel, Orangeville, and North Wellington among others. The Fairfield OMRC is comparable to the Southgate facility and services utilities in the San Francisco Bay Region including the Fairfield-Suisun Sewer District as well as communities such as San Francisco, Palo Alto, Santa Rosa, and Petaluma.

See Appendix A for a summary of Lystek installations and Appendix B for example case studies.

We are committed to long-term partnerships with our customers and leverage our expertise to offer comprehensive technology, design-build, product management, and communications and engagement support.

Lystek's management team offers proven national and international experience in the wastewater, organics, agriculture, and waste management industries. Lystek offers expertise, innovation, and leadership with a proven solution that allows customers to achieve diversion goals and optimize resource recovery, while also minimizing program costs and greenhouse gas (GHG) emissions. The Lystek team offers an unparalleled depth and breadth of experience designing, constructing, and operating advanced biosolids resource recovery solutions.



Figure 2-1 Map of Lystek's Ontario customers

2.1 LYSTEK THP®

Lystek THP is a unique, thermal-chemical hydrolysis process employing high-speed shearing, alkali, and low-pressure steam injection. The technology processes organic feedstocks into a multi-purpose hydrolyzed product.

Lystek THP has multiple product applications including **LysteGro®** CFIA regulated fertilizer and **LysteMize®** digestion.

2.2 PROCESS DESCRIPTION

Dewatered biosolids are fed into the dewatered biosolids tank and then pumped using progressive cavity feed pumps into the Lystek Reactor (see Figure 2-2 for Lystek process flow).

Within the Reactor the combination of low-pressure steam, potassium hydroxide (an agronomically valuable chemical), and physical shearing transform residuals into a homogenized and pumpable high-solids, liquid product.

The Reactor operates at atmospheric pressure and is insulated to reduce heat loss. The Reactor operates in a semi-continuous mode, meaning that the Reactors are regularly filled to their working capacity while steam, alkali, and shear are applied. The hydrolyzed product is discharged on a continuous operating cycle to maximize the throughput of the system. The newly processed material typically has a solids content in the range of 13-16% but has the physical properties of a liquid that can be handled using the conventional liquid pipes, pumps, tankers, and application equipment operators are familiar with.

There is opportunity to generate biogas if LysteGro is stored in an anaerobic environment due to enhanced properties of the hydrolyzed product. This LysteMize biogas can be used on-site.

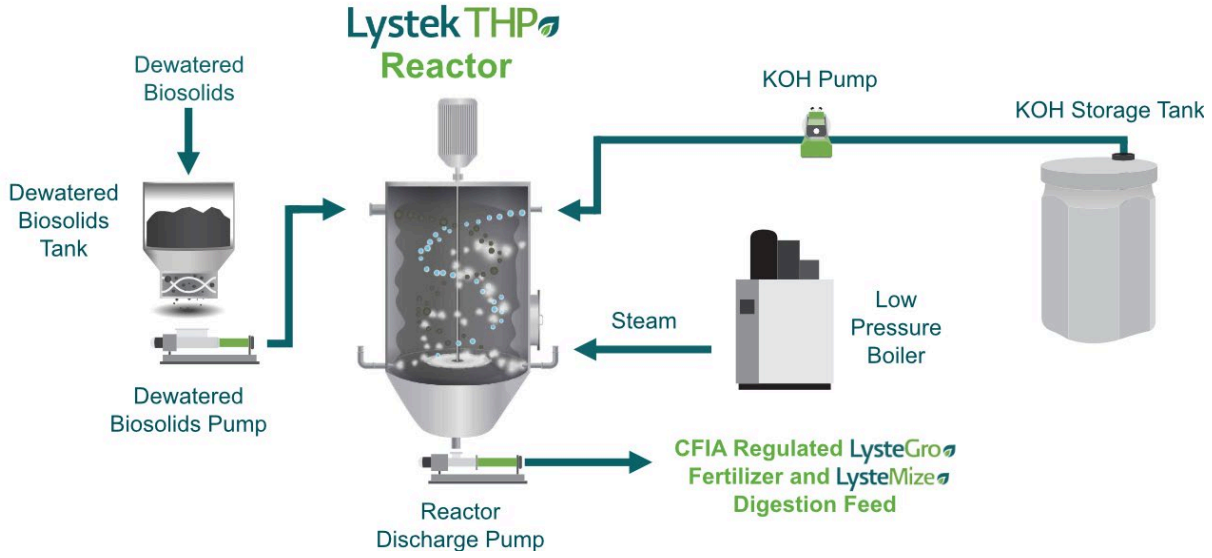


Figure 2-2 Lystek process flow

LysteGro fertilizer is stored between application seasons. The characteristics and benefits of LysteGro fertilizer are outlined in detail in Section 6 below along with an overview of our Fertilizer Management Services offering.

3 PROPOSED LYSTEK SOLUTION FOR THE NORFOLK COUNTY SIMCOE WWTP

We understand that Norfolk County is currently considering alternative means of biosolids management as the Simcoe WWTP anaerobic digester is nearing end of life.

We propose integrating dewatering, Lystek THP, and LysteMize Digestion on-site at the Simcoe WWTP to co-process the County's biosolids into a high-solids liquid fertilizer, LysteGro. This proposed solution has been developed using the design parameters noted in Table 3-1. Block flow diagrams for the short term, 2051, and ECA capacity flow scenarios are included in Appendix C.

One LY10 THP Module is required to process the County's short-term biosolids flows. A second LY10 Module will be required to process the County's biosolids volumes at both the 2051 and ECA rated capacity flow rates.

Assuming a 25-year period between the Short-Term and 2051 scenarios, and that growth in sludge mass flows is constant, the annual growth rate in sludge flows is approximately 2%. At this rate, we estimate that an additional LY10 will need to be brought online around 2040 to keep processing hours within the preferred 30-hour period. However, the point at which the second LY10 module will be needed will also depend on when aerobic and anaerobic digestion processes at the smaller WWTPs are taken offline, as these changes will cause step increases in flows to be treated at Simcoe. Depending on the County's priorities, and project budget, the second LY10 Module can be installed at the project outset or can be implemented in the future as treatment needs dictate.

Rather than needing a huge investment in new infrastructure we were able to really transition from what we were doing to a Class A Lystek process. We were able to take what could have been a 45-50 million dollar project and turn it into a 13-15 Million dollar project just by choosing a technology that worked well within our envelope.

Patrick Shea, Public Services Director, City of St. Cloud

Table 3-1 Project design parameters

	FLOW SCENARIOS		
	SHORT TERM	2051	ECA CAPACITY
OPERATING PARAMETERS			
Projected sludge flows (kg/d)[i]	3,617	5,850	9,496
Projected volumetric flow (m^3/d)[i]	140.6	234.9	386
Blended influent total solids[ii]	2.6%	2.5%	2.5%
DEWATERING			
Centrifuges	1	2	2
Centrifuge feed rate (m^3/h)	33	27	45
LYSTEK THP			
LY10 Modules	1	2	2
Weekly runtime required (h)	20	16	27
MAXIMUM MONTHLY THP PARAMETERS			
MM factor[iii]	1.5	1.5	1.5
MM THP weekly runtime (w/# of Modules above)	30	24	40
LYSTEMIZE DIGESTION[iv]			
Flow to LysteMize digester (wet tonnes/year)	9,430	15,252	24,757
Flow to LysteMize digester (m^3/year)[v]	9,155	14,808	24,036
Annual biogas production (m^3/yr)	381,209	616,553	1,039,812
Annual biomethane production (GJ/yr)	9,350	14,927	25,505
LYSTEGRO FERTILIZER PRODUCTION			
Annual LysteGro production (wet tonnes/year)	8,922	14,430	23,371
Annual LysteGro production (m^3/yr)[v]	8,662	14,009	22,690

[i] Biosolids operations flow and volumetric assumptions provided by Hatch July 2, 2024.
[ii] Blended influent total solids is calculated based on data provided by Hatch and assumes that Waterford WAS will arrive pre-thickened.
[iii] Max month criterion provided by Hatch June 10, 2024.
[iv] LysteMize performance is feedstock dependent. At the time of proposal submission the LysteMize characterization work was still underway. Estimates provided are based upon data from similar feedstocks.
[v] Assumes a specific gravity of 1.03 based on measurements from laboratory characterization work completed summer 2024.

3.1 INTEGRATION OF THE LYSTEK MODULE

We propose implementing dewatering, Lystek THP, and LysteMize digestion at the Simcoe WWTP to process the County's blended biosolids feedstocks into a high-solids liquid CFIA fertilizer product LysteGro. The proposed facility process integration is illustrated in Figure 3-1.

We have assumed that the liquid sludges (combination of thickened aerated, raw primary, and WAS) from the four WWTPs will be received at the Simcoe WWTP and blended with Simcoe's co-thickened primary and WAS sludge.

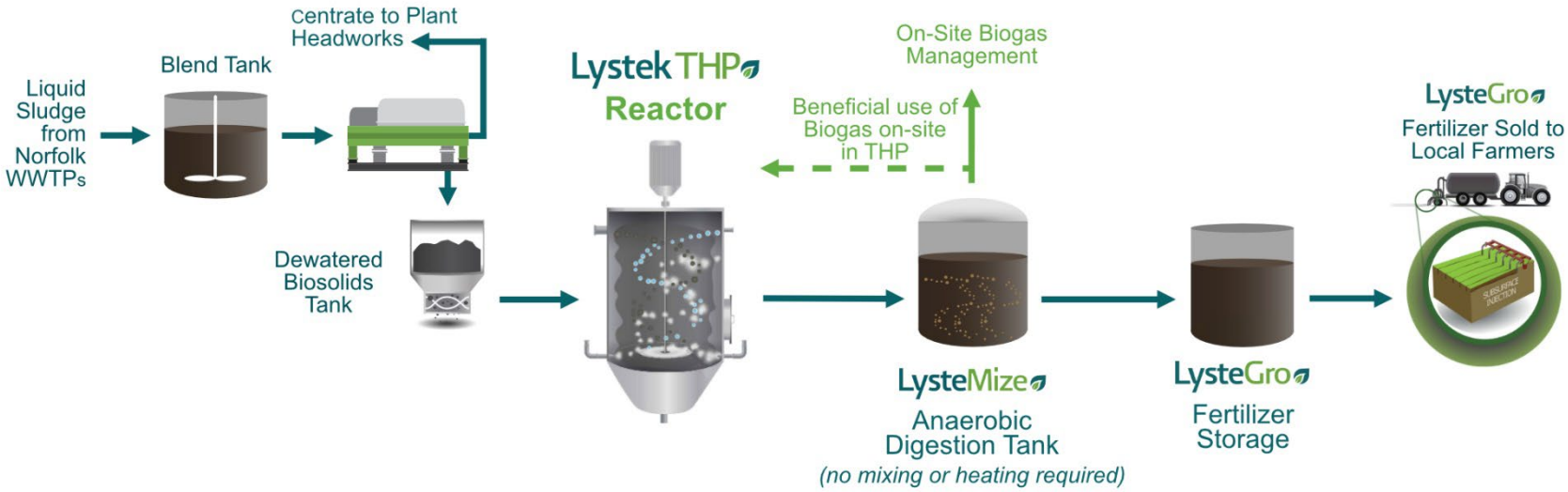


Figure 3-1 Integration of Lystek THP at the Norfolk County Simcoe WWTP

3.2 THP MODULE MAJOR MECHANICAL EQUIPMENT

One LY10 Lystek THP Module is required to process the County's current biosolids volumes with operations completed in a 30-hour week. Two LY10 Modules will be required to process the County's 2051 and ECA-rated flows in less than 30 hours.

There is sufficient capacity with one LY10 Module to process max monthly flow rates in the short term in less than 30 hours weekly. Max monthly flow rates in the 2051 flow scenario can also be processed within 30 hours weekly with two LY10 Modules operating. Treating the projected ECA capacity max month flows with two LY10 Modules will require processing times of up to 40 hours weekly.

Each Module includes the Lystek THP Reactor as well as the associated pumps, tanks, and supporting instrumentation and controls. Listed below in Table 3-2 are the major mechanical elements associated with the proposed system.

We understand the County is interested in using LysteMize biogas to fuel the Lystek THP process. We have included for a dual-fuel boiler as a part of the Lystek THP Module package.

Table 3-2 THP Module major mechanical equipment

Element	Quantity		Function
	1 LY10	2 LY10s	
Dewatered Biosolids Tank	1	2	Receives and stages dewatered biosolids from dewatering centrifuge
Dewatered Biosolids Pump	1	2	Progressive cavity pump doses dewatered biosolids to the Reactor
Lystek THP Reactor and Disperser	1	2	Transforms biosolids into CFIA regulated LysteGro fertilizer
Reactor Discharge Pump	1	2	Positive displacement pump transports LysteGro fertilizer from the Reactor to the LysteMize digester
KOH Storage Tank	1	1	Double walled storage tank to store KOH solution
KOH Dosing Skid	1	2	Doses KOH solution to Reactor
Steam Boiler	1	2	Dual-fuel low pressure boiler (<15 PSI) providing steam heat to the Reactor. Inclusive of standard associated boiler water treatment equipment

With the expected operating hours, equipment reliability, and ease of maintenance, a duty/standby arrangement is not required. If preferred, the Reactor discharge pump and KOH dosing pump can easily be deployed in duty/standby configurations.

3.3 THP OPERATIONS

Due to the highly automated and easy to operate nature of the system, minimal staff intervention is required. This approach has been proven and confirmed throughout Lystek's existing in-plant deployments.

Typical processing parameters associated with this system are noted in Table 3-3.

Table 3-3 Estimated THP processing parameters

Operating Parameter	Value
Operating temperature set point	75°C
Solids content – hydrolyzed product	13 - 16%
Viscosity – LysteGro product	< 20,000 cP
Specific gravity	1.03

Process consumables and utility inputs include natural gas or biogas for heating, electricity for Reactor shearing and mixing, as well as KOH to elevate the pH of the material. Estimates of process inputs are provided in Table 3-4.

Table 3-4 Per dry tonne and annual THP input estimates

Input	Per Dry Tonne	Annual Consumption		
		Short Term	2051	ECA Capacity
Natural gas/biogas consumption[1] (GJ)	1.7	2,225	3,599	5,841
45% KOH[2,3] (tonne)	0.095	125	203	329
Electricity (kWh)	38	50,168	81,140	131,710

[1]Dependent upon average biosolids feed temperature into the Lystek Reactor, which was assumed to be 15°C
[2]Estimates refined during Lystek laboratory processing of Norfolk's biosolids in June 2024
[3]Summer 2024 Southgate OMRC 45% KOH solution costs were $1.125 per kg

We understand the County is interested in evaluating a Service Agreement with Lystek. These services include inspection of annual THP Module equipment condition and review of THP performance. An example draft agreement can be found in Appendix D for your consideration. Note that this is a draft for your consideration and that final terms will be amended to suit the Project Team's preferences and the specifics of the project.

3.4 THP MAINTENANCE

Lystek THP equipment, such as the pumps, instruments, and boiler, are selected from typical municipal wastewater treatment suppliers. The system has been optimized to utilize robust equipment that has a proven record of longevity, easy service, and rapid access to spare parts. Regular preventative maintenance includes activities such as: inspections for wear, greasing and lubricating of rotating equipment, boiler feed water quality checks, boiler blower air filter, inspecting and testing drive belts for wear and proper tension.

The THP system includes equipment with parts that will wear over time and need eventual replacement. Table 3-5 lists the equipment and typical replacement frequency.

Please note that the estimated life for each component is an estimate only. The actual time before replacement depends on sludge quality/degree of contamination and the plant's preventative maintenance program.

An example draft maintenance schedule excerpt from a Lystek Operations and Maintenance Manual is included in Appendix E.

Table 3-5 THP Module wear item overview

Element	Component	Typical Service Life	Estimated Life[i]
Dewatered Biosolids Pump			
	Stator	7,500 hours	5 years
	Rotor	15,000 hours	10 years
	Complete Gear Joint	7,500 hours	5 years
	Radial Shaft Seal	10,000 hours	6.5 years
Reactor Discharge Pump			
	Stator	7,500 hours	5 years
	Rotor	15,000 hours	10 years
	Radial Shaft Seal	10,000 hours	6.5 years
High Speed Disperser			
	Shear blade	Inspection: 6 – 12 months Replacement: 1 – 5 years	

[i] Calculated based on normal wear and 1,560 annual processing hours.

4 LYSTEMIZE DIGESTION

We understand that the County is interested in a LysteMize Digestion application to further reduce LysteGro volumes and produce renewable biogas on-site. We understand the County is interested in a dual-fuel boiler. This is included in our THP Module scope of supply to fuel the Lystek THP process from the LysteMize biogas generated.

At this conceptual stage we have assumed the biogas generated in the LysteMize digestion tank can be collected using the existing biogas infrastructure on-site. Table 3-1 above provides an estimate of LysteMize biogas generated. These estimates are based on project assumptions and data from similar feedstocks. The LysteMize characterization work (currently underway) will further refine these estimates.

LysteMize biogas can be used to fuel the dual-fuel boiler associated with the LY10 Module to reduce operating costs and the facility's carbon footprint. THP heating demands are summarized in Table 3-2. Note that we expect surplus biogas, beyond what is required for THP heating, will be generated. This gas can be used elsewhere on-site, flared, or further treated for additional use should the Project Team determine this is of interest.

4.1 HOW IT WORKS

LysteMize is the process of anaerobically digesting the hydrolyzed liquid produced with Lystek THP. Lystek THP reduces particle sizes, homogenizes feedstocks, and solubilizes organic carbon, making organic materials more amenable to biodegradation.

The hydrolyzed product can be digested at high total solids content (up to approximately 14% TS in this application). Digestion is possible in un-heated, un-mixed digesters because of three mechanisms:

- Soluble COD in the hydrolyzed product is greatly increased compared to unprocessed residuals. The high quantity of soluble carbon available to microbes allows for rapid conversion of organic material to biogas.
- The hydrolyzed product is homogeneous and does not separate, stratify, or settle. As a result, the natural convective mixing due to microbial metabolism and gas evolution is sufficient to keep the microbes in contact with their food source and maintain activity.
- The residual heat from THP provides sufficient heat for microbial metabolism.

The hydrolyzed residual is completely homogeneous, has low viscosity and high soluble carbon content, and therefore requires no mixing for digestion and no supplementary heating. In addition, the added alkalinity of the hydrolyzed liquid helps mitigate the risk of digester souring. These properties not only reduce the CAPEX and OPEX costs when compared to conventional anaerobic digestion, but also minimizes the need for operator intervention.

4.2 LYSTEMIZE DIGESTION TANK

For extended retention time and to minimize overall long-term project costs, **we recommend a 5,000 m^3 LysteMize Digestion tank be installed in Phase One as the most cost-effective option when considering the overall project requirements. This tank will provide up to 190 days retention time, providing additional LysteGro storage capacity on-site.** This configuration is a cheaper alternative than installing a smaller LysteMize tank and additional LysteGro storage tank(s).

We recommend the LysteMize digestion tank be a glass-fused-to-steel tank with a dual-membrane roof designed for gas-holding. The tank will be equipped with gas monitoring and process instrumentation, along with safety/relief valves. As noted above, no mixing or heating is required with this digestion tank.

5 MODULE INTEGRATION AND PROJECT CONSIDERATIONS

5.1 LYSTEK BUILDING

Given that two LY10 Modules are required to process both the 2051 and ECA capacity flows, and economies of scale associated with building construction costs, we recommend the building be designed and built with space for both Modules during Phase One. This will allow for faster and easier installation of the second centrifuge and LY10 Module in the future.

We have designed and included a conceptual facility layout for two LY10 Modules in Appendix F to demonstrate the compact and modular nature of the Lystek THP technology. ***The overall footprint of this conceptual facility is 369 m^2 (3,969 ft^2).***

Note that this layout is a conceptual starting point for the Project Team's consideration and can be easily adapted to alternate geometries to suit site constraints or project preferences.

This layout also illustrates how dewatering equipment can be installed directly above the dewatered biosolids tank to eliminate conveyance and minimize costs as well as building footprint.

5.1.1 Building Design Considerations

Lystek has been successfully deployed in a range of building types including pre-engineered metal buildings and concrete/block. Innisfil's Lakeshore plant included a new metal building to house its THP installation and Lystek's own Southgate OMRC was built using a pre-engineered metal building. The THP Module at the South Huron Valley Utility Authority (SHVUA) in Brownstown, MI, was installed in an existing, underused metal building. Exterior photos of each building are shown in Figure 5-1.



Figure 5-1 Examples of Lystek THP installed in metal buildings. Left – Innisfil ON, Centre – Southgate OMRC, Right – SHVUA, MI

The buildings are designed by a manufacturer to handle specified load requirements and can include the same elements found in traditional buildings, such as mezzanines and bridge cranes. The Southgate OMRC was designed with a concrete mezzanine feature which supports HVAC equipment and the steam boilers for the facility. Our installation at Commerce Township in Michigan, in contrast, was designed to leverage the existing steel mezzanine within a block and concrete building. See Figure 5-2 for photos of the Southgate and Commerce mezzanines.



Figure 5-2 Mezzanine styles. Left – concrete at Southgate OMRC. Right – steel at Commerce Township, MI

We understand maintenance access and ease to be a key consideration for Norfolk County. The building can be designed with sufficient space and clearances to accommodate equipment such as a telehandler for reaching equipment on the mezzanine. This approach has been selected across multiple installations. Alternatively, the building design can accommodate installation of an overhead bridge crane. A manual overhead bridge crane was installed as part of the Innisfil project (depicted in Figure 5-3).

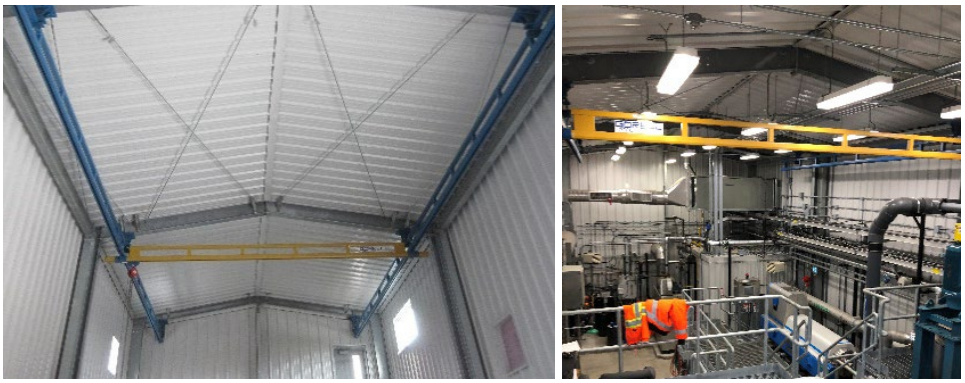


Figure 5-3 Innisfil manual bridge crane

5.2 DEWATERING

To maximize the efficiency of Lystek THP, and allow the plant to realize the benefits of reduced residual volumes, a dewatering step must be included upstream of the Lystek THP system. The dewatering equipment can be placed directly above the dewatered biosolids storage tank, which reduces material handling capital and operating costs and minimizes processing footprint (Figure 5-4). This represents a significant avoided cost in conveyors, piping, and truck loading facilities. Appendix F includes a conceptual plan view and partial section of the facility, which illustrate co-deployment of the centrifuge directly on top of the Dewatered Biosolids Tank.



Figure 5-4 Example installations with dewatering centrifuge installed directly above the Lystek THP dewatered biosolids tank (Left – Elora, ON / Right – South Huron Valley Utility Authority, MI)

Based on previous experience with centrifuge dewatering of similar materials, we estimate specific power consumption for the centrifuges to be approximately 35 kWh/dry tonne. We estimate the polymer addition rate to be 10 kg active/dry tonne TSS.

5.2.1 Centrifuge Maintenance

Table 5-1 presents a summary of the frequency of typical centrifuge maintenance items. Maintenance frequency is based upon run hours and may vary with feedstock quality.

Table 5-1 Centrifuge maintenance items and frequency

Frequency (Estimated years[i]) - Maintenance Item
200 hours after start up (break in period)
- Check belt tension
- Lubricate front and rear pillow block bearings
3,000 hours (2 years)
- Change lubricant in cyclo reducer and replace copper seals
- Check belt tension
- Inspect/replace (if worn): discharge nozzles on bowl, watertight disks, solids discharge casing, and sedimentation control in canals
6,000 hours (4 years)
- Inspect scraper blades for wear (replace as needed plus mounting screws)
- Replace belts
- Front pillow block bearing and seal replacement
- Inspect scroll, replace wear items if required
12,000 hours (8 years)
- Front and rear pillow block bearing and seal replacement, cyclo reducer overhaul, tension system overhaul, torque limiter overhaul
- Replace scroll thrust bearing
- Replace belts
18,000 hours (12 years)
- Front pillow block bearing and seal replacement, torque limiter overhaul
- Inspect scroll, replace wear parts if required
- Replace belts
- Inspect shock absorbers, replace if worn

[i] Estimated life calculated based on normal wear and 1,560 annual processing hours.

5.3 LYSTEGRO STORAGE

After the hydrolyzed biosolids have been digested in the LysteMize tank they are pumped into enclosed storage. The material is stored in a contained environment to maintain product quality for agricultural customers.

We recommend a glass-fused-to-steel tank with an aluminum dome roof for the LysteGro storage tank. The homogenous nature of LysteGro results in no settling in storage. The unique product properties eliminate the need for any decanting, mixing, aeration, or cleanout activities in the storage tanks and the capital and operational costs associated with this. The concentrated nature of the LysteGro fertilizer will minimize the site footprint required for LysteGro storage.

5.3.1 Recommended Storage Capacity

Given land application seasonality in Ontario, and the ability to also use the majority of the LysteMize tank for additional storage capacity, we recommend a minimum 210 days time (seven months) of total tank capacity. Seven months capacity will provide a minimum of 30-days retention in the LysteMize Digestion tank as well as six months of LysteGro storage capacity to provide operational security through winter months.

We recommend a 5,000 m^3 LysteGro storage tank be installed in addition to the LysteMize digestion tank outlined above. This will provide adequate storage through the 2051 flow scenarios. Additional storage will be required to maintain 210 days capacity at the ECA capacity flows. Recommended storage capacities and associated 'days of storage' for each flow scenario are summarized in Table 5-2.

We are proposing a 5,000 m^3 tank with a diameter of 25.6 m and height of 10.2 m at this phase. These preliminary dimensions are provided for conceptual consideration at this phase of the project.

Table 5-2 Summary of total LysteMize and LysteGro tank volumes

	FLOW SCENARIO		
	SHORT TERM	2051	ECA CAPACITY
PRODUCT VOLUME SUMMARY			
Flow to LysteMize digester (m^3/year)	9,430	15,252	24,757
LysteGro fertilizer (m^3/year)	8,928	14,440	23,371
RECOMMENDED TANK CAPACITY			
LysteMize tank volume (m^3)	5,000	5,000	5,000
LysteGro storage volume (m^3)	5,000	5,000	2 x 5,000
Total storage volume	10,000	10,000	15,000
Total days of storage[ii]	**387**	**239**	**221**
ADDITIONAL TANK CAPACITY REQUIRED FOR 240 DAYS			
LysteMize tank volume (m^3)			5,000
LysteGro storage tank volume (m^3)			1 x 5,000, 1 x 6,300
Total storage volume			16,300
Total days of storage			**240**

[ii] Calculated based on total product out of the THP Reactor

5.4 LYSTEGRO TRUCK LOADING

We understand there is existing liquid truck loading infrastructure on-site but that this equipment may require replacement along with the project upgrades being considered.

A LysteGro truck loading station and pump house are typically located adjacent to storage tank. Example LysteGro truck loading stations are shown in Figure 5-5.

The County can expect two to three weeks of truck loading and land application annually. This period is dependent on weather and distance to field.



Figure 5-5 Examples of truck loading platform infrastructure installed at both our Centre Wellington (left) and St. Thomas (right) deployments in Ontario

5.4.1 Truck Loading Operations and Maintenance

As fertilizer loading and land application is seasonal and occurs for a short time annually, Lystek recommends that before each season's first application event the truck loading equipment is inspected and tested. Equipment such as the valves and instrumentation should be inspected for wear and proper function. The truck loading pump oil level, mechanical seal, lobes (or lobe tips, depending on pump type), and lobe/tip mounting set, casing O-ring, and casing liner and wear plate should be inspected and replaced if worn. Pump oil should be added on an as-needed basis. Over time, the wear plate and pump lobe/lobe tips will wear with use. While the replacement frequency of these components depends on quantity of grit or other abrasive material in final product, we see an average life for the lobes/lobe tips in this application of around four years of operation.

At the end of the application season the truck loading system should be flushed and drained.

5.5 DEBRIS AND CONTAMINANT MANAGEMENT

We observed contaminants and debris, such as cigarette butts, bandages, and hair in the biosolids sample collected from the Simcoe WWTP in June 2024. We understand that Norfolk is intending to complete upgrades to Simcoe's headworks, including screening. We support this approach as we maintain that improved screening and thus removal of debris is the best method to minimize wear on mechanical equipment and produce the highest quality fertilizer product.

However, we also understand that improvements to screening at the Simcoe WWTP may be completed in a phased approach beyond the scope of the biosolids project under consideration. Based on this, and previous discussions with the team at Hatch and the County, we encourage consideration of macerators and grinders upstream of dewatering to ensure dewatering and THP operations can run smoothly and to minimize downstream equipment wear and maintenance. This approach will reduce any operational hassles associated with fouling of dewatering and pumping equipment.

In our experience, grinders alone are insufficient to mitigate the impacts of debris such as hair, rags, wipes etc. that is likely to flow in-line. With the observation of substantial amounts of hair in the Simcoe sample we recommend a macerator be incorporated in this project design. The size and type of macerator will be dependent on the flow required, pipe size, and whether the macerator is installed upstream or downstream of the liquid sludge pump that feeds dewatering.

We also have experience implementing a grinder in addition to a macerator. The grinder is best incorporated upstream of the macerator and can be implemented as a standalone grinder or a chopper-style liquid feed pump. Similar to the macerator, the sizing of the grinder will be dependent on the flow rate, pipe size, type, and placement of the equipment. We would be happy to discuss our experiences with the nuances of these units during detailed design of this project.

5.6 ODOUR MANAGEMENT

A significant advantage of maintaining the liquid properties of LysteGro fertilizer is the ability to complete processing, conveyance, storage, and truck loading activities within enclosed systems. From the point of production to application in the field, LysteGro is contained. This minimizes process air generated and is a significant advantage when looking to capture and manage odours.

We are experienced implementing odour control as part of our solution and typically use a biofilter system to treat process air from the dewatering equipment, dewatered biosolids tank, THP Reactor, and LysteGro storage tank.



Figure 5-6 Biofilter at Innisfil, ON installation

Based on our preliminary understanding of the project and the County's biosolids, we recommend the installation of a BIOREM BASYS Biofilter System as shown in Figure 5-6. We have previously installed this biological treatment system at several of our in-plant installations. We recommend installing one dedicated unit to treat process air from the dewatering centrifuges, dewatered biosolids tanks, and THP Reactors. We also recommend a second biofilter be installed to treat the air flow from the LysteGro storage tank(s).

The footprint of the biofilter can be assumed to be 3.4 m x 9.1 m at this phase. The top of the roof is 2.9 m and the top of the stack is approximately 4 m. Actual dimensions will be determined during detailed design.

5.6.1 Biofilter Maintenance

Biofilter maintenance is typically minimal, consisting of regular inspections for fan bearing lubrication (monthly), fan belt drive inspection (semi-annually), and ensuring the fan motor is properly lubricated per manufacturer specifications.

BIOREM provides a detailed datasheet for monitoring to ensure optimal performance. Parameters to be observed and recorded include biofilter fan drive speed, fan inlet and outlet pressure, biofilter media bed temperature, and differential pressures. Preventative maintenance for the biofilter media bed includes quarterly inspection and observation of the media bed and media sampling and analysis.

A major advantage of this type of biofilter versus using traditional carbon-based media for odour treatment is the longevity of the media. Carbon-based media will require regular replacement as the media breaks down and can no longer effectively remove odour. With proper preventative maintenance, the media in this biofilter should not require replacement during its service life, which is typically 20 years.

5.7 SITE CONSIDERATIONS

Understanding that other facility upgrades are being considered as part of the broader project, we have illustrated the conceptual footprint (Figure 5-7) of the Lystek Building, LysteMize Tank, and LysteGro Tanks for your reference. We look to the Project Team to conceptualize the exact site location for this building and would be happy to discuss site considerations at your convenience.

Conceptual dimensions can be revised based upon the Project Team's preferences during detailed design.



Figure 5-7 Conceptual site illustration to show footprint of Lystek Building and tanks. Actual site locations to be determined.

6 FERTILIZER MANAGEMENT

Part of our overall strategic approach is to offer turnkey product and service management to our customers. Our team effectively manages large and small-scale LysteGro sales and application programs across North America.

The Lystek team has the experience and expertise needed to develop and manage an effective and professional fertilizer marketing and application program for the region surrounding the Town of Simcoe.

This section will provide an outline of the benefits of producing CFIA regulated biosolids and the approach we will use to manage the LysteGro marketing, sales, and distribution.

The Lystek THP system transforms biosolids and residuals into a CFIA regulated fertilizer that is pathogen free and in high demand.

6.1 LYSTEGRO® FERTILIZER

Lystek THP transforms biosolids and residuals into a pathogen free, CFIA regulated fertilizer which is in high demand by the end customer. This system and Lystek's product management methods have been designed and proven to maximize the value of LysteGro for both the agricultural customer and utility.

The CFIA regulates fertilizer products in Canada after they have undergone full evaluation for nutrient concentration and safety. As a CFIA regulated fertilizer, LysteGro is regulated like any other commercial fertilizer and is no longer designated a waste. Once the product is classified as a fertilizer, it does not fall under Provincial Non-Agricultural Source Material (NASM) regulations. This means that there is reduced administrative burden for farmers in the community when using LysteGro. Our Product Management team works with application contractors and local farmers to ensure that LysteGro is always applied following

Lystek's best management practices. Theses best practices exceed regulations and ensure the product is handled and applied in an environmentally responsible manner, at agronomically beneficial rates, under appropriate field conditions, and with diligent recordkeeping.

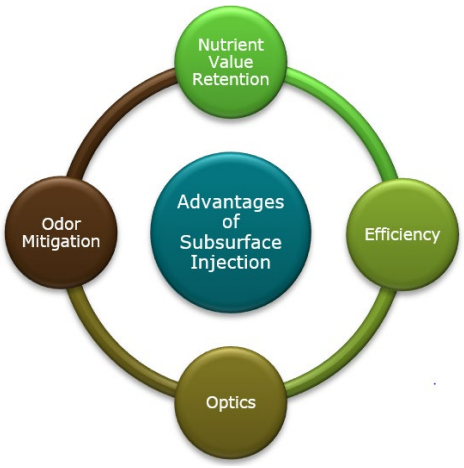
LysteGro is a valuable fertilizer with proven performance as a commercial fertilizer replacement with predictable nitrogen, phosphorus, and potassium (NPK) values. LysteGro is pathogen-free, concentrated, and remains pumpable with conventional liquid handling and application equipment. In addition to the macronutrient value, LysteGro is beneficial to farmers for several reasons, specifically:

Cost Savings: We market LysteGro to farmers at an affordable price based on the macronutrient content of the material. Notably, LysteGro fertilizer contains added Potassium (K), a key nutrient that is present in only very low quantities in other biosolids, providing significant value to the farmer. Benefits of LysteGro application are realized over multiple years due to the slow-release nature of the nutrients in the product and improvements in soil health.

Micronutrients: Micronutrients important for crop growth, including calcium, sulfur, zinc, copper, and several others inherent in biosolids, provide the farmer with an affordable option for these nutrients that are expensive to purchase in the commercial fertilizer form. The value of micronutrients in LysteGro is not factored into the fertilizer pricing to the farmer, so this is an added benefit.

Organic matter: The addition of organic matter to soils will help to improve overall soil health, including improved water holding capacity, soil structure and tilth, increased microbial activity as well as increased resilience to severe weather conditions.

LysteGro is subsurface injected to increase soil contact, ensure maximum nutrient use efficiency, and mitigate odours as well as run-off potential. The in-field aesthetics and cleanliness of the injection operation that we employ is superior to alternative surface application methods. The liquid nature of LysteGro allows for loading and off-loading efficiencies as well as odour mitigation at the plant and throughout transportation.



Compared to the conventional liquid land application programs:

- Application events are more efficient allowing more acres to be fertilized in less time during short application windows.
- Farmers receive the added benefit of potassium, making LysteGro a more complete fertilizer.
- The fertilizer is homogenous – allowing for application accuracy and nutrient use efficiency. This provides confidence that our agricultural customers can rely on the material as a synthetic fertilizer replacement.
- Less water is applied to field, increasing soil contact, mitigating risks of run off, and eliminating concerns about the hydraulic loading rate of the soil.

The advantages of producing a high-solids liquid product and Lystek's approach to product management are described further in Appendix G.



Figure 6-1 Examples of LysteGro hauling and application equipment

We will work with local and regional farmers and contractors to ensure LysteGro is transported and applied based on our internal best management practices.

These requirements meet provincial and federal regulations for CFIA regulated products and incorporate best management practices that are standard for the agricultural industry.

6.2 MARKETING AND SALES

We have developed a proven and successful marketing program for LysteGro in North America. We are capable and willing to assume full responsibility for the fertilizer distribution program at the Norfolk County Simcoe WWTP and are currently performing this service for most of our customers. An example draft LysteGro Services Agreement is included in Appendix H.

The combination of our cost-effective technology and our ability to provide back-end fertilizer management offers a turnkey service to our customers. This full-service approach sets us apart from alternative technology providers.

We have invested significant resources into developing a professional product management team and the resources required to facilitate this. We employ agricultural professionals (Certified Crop Advisors, Professional Agrologists, etc.) who have an educational background in environmental science and as a result, we understand and focus on both the needs of our agricultural customers and the importance of environmental stewardship.

*We have sold over **1.3 million tonnes** of LysteGro in southern Ontario alone!*

We have sold all LysteGro fertilizer we manage across North America, and we intend to do the same with the material produced at the Simcoe WWTP.

With commercial fertilizer prices and demand for organic amendments from the agricultural sector continuing to increase, the value of LysteGro fertilizer is expected to increase over time. This represents a built-in hedge against future rising management prices.

For example: in the Township of Southgate and surrounding areas, we have built a strong and growing market demand for the LysteGro fertilizer from our regional OMRC. At this facility we have successfully increased LysteGro prices by more than 300% across our decade of operations. This successful program, and the demonstrated value and demand for the product, has translated across our other deployments and allowed us to begin marketing the product at a greater price than we initially started in Southgate. For

example: the Elora WWTP in Centre Wellington began operations in 2016 and we have been able to establish market demand and achieve a LysteGro price greater than Southgate.

Through our revenue sharing agreement, Centre Wellington has already realized the advantage of increasing market demand for LysteGro by offsetting their management costs with a steadily increasing revenue share.

Over the next 20 years, these market trends are expected to continue as society continues to prioritize resource recovery, soil health, and sustainability.

In summary, Lystek's approach to product management is to ensure that the material is handled and applied in the most effective manner possible to optimize the value of the material while also engaging the local agricultural community to demonstrate product value. This long-term strategy is proven to effectively develop a stable market of loyal customers who understand the value of the product and are willing to pay for it.

With Lystek as its partner, Norfolk County can leverage our proven successful approach to manage the product.

"It has been a pleasure to work with Lystek International staff to complete this project. Not only did we find a more reliable and sustainable method of beneficially reusing our biosolids, but we also now have twice the storage volume since the stored biosolids are twice as thick, more homogeneous, and easier to handle. Another added benefit to the Authority is transferring the responsibility of transporting and marketing the biosolids to Lystek."

Firooz Fath-Azam,
South Huron Valley Utility Authority

7 REDUCING NORFOLK COUNTY'S CARBON EMISSIONS

Beneficial use of biosolids consistently allows for reduced greenhouse gas (GHG) emissions versus disposal oriented biosolids management options. Land applying biosolids enhances carbon sequestration in the soil and provides further emissions reductions by displacing use of synthetic nitrogen and phosphorous fertilizers. Considerations when comparing land application programs include factors such as the finished product concentration, distance travelled to field, energy input associated with processing, chemical inputs, and application methods.

Lystek has prepared a high-level comparison between two biosolids treatment options at Simcoe WWTP. The baseline process flow consists of hauling a blend of sludges from Norfolk County WWTPs to Simcoe for conventional anaerobic digestion followed by thickening, storage, and NASM land application. The Lystek THP process flow consists of hauling the same quantities of sludge, dewatering, Lystek THP, LysteMize digestion, storage, and fertilizer application.

To calculate GHG emissions in each process scenario, we used a customized approach combining emissions factors and methodologies derived from the 2022 Biosolids Emissions and Assessment Model (BEAM) and Lystek's proprietary models. 2051 projected flow rates were used for the calculation. Emissions from the following sources were considered for the baseline scenario:

- Emissions from the electricity consumed in digester mixing and digestate thickening. The digester heating fuel was assumed to be biogas. Digester was assumed to achieve 50% volatile solids reduction.
- Emissions from the manufacturing and transportation of polymer. Transportation distance was assumed as the distance from a supplier's location in the Greater Toronto Area to Simcoe

- Fugitive emissions from biogas combustion in boilers and flare
- Emissions from diesel fuel combustion during transportation and land application of thickened NASM biosolids from site within a 20 km radius
- Emissions avoided from use of NASM biosolids to displace conventional nitrogen and phosphorus fertilizers
    - The total nitrogen content of thickened NASM biosolids was estimated from recent LysteGro testing. For modelling purposes, the mineral nitrogen (NH_3, NO_3, NO_2) available to plants was assumed to be 15% of the total nitrogen. Further, it was assumed that thickened NASM biosolids would have nitrogen mineralization rate equal to that reported for compost, which is about 10%

To calculate emissions from the Lystek scenario, the following sources were considered:

- Emissions from the electricity consumed by dewatering and the THP Module. Process heating source was modelled as biogas. LysteMize digestion assumed to achieve 50% VSR
- Emissions from the manufacturing of dewatering polymer and 45% KOH solution, and their respective transportation from suppliers' locations (Greater Toronto Area and Guelph) to Simcoe
- Fugitive emissions from biogas combustion in the steam boilers and flare
- Emissions from diesel fuel combustion during transportation and application of LysteGro fertilizer from Simcoe WWTP within a 20 km radius
- Emissions avoided from the conventional nitrogen, phosphorus, and potassium fertilizers displaced by land application of LysteGro
    - The total nitrogen content of the LysteGro fertilizer was estimated based on recent LysteGro testing, as well as operational data experience with similar feedstocks. For modelling purposes, the mineral nitrogen (NH_3, NO_3, NO_2) available to plants was assumed to be 40% of the total nitrogen, with a mineralization rate of 40% over the growing season

A summary of emissions from each process is provided in Table 7-1. A positive value denotes emissions generated, while a negative value indicates emissions avoided.

By pursuing facility upgrades to improve its biosolids management practices the County is on a path to reduce its greenhouse gas emissions. Using Lystek's highly energy efficient THP and LysteMize digestion processes to produce a nutrient dense liquid fertilizer will provide the County with a lower carbon process for biosolids management, while simultaneously benefiting local farmers with a sustainable source of nutrients.

Although there are no emissions associated with conventional digester heating due to the availability of digester gas, it should be noted that our modelling estimated that approximately 99% of the biogas generated would be consumed by heating demands. By contrast, we estimated that Lystek THP process heating would consume just 24% of the LysteMize gas, leaving a significant amount of potential energy that can be used to offset electricity or natural gas use in other areas of the Simcoe WWTP. For instance, the remainder of the LysteMize gas could be used to generate approximately 1,220 MWh of electricity, which would provide additional emissions reductions of almost 49 tonnes CO_2e. **Use of the surplus LysteMize biogas will further lower the WWTP's carbon footprint.**

Table 7-1 2051 greenhouse gas emissions summary

	2051 GHG Emissions (tonnes CO_2e)	
	Alternative 1B[i]	Lystek
THP MODULE		
Electrical consumption	N/A	3
KOH manufacturing	N/A	171
CONVENTIONAL/LYSTEMIZE DIGESTION		
Fugitive emissions from biogas combustion and flaring	20	20
Digester mixing electrical consumption	13	N/A
THICKENING/DEWATERING		
Polymer manufacturing	11	26
Electrical consumption	0.3	3
TRANSPORTATION		
Biosolids to land application	23	17
Polymer to Simcoe WWTP	0.1	0.4
KOH to Simcoe WWTP	N/A	2
LAND APPLICATION		
Tractor diesel consumption	13	8
Nitrogen applied to soil	-91	-247
Phosphorus applied to soil	-83	-83
Potassium applied to soil	N/A	-61
Carbon sequestration from biosolids applied to soil	-328	-328
TOTAL	**-423**	**-465**

[i] Lystek THP is being compared to what we understand to be "Option 1B" which includes mesophilic anaerobic digestion, thickening of the digestate up to 6% TS, and production and management of NASM biosolids.

8 QUOTATION

8.1 LYSTEK THP TECHNOLOGY AND EQUIPMENT SUPPLY

Based on our current understanding of the proposed Simcoe WWTP we are prepared to offer a quotation for the equipment supply and technology licence for one LY10 Module: **$2,991,000**.

This cost accounts for the technology licence, mechanical and electrical equipment, Module instrumentation and controls, and software associated with the Lystek THP LY10 Module and is contingent on the project assumptions. This cost does not include installation, interconnect wiring and piping, utility connections, freight, or integration of the Lystek SCADA system into the overall facility SCADA.

This quotation is provided based on commodity and material pricing at the time of proposal delivery and is firm for 90 days.

The quoted price in this proposal has been calculated based on the current market prices required to manufacture the quoted equipment and services pursuant to regulations, duties and law in effect as of the date of this proposal. In the event that the introduction of new tariffs, levies, duties, regulations, or any type of legislation by a domestic or foreign government has the effect of increasing the price of the quoted equipment or services, Lystek reserves its right to adjust its quoted price in order to reflect these increases in cost. Nothing in this document or in any of the applicable contractual documentation shall be construed as a waiver of this right.

8.2 TECHNOLOGY AND EQUIPMENT SUPPLY SCOPE – BUDGETARY SUMMARY

Per Norfolk County's request, we are pleased to present budgetary estimates for the equipment listed in Table 8-1. Further information on the inclusions and exclusions related to these items are described in the sub-sections below.

Table 8-1 Budgetary capital estimates for Lystek THP, LysteMize, and LysteGro facility

Item	Technology and Equipment Quotation
LY10 Lystek THP Module	$ 2,991,000
Duty/Standby Pump Arrangement	$69,300
	Budgetary Estimate
Macerator and Grinder	$106,300
Dewatering Centrifuge System	$835,500
LysteMize Digestion Tank	$1,394,000
LysteGro Storage Tank	$1,371,900
Odour Management	$798,000
LysteGro Truck Loading	$231,200
Contingency[ii]	$1,657,915
Subtotal (budgetary items)	**$6,464,115**
BUDGETARY TOTAL	**$9,455,115**

[i] Optional standby Reactor discharge pump and KOH dosing pump and associated instruments and controls
[ii] 35% contingency carried on all budgetary cost items as directed by Norfolk County July 23, 2024

8.2.1 Macerator and Grinder

Supply of one (1) macerator and control panel, and one (1) sludge grinder and control panel. Costs for equipment spares are not included.

8.2.2 Dewatering Centrifuge

This budgetary estimate accounts for the complete polymer system, centrifuge, PLC and motor control panel, startup, commissioning, testing, and training. One set of special tools including lubricants for first year of operations is also included. Estimated cost is contingent on project assumptions. Costs for sludge feed pump(s) and spare parts are excluded.

8.2.3 LysteMize Digestion Tank

Supply and installation of one (1) 5,000 m^3 above ground, glass-lined steel LysteMize Digestion tank. Includes dual membrane roof, instrumentation, pressure relief equipment, and access ladder. Estimate does not include foundation installation or required earthworks.

8.2.4 LysteGro Storage Tank

Supply and installation of one (1) one (1) 5,000 m^3 above ground, glass-lined steel LysteGro storage tank. Includes aluminum dome roof and access ladder. Estimate does not include foundation installation or required earthworks.

8.2.5 LysteGro Truck Loading

Truck loading includes: truck loading pump, discharge flow meter and pressure sensor, and truck loading station with operator console.

8.2.6 Odour Management

Supply of two (2) BIOREM BASYS biofilters. Includes all required pumps, fans, instrumentation and controls, control panel, winterization kit, commissioning, start-up and performance testing by vendor. Estimate does not include spare parts.

8.2.7 Exclusions

- Taxes
- Insurance and bonding as required
- All items not explicitly listed as included shall be considered to be exclusions

8.3 LYSTEGRO® MANAGEMENT FEE

Based on our initial assessment of the area and potential market for LysteGro we are prepared to offer a management fee of **CAD $10.50** per cubic meter of LysteGro for a five-year term.

This full-service offering includes all marketing, sales, hauling, and regulatory reporting requirements of the product. We ensure that all local, provincial, and federal regulations are adhered to along with Lystek's industry leading best management practices.

8.3.1 Revenue Sharing Agreement

As part of the management contract for LysteGro we also offer a revenue sharing agreement to the County whereby any revenue paid by the farmer for the product over and above $6/m^3 will be shared 50/50 between the County and Lystek. LysteGro revenue sharing scenarios are outline in Table 8-2 below.

Revenue sharing allows the County to directly benefit from the production of a high-quality fertilizer.

Table 8-2 LysteGro revenue sharing example scenarios

Example LysteGro Selling Price (per m^3)	Revenue Sharing with County (per m^3)	Total Management Fee paid by the County (per m^3)[i]
≤ $6	$0	**$10.50**
$9.36[ii]	$1.68	**$8.82**
$11	$2.50	**$8.00**

[i] Example of effective total management fee paid by the County per m^3, assuming LysteGro fertilizer revenues are used to offset the County's management costs.

[ii] Farmers in Ontario paid an average of $9.36 per m^3 for LysteGro in 2023.

The production of a value-add fertilizer offers assurance of predictable expenses and a stable management option. These minimized fertilizer management costs can be further offset through shared revenues from LysteGro sales. The revenue return to the County presents a significant hedge against inflation risk and can help to offset costs. This is one of the few areas where a utility can minimize future price risk with a cost increase factor that is below inflation and may reduce over time. This technology will enable the County to create a valuable product that can offset management costs while supplying local farmers with required nutrients.

9 SUMMARY

We thank you for the opportunity to propose an advanced biosolids processing and management solution for the Norfolk County Simcoe WWTP.

This approach will enhance Norfolk County's biosolids management operations with an affordable alternative to conventional anaerobic digestion, up to 90% less biosolids to manage, and production of an in-demand, saleable fertilizer product. Lystek THP is modular and will easily enable the County to scale to meet the demands during peak-flow periods as well as flow demands accompanying community growth.

This proposed application includes compact processing equipment and tank infrastructure, minimizing the site footprint and capital costs. This solution minimizes life-cycle costs and will improve operational security, all while ensuring the valuable nutrients found in these residuals continue to be recovered.

LysteMize digestion is an affordable and efficient alternative to conventional anaerobic digestion. LysteMize digestion is simple to operate and maintain and will further reduce the County's GHG emissions by optimizing recovery and beneficial use of these renewable resources.

We are pleased to offer our comprehensive product management services to develop a long-term biosolids program in the region and ensure best-practice use of LysteGro. This offers Norfolk County a hands-off, worry-free, and sustainable solution with the opportunity to offset management costs with fertilizer sales revenues.

We look forward to working with Hatch and Norfolk County to develop an advanced and affordable biosolids management solution for the Simcoe WWTP. This will enhance resource recovery, operational and management efficiencies on-site, and will set the County up for a sustainable future that can easily accommodate increased flows.

Thank you for your consideration. We look forward to future discussions.

Sarah Mason-Renton, Ph.D.
Business Development Manager
519-465-1294
smasonrenton@lystek.com

Alex West, P.Eng
Applications Lead
519-807-4952
awest@lystek.com

APPENDICES

Appendix A
Lystek Installations

Lystek

On -Site Installations

Location (Commissioned)	Pop.	Volumes Currently Processed (DT/Y) [1,2]	Site Installation Details	Module Size	Feedstock	Lystek Products/ Processes	LysteGro Storage
Guelph, ON (2008)	150,000	2,750	On-Site - Retrofit	**2 - LY6s**	Anaerobic Digested Biosolids	**LysteGro, LysteMize**	Modular Transportable Above Ground Storage Tanks
St. Marys, ON (2010)	7,916	265	On-Site - Retrofit	**LY3**	Originally: Anaerobic Digested Biosolids Current: Aerobic Digested Biosolids	**LysteGro, LysteMize, LysteCarb**	Below Ground Concrete Tank
Elora, ON (2014)	7,756	145	On-Site - Retrofit	**LY6**	Aerobic Digested Biosolids	**LysteGro**	Below Ground Concrete Tank
North Battleford, SK (2014)	14,935	540	On-Site - Retrofit	**LY6**	Aerobic Digested Biosolids	**LysteGro**	Retrofitted Reservoir – Lined & Covered
St. Thomas, ON (2018)	41,800	1,650	On-Site - New Build	**LY6**	Undigested Residuals	**LysteGro**	Above Ground Tank
St. Cloud, MN (2018)	69,032	1,650	On-Site - Retrofit	**LY10**	Anaerobic Digested Biosolids	**LysteGro**	Repurpose - Below Ground Concrete Tank
Innisfil, ON (2019)	42,700	610	On-Site - New Build	**LY3**	Aerobic Digested Biosolids	**LysteGro**	Retrofit - Above Ground Tank with Floating Cover
Goleta, CA (2019)	N/A	Demo / R&D	On-Site - Skid Unit	N/A	Source Separated Organics (UC Santa Barbara), Biosolids (Goleta Sanitary District)	**LysteMize**	N/A
South Huron Valley, MI (2022)	90,000	2,149	On-Site - Retrofit	**LY10**	Undigested Biosolids	**LysteGro**	Below Ground Concrete Tank

Lystek

On-Site Installations

Location (Commissioned)	Pop.	Volumes Currently Processed (DT/Y) [1,2]	Site Installation Details	Module Size	Feedstock	Lystek Products/ Processes	LysteGro Storage
Sharjah, UAE (2022)	1.8 M	1,370	Off-Site – Container Module	**LY3**	Aerobic Digested Biosolids	**LysteGro**	N/A
Commerce Township, MI (2024)	44,000	525	On-Site - Retrofit	**LY10**	Undigested Biosolids	**LysteGro**	Above & Below Ground Concrete Tanks
Erin, ON (Coming Soon!)	12,446		On-Site	**LY10**	Undigested Biosolids	**LysteGro** **LysteMize**	Above Ground Steel Tanks
Valley Sanitary District, CA (Coming Soon!)	100,000		On-Site – New Build	**LY10**	Primary digestate, WAS	**LysteGro** **LysteMize**	Above Ground Steel Tanks

[1]Approximate current volumes processed in dry tons per year

[2]Current site processing dependent upon hours of operation and regulated processing rates

**Customer references available upon request*

Regional Installations

Location (Commissioned)	Module Size	Site Capacity (WT/Y)[1]	Site Details	Deployment Structure	Lystek Products/ Processes	Feedstock	LysteGro Storage
Southgate, ON (2012)	**3 – LY10**	165,000	Off-Site - Regional Facility, Greenfield	DBOO	**LysteGro**	Undigested / Digested Biosolids & Organics from Various Municipalities	Reservoirs – Lined & Covered
Serving generators such as: - Toronto, Halton, Hamilton, Kitchener, Guelph, Niagara, Orangeville, Tay Township, West Grey, Gravenhurst, Peterborough, Huntsville, Mississauga, Brantford, Arthur, Innisfil, Meaford, Owen Sound, Midland, Walkerton, Centre Wellington, Mono, Biox Ltd.							
Iroquois, ON (2012)	**1 – LY10**	45,000	Off-Site - Regional Facility Upgrade	DBT	**LysteGro**	Undigested / Digested Biosolids from Various Municipalities	Below Ground Concrete Tank
Serving generators such as: - Ottawa, Toronto, and Peterborough, among others							
Fairfield, CA (2016)	**2 – LY10**	150,000	On-Site - P3 Regional Facility	P3 - DBOO	**LysteGro, LysteMize**	Undigested / Digested Biosolids from Various Municipalities	Reservoir – Lined & Covered
Serving generators such as: - Fairfield-Suisun Sewer District, City and County of San Francisco, East Bay Municipal Utility District, Santa Rosa, Central Marin Sanitation Agency, Petaluma, Benicia, Palo Alto, City of South San Francisco, Budweiser Brewing in City of Fairfield							

[1]Site capacity represented in wet tons (average 15% TS) per year

**Customer references available upon request*

Appendix B
Case Studies

(CASE STUDY)

Lystek



Sustainable Solutions for Unsustainable Storage Challenges

ABOUT

The South Huron Valley Utility Authority (SHVUA) services over 90,000 people across seven communities. **www.shvua.org**

CHALLENGES

- Insufficient storage capacity for lime-stabilized, liquid Class B biosolids program
- Land application constraints due to weather and time in field
- Unsustainable and cost prohibitive reliance on contingency landfill disposal

PROJECT DRIVERS

SHVUA selected Lystek THP as an advanced treatment technology providing these benefits:

- Substantially reduce biosolids volumes, alleviate operational stressors and enhance efficiencies and cost savings overall
- Production of Class A biosolids

RESULT

- More than 2x biosolids volume reduction and extension of onsite storage capacity
- Elimination of alkali stabilization, expensive storage clean out, and contingency dewatering activities
- Optimized use of existing site infrastructure with equipment installation in existing building and continued use of the 4 MG biosolids storage tanks

"It has been a pleasure to work with Lystek staff to complete this project. Not only did we find a more reliable and sustainable method of beneficially reusing our biosolids, but we also now have twice the storage volume since the stored biosolids are twice as thick, more homogeneous, and easier to handle. Another added benefit to the Authority is transferring the responsibility of transporting and marketing the biosolids to Lystek."

Firooz Fath-Azam, System Manager

South Huron Valley Treatment Plant
South Huron Valley, Michigan US

The South Huron Valley Utility Authority has implemented Lystek THP, to enhance their biosolids management program at their WWTP located in Brownstown Township, Michigan.



KEY METRICS

Population Served: 90,000

WWTP Rating: 24 MGD design, ADF of 10 MGD (90,000 m^3 / day)

Lystek THP Processing Footprint: 1,850 ft^2 (172 m^2)

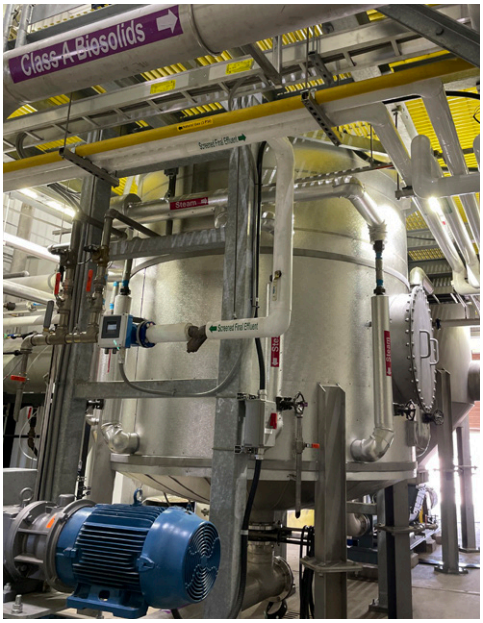
Lystek THP Module Size: 1 x LY10 (1.0 dry tons / hr)

Feedstock: Municipal biosolids (undigested)

Project Delivery Model: Integrated Design-Build-Transfer

Lystek THP substantially reduced the facility's residual biosolids volumes with the production of Class A LysteGro, presenting cost-savings, operational relief, and a secure and sustainable biosolids management solution.

The Authority services over 90,000 people across seven communities. Historically, the South Huron Valley wastewater treatment plant (WWTP) produced a Class-B quality low solids liquid lime stabilized biosolids for land application. The facility was experiencing challenges related to solids accumulation and insufficient liquid biosolids storage capacity on site. When combined with seasonal weather variations further stressing land application, excess biosolids were being dewatered using temporary equipment and disposed of in landfill. These operational challenges and contingency disposal outlet resulted in substantially increasing program costs.



Analysis of the Net Present Value of alternatives, including continuing to rely on temporary dewatering and installing permanent dewatering, conducted by Jacobs Engineering Group (plant and collection system operator) and the Authority's engineering firm, Hubbell Roth & Clark (HRC), found that the Authority's long-term costs for residual management would be lower with the operation of Lystek THP and a LysteGro Class A biosolids management program than with dewatering alone.

Based on these factors, the Authority decided to engage Lystek in 2020 to design and build this new system into existing building space on site. This advanced biosolids management project includes the implementation of one Lystek THP LY10 Module alongside a dewatering centrifuge and permanent biosolids truck loading infrastructure. The project took advantage of existing liquid storage tanks and building infrastructure to optimize the use of existing infrastructure and minimize capital costs. The facility was commissioned and operations handed over to Jacobs in April 2022.

This technology presents an affordable solution that is energy efficient, requires no additional operators beyond their existing staff complement, and significantly reduced the Authority's biosolids volumes, substantially extending the capacity of the WWTP's existing liquid storage infrastructure.

With the production of a Class A quality biosolids fertilizer and the operational security achieved, this solution removed the need for contingency disposal of biosolids in landfills and advances the Authority's resource recovery program.

The Authority has also entered into a multi-year Agreement with Lystek for comprehensive LysteGro Management Services, and we completed the first application in the Fall of 2022. The enhanced biosolids quality and concentrated nature of the high-solids liquid Class A biosolids, exceeds regulatory requirements and drives the demand for LysteGro amendments from local farmers, providing further price security to the Authority.





About Lystek

Lystek International is the leading provider of advanced, thermal hydrolysis solutions in North America, servicing over 60 utilities globally. Lystek offers turnkey solutions including technology supply, design-build and installation services, regional processing solutions, and comprehensive LysteGro sales and management. **Lystek THP®** is proven across a range of small, medium, and large communities. We work with public and private sector clients to enhance operations, reduce GHG emissions, and recover valuable nutrients and carbon from biosolids and organic feedstocks through the production of increased renewable biogas with **LysteMize®** and **LysteGro®** Class A quality biosolids fertilizers.

Toll Free 888.501.6508 • www.lystek.com • info@lystek.com

(CASE STUDY)

Lystek



Lowering Carbon Footprint with Landfill Diversion and Efficient Production of Class A Biosolids

ABOUT

The Commerce Wastewater Treatment Plant (WWTP) treats approximately two million gallons per day (MGD) of municipal wastewater and has a permitted capacity of 8.5 MGD. The WWTP services the majority of Commerce Township as well as portions of White Lake Township, the Village of Wolverine Lake, West Bloomfield Township, and City of Novi. The WWTP is operated by the Oakland County Water Resources Commission. **https://commercetwp.com/**

CHALLENGES

- The WWTP relied on off-site landfill disposal
- Average 30% annual increase in disposal costs
- Insufficient storage capacity on-site to return to previous practice of liquid Class B Biosolids management

SOLUTION

Commerce Township engaged Lystek under a Progressive Design-Build agreement to:

- Deploy Lystek THP® following the existing belt filter presses
- Use the existing solids conveyance equipment to transport dewatered biosolids directly into the LY10 THP Module
- Install the Module within a portion of the existing solids handling building and make use of the existing mezzanine
- Incorporate indoor LysteGro® truck loading
- Use the existing liquid storage tanks for Class A LysteGro

RESULT

- Design-build project completed in less than two years
- Optimized use of existing infrastructure by complementing previous capital investments
- CAPEX and OPEX savings
- More than 12 months of storage with high-solids LysteGro
- Long-term price certainty with multi-year LysteGro management agreement

Commerce Wastewater Treatment Plant
Commerce, MI

"The overall project went smoothly from the initial discussions with the Township all the way through design and construction. The project was completed on time and on budget and is functioning well."

Jason Mayer, Partner, Giffels Webster



KEY METRICS

Population Served: 43,165

WWTP Rating: 8.5 MGD; ADF 2 MGD / (32,000 m^3 /day)

Lystek THP Processing Footprint: 1,265 ft^2 (118 m^2)

Lystek THP Module Size: 1 x LY10 (1.0 dry tons / hr)

Feedstock: Municipal biosolids (undigested)

Project Delivery Model: Progressive-Design-Build; On-site Retrofit

The Commerce Wastewater Treatment Plant (WWTP) treats approximately two million gallons per day (MGD) of municipal wastewater and has a permitted capacity of 8.5 MGD. The WWTP services the majority of Commerce Township as well as portions of White Lake Township, the Village of Wolverine Lake, West Bloomfield Township, and City of Novi. The WWTP previously relied on off-site landfill disposal.



The Commerce WWTP historically generated liquid Class B Biosolids for land application. This liquid biosolids program created operational stress with insufficient storage on-site. In 2010 the WWTP installed belt-filter presses to dewater the biosolids and transition to landfill disposal. The cost of landfill disposal increased substantially, with an average annual increase of over 30% since the dewatering program was implemented. These cost increases led the Township to question the viability of this program.

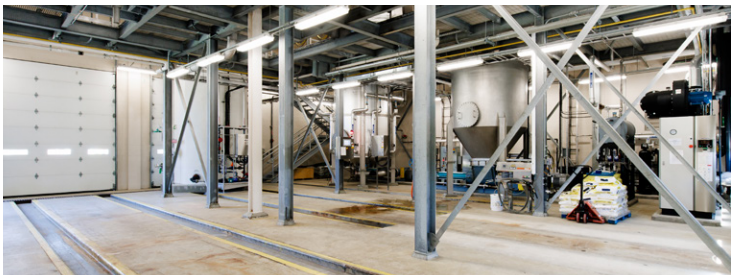
Lystek THP® eliminates the Township's reliance on unsustainable landfill disposal with the production of Class A LysteGro® Biosolids fertilizer. This sustainable biosolids management program provides the Township with long-term cost-certainty and reduce the facility's carbon footprint.

This Project was completed as a Progressive Design-Build. The Charter Township of Commerce awarded Lystek a preliminary design contract in summer 2021 to complete the 30% design phase required for permit application to the Michigan Department of Environment, Great Lakes, and Energy (EGLE). This design was completed December 2021 in collaboration with the Township's engineering firm, Giffels Webster, and the Oakland County WRC operations and engineering team. EGLE awarded permits for the project in April 2022 and Commerce Township awarded Lystek the Design-Build contract shortly after in May. The Design-Build project began in July 2022 and the system was commissioned 18 months later with operations handed over in March of this year. EGLE authorized the Commerce WWTP Class A Biosolids permit in June 2024 and land application will begin this fall.

The Lystek THP Module was installed into a portion of the existing solids handling building space on-site with no major infrastructure being decommissioned. Incorporating Lystek THP downstream of dewatering operations built upon previous capital investments at the WWTP with use of the existing belt filter presses and dewatering conveyance equipment located in the dewatering building. Producing a high-solids liquid Class A Biosolids brings new life to the existing liquid biosolids storage tanks, while extending capacity to alleviate this historical point of operational stress.

The Township has engaged Lystek in a multi-year agreement for comprehensive Class A LysteGro Management Services.





"The Lystek system fit perfectly within our wastewater treatment plant. We didn't have to build any buildings. We had an open stall that we could fit the system right in. Working with Lystek was seamless. Any time the Board or I had questions, they were quick to respond. They were very helpful. They hit every target moving forward. Promises made, promises kept." – Larry Gray, Commerce Township Supervisor

About Lystek

Lystek International is the leading provider of advanced thermal hydrolysis solutions in North America, servicing over 60 Utilities globally. Lystek offers turnkey solutions including technology supply, design-build and installation services, regional processing solutions, and comprehensive LysteGro sales and management. **Lystek THP®** is proven across a range of small, medium, and large communities. We work with public and private sector clients to enhance operations, reduce GHG emissions, and recover valuable nutrients and carbon from biosolids and organic feedstocks through the production of increased renewable biogas with **LysteMize®** Digestion and **LysteGro®** Class A quality biosolids fertilizers.

Toll Free 888.501.6508 • www.lystek.com • info@lystek.com

(CASE STUDY)

Lystek



Costly Liquid Storage Becomes Fertilizer Sales Success Story

ABOUT

Centre Wellington is a township in South-Central Ontario, with a population of 26,000. The township consists of two small urban centres, Elora and Fergus, with a number of other smaller communities. **www.centrewellington.ca**

CHALLENGES

- Liquid biosolids production had exceeded the Elora Wastewater Treatment Plant's (WWTP) processing and storage capabilities
- Limited space on-site for the construction of additional biosolids storage
- Costs for year-round off-site storage and disposal were escalating

PROJECT DRIVERS

Centre Wellington selected Lystek THP as a biosolids treatment technology, along with additional plant upgrades, providing these benefits:

- Dramatic reduction in storage and hauling requirements for biosolids
- Production of a high-quality CFIA regulated fertilizer to provide a source of organic matter and cost effective nutrients for local farmers

RESULT

- More than **9,000 m³** of LysteGro fertilizer produced and sold to local farmers
- Ability to store almost two years of LysteGro production volume on-site
- Minimal staff hours dedicated to advanced treatment process
- Annual LysteGro fertilizer revenue returns offset program costs and continue to outpace inflationary increases

Elora Wastewater Treatment Plant
Township of Centre Wellington, ON

Centre Wellington takes advantage of its wastewater plant upgrade to reduce volumes, alleviate costly storage problems, and convert "waste" into a nutrient-rich, saleable fertilizer.



KEY METRICS

Population Served: 7,500

WWTP Rating: 5,000 m³ / day (1.1 MGD)

Lystek THP Processing Footprint: 74 m³ (800 ft²)

Lystek THP Module Size: 1 x LY6 (0.6 dry tons / hr)

Feedstock: Municipal biosolids (aerobically digested)

Project Delivery Model: Technology & Equipment Supply

The Town of Elora is a growing community located along the Grand River in Wellington County, Ontario. The WWTP historically generated a low-solids non-agricultural source material (NASM, or Class B biosolids) that was applied to local farmlands from spring to fall and hauled to off-site storage and disposal in the winter. Increasing biosolids volumes and costs of management, along with additional required plant upgrades, led Township council to approve a project to expand and upgrade the treatment plant.

Lystek THP was pre-selected by the Town and specified as a mandatory part of the overall strategy to upgrade the plant's biosolids management practices. Christine Furlong, P.Eng., of Triton Engineering (the Township's Engineering Firm) said that "***Lystek was selected because, when combined with an effective dewatering strategy, the process reduces typical issues associated with Class B biosolids. The net result is a substantial reduction in the volume of end product requiring management as well as a smaller biosolids storage building.***"

"***We also liked the fact that the process is returning organic material back to the earth***," says Furlong. Another benefit is that Lystek THP eliminates pathogens, producing a Canadian Food Inspection Agency (CFIA) regulated fertilizer (Class A biosolids), which can be used in agriculture the same as any commercial fertilizer product.

Ease-of-operations was another key requirement for the solution. "***Our plant operations staff also has to look after other plants and lift stations***," says Colin Baker, Managing Director of Infrastructure for the Township of Centre Wellington. A major benefit of Lystek THP is that while it must be monitored by plant staff, the process itself is fully automated and requires minimal operator intervention.

Lystek THP was implemented alongside additional upgrades at Elora WWTP by Wellington Construction Contractors, supervised by Triton Engineering Services in 2014. The Lystek process significantly reduced the storage requirements by concentrating the product, increasing the solids from 3% to 15%. "***It's much easier to handle and store than a dewatered or dry product***," confirms Furlong. The site now has approximately 2-years of storage capacity, and with Lystek's fertilizer management services, has sold more than 9,000 m^3 of LysteGro fertilizer to local farmers. The Town's fertilizer revenue sharing agreement with Lystek has provided long-term price certainty with fertilizer revenues continuing to offset management costs such that the Township is paying less per ton of biosolids nearly a decade into operations than when the program first began.

"***LysteGro is showing to be a highly valued product in our area and, as proof of that, our revenue sharing returns have reduced our biosolids management fees. That's a real-game changer.***" John den Hoed, Supervisor of Wastewater Services, Elora WWTP





About Lystek

Lystek International is the leading provider of advanced, thermal hydrolysis solutions in North America, servicing over 60 utilities globally. Lystek offers turnkey solutions including technology supply, design-build and installation services, regional processing solutions, and comprehensive LysteGro sales and management. **Lystek THP®** is proven across a range of small, medium, and large communities. We work with public and private sector clients to enhance operations, reduce GHG emissions, and recover valuable nutrients and carbon from biosolids and organic feedstocks through the production of increased renewable biogas with **LysteMize®** and **LysteGro®** Class A quality biosolids fertilizers.

Toll Free 888.501.6508 • www.lystek.com • info@lystek.com

(CASE STUDY)

Lystek



Nutrient Recovery & Reuse (NR2) Project

ABOUT

The City of St. Cloud is the 10th largest city in Minnesota. It is centrally located in the heart of the Midwest along the banks of the Mississippi River and was the first to use the River as a drinking water source. **www.ci.stcloud.mn.us**

CHALLENGES

- Liquid biosolids storage capacity was under pressure due to community growth and wet weather events shortening the land application season
- Intention to increase co-digestion with third-party organics, further increasing biosolids volumes and storage challenges
- Anticipated future regulatory pressures to produce a Class A biosolids for land application
- Desire to maximize existing infrastructure and minimizing cost to their ratepayers

PROJECT DRIVERS

The City of St. Cloud selected Lystek THP as a biosolids treatment technology, providing these benefits:

- Dramatic reduction in storage and hauling requirements for biosolids, capacity for co-digested organics
- Production of a concentrated liquid Class A biosolids fertilizer product, which can be managed with the City's existing liquid transportation and land application equipment

RESULT

- **70%** reduction in biosolids volumes extending the capacity of the City's existing storage, reducing overtime and trucking requirements, and minimizing wear and tear on equipment
- Estimated **cost savings of $12 million** over a 20 year life cycle as compared to alternative solutions
- Maximizing the life and use of the Facility's existing infrastructure and equipment

St. Cloud Wastewater Treatment Facility
City of St. Cloud, Minnesota, USA

"The biggest, driving force behind the various upgrades to our biosolids program was that we were running out of storage."

Brian Shoenecker Wastewater Services Manager for the City of St. Cloud



KEY METRICS

Population Served: 69,032

WWTP Rating: 13 MGD (~49,000 m^3 / day)

Lystek THP Processing Footprint: 1600 ft^2 (149 m^2)

Lystek THP Module Size: 1 x LY10 (1.0 dry ton / hr)

Feedstock: Municipal biosolids (anaerobically digested)

Project Delivery Model: Technology & Equipment Supply

The St. Cloud Nutrient, Energy and Water (NEW) Recovery Facility services a total population of about 120,000, including the City of St. Cloud and several area cities such as St. Augusta, St. Joseph, Sartell, Sauk Rapids, and Waite Park. As a recognized leader in resource recovery, the St. Cloud NEW Recovery Facility is one of only a few water utilities in the United States to be named a "Utility of the Future Today" by the National Association of Clean Water Agencies (NACWA) for four years in a row.



In 2017, the utility saw the opportunity to advance their Resource Recovery and Energy Efficiency Master Plan when they received notification that state funding was available through the Clean Water Legacy Act. With this funding, the City embarked on an initiative they called the Nutrient Recovery and Reuse (NR2) Project, of which the main goals were phosphorus recovery and the production of Class A biosolids at the facility.

The City was interested in pursuing a Class A treatment technology to prepare for possible changes in future regulatory requirements. Facing storage capacity issues with their low solids liquid Class B program, they were also looking to solutions that could reduce the volume of material. St. Cloud's Class B biosolids application program had been successfully managed and operated for many years by City staff with a receptive farming community for the biosolids.

Evaluation of solutions and alternative technologies included several options such as a producing a dewatered cake. According to Hodel, "***We were in our facility planning phase when we first heard about Lystek. The timing was perfect. We were looking at various solutions and we are known for being innovative and taking some (measured) risk in our approach, including different technologies. It started with a conference call and evolved into a detailed review of the Lystek THP system. What really impressed us was how well it fit with our existing infrastructure and equipment. Plus it enabled us to continue providing the type of end product our agricultural customers prefer and ask for***."

Lystek THP was selected by the City of St. Cloud and provided through a technology supply agreement. Construction services were provided by Rice Lake Construction and engineering was carried out by Donohue and Associates. Lystek THP was operational at the plant by September 2018. St. Cloud has continued to operate their successful land application program using their existing infrastructure and equipment, however, they have seen a dramatic reduction of over 70% in their biosolids volumes and the associated trucking, reducing their biosolids program's greenhouse gas emissions. In addition, the program itself has become less stressful to manage – the City saw decreases of 85% in their overtime hours associated with land application.

Since inception of this program, St. Cloud has also successfully increased the amount of food and beverage byproducts they have been co-digesting from 5,000 to over 20,000 gallons per day with no process disruptions. This has demonstrated Lystek THP's ability to accommodate feedstocks with increasing organic content, which has enabled the City to enhance their comprehensive resource recovery program and service offering to the region. On site research has also shown the ability for the Ostara WASSRIP® process, also implemented as part of their NR2 project, to utilize Lystek-processed biosolids as a carbon source for additional phosphorous removal at the plant.



About Lystek

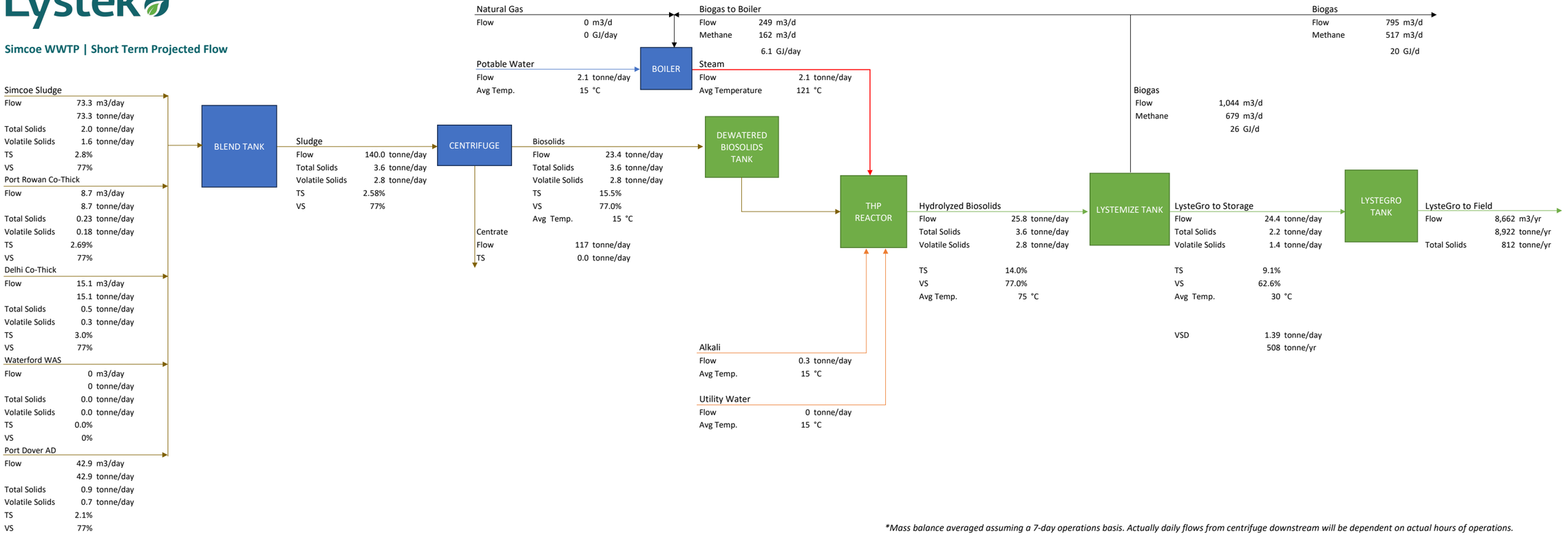
Lystek International is the leading provider of advanced, thermal hydrolysis solutions in North America, servicing over 60 utilities globally. Lystek offers turnkey solutions including technology supply, design-build and installation services, regional processing solutions, and comprehensive LysteGro sales and management. **Lystek THP®** is proven across a range of small, medium, and large communities. We work with public and private sector clients to enhance operations, reduce GHG emissions, and recover valuable nutrients and carbon from biosolids and organic feedstocks through the production of increased renewable biogas with **LysteMize®** and **LysteGro®** Class A quality biosolids fertilizers.

Toll Free 888.501.6508 • www.lystek.com • info@lystek.com

Appendix C
Lystek THP Block Flow Diagrams

Lystek

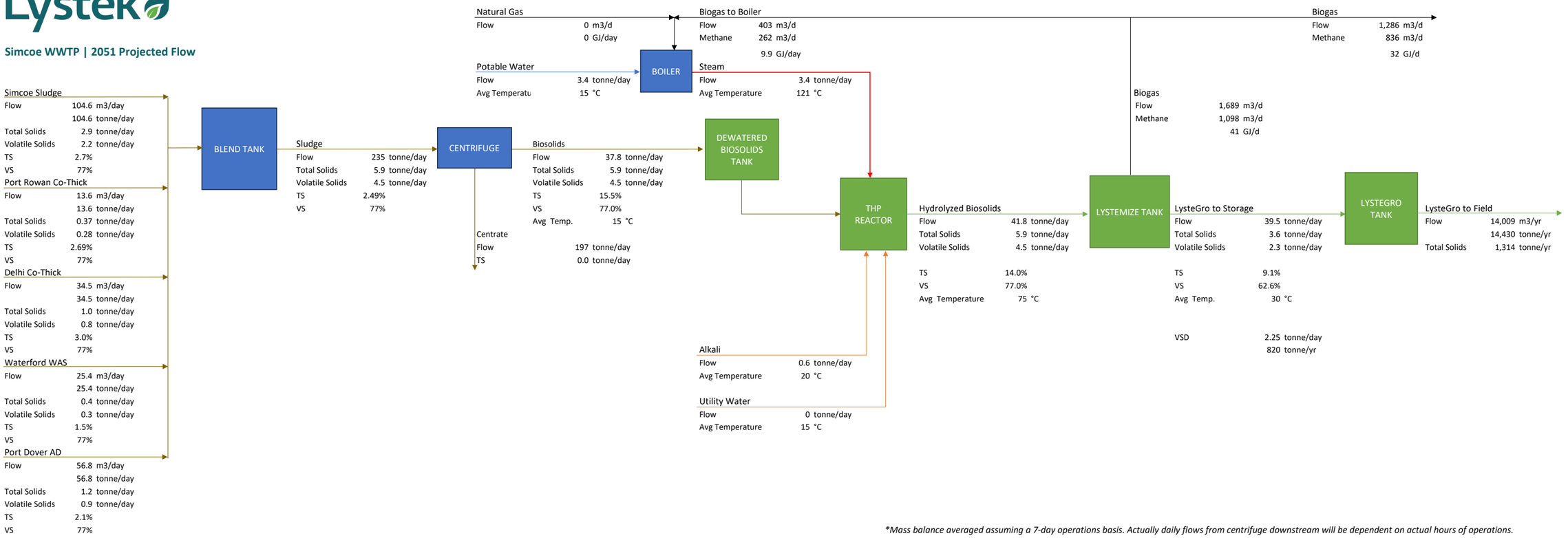
Simcoe WWTP | Short Term Projected Flow



*Mass balance averaged assuming a 7-day operations basis. Actually daily flows from centrifuge downstream will be dependent on actual hours of operations.

Lystek

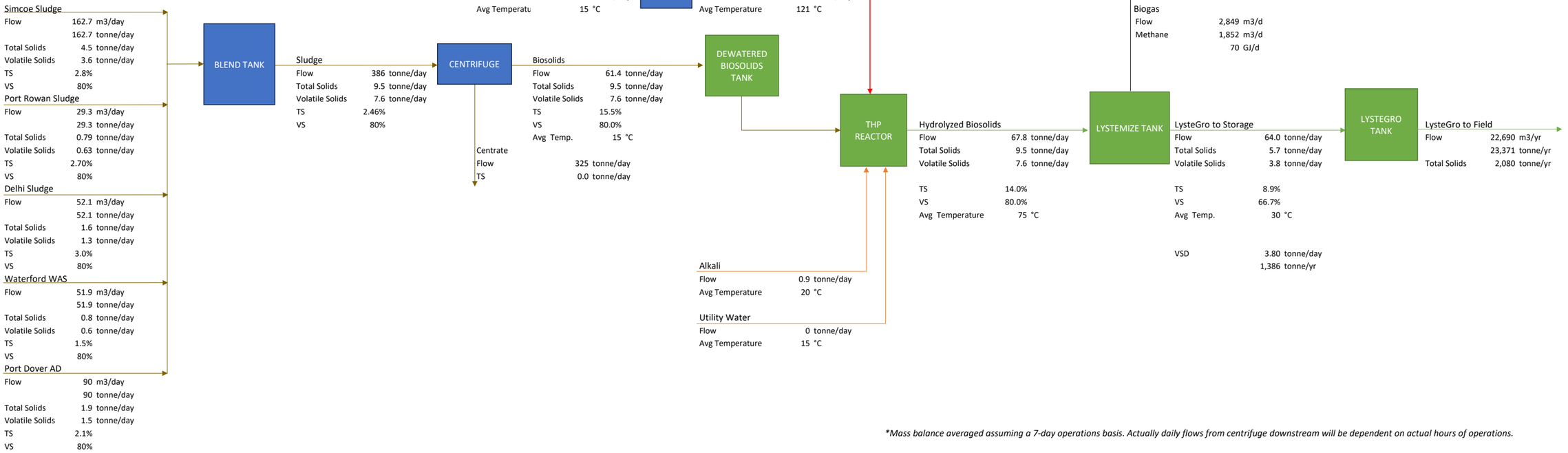
Simcoe WWTP | 2051 Projected Flow



*Mass balance averaged assuming a 7-day operations basis. Actually daily flows from centrifuge downstream will be dependent on actual hours of operations.

Lystek

Simcoe WWTP | ECA Rated Flow



*Mass balance averaged assuming a 7-day operations basis. Actually daily flows from centrifuge downstream will be dependent on actual hours of operations.

Appendix D

Draft Example Lystek THP Services Agreement

125 McGovern Drive Unit 1, Cambridge, Ontario N3H 4R7
T. 226.444.0186 TF. 888.501.6508 E. info@lystek.com

LYSTEK THP SERVICE AGREEMENT

This Service Agreement (the "Agreement") is entered into as of [Date] (the "Effective Date"), by and between Lystek International Corp., a corporation organized and existing under the laws of the Province of Ontario with its principal place of business located at 125 McGovern Dr. Unit 1 Cambridge, ON ("Service Provider"), and [Client Name], an organization/corporation with its principal place of business located at [Client Address] ("Client").

Lystek THP was selected and supplied under [*project agreement details*].

WHEREAS, the Service Provider is in the business of providing Biosolids Treatment Solutions and Services; and

WHEREAS, the Client desires to retain the services of the Service Provider to perform such services under the terms and conditions set forth herein;

NOW, THEREFORE, in consideration of the mutual covenants and promises herein contained, the parties hereto agree as follows:

DRAFT

1. **Client's Responsibilities**

   The Client is responsible for the following:

   - Equipment must be operated in accordance with the most recent version of the Lystek Operations and Maintenance Manual provided by Lystek
   - Equipment must be maintained in accordance with the most recent versions of vendor supplied manuals as provided by Lystek
   - Spare parts stock to be supplied and maintained by the Client
   - Provide Service Provider with electronic monthly operation logs
   - Maintaining remote monitoring capabilities [*if applicable for the project*]

2. **Service Provider's Responsibilities**

   The Service Provider agrees to provide the following services to the Client (the "Services"):

   - One single-day site visit annually
     - Site visit on an annual cycle, to be coordinated to accommodate the Client and Service Providers' availability
       - *Ideally this will occur during a truck loading event such that LysteGro truck loading can be observed in operation alongside operations of the Lystek THP Module.*
   - Annual condition assessment of Lystek THP Module and LysteGro truck loading equipment
   - Monthly remote review of operations performance of Lystek supplied equipment, inclusive of:

- THP production throughput and volumes
- Solids concentration and product viscosity
- KOH dosing

- Year-round remote support as needed via email or phone during regular business hours
  - Business hours are Monday to Friday 8 am to 5 pm EST
- Annual report summarizing operations and equipment condition review and recommendations
  - Report to be delivered electronically within 30 days of site visit

3. **Term**

   This Agreement is for a ten-year term. The agreement shall commence on the Effective Date and shall continue until [End Date], unless terminated earlier in accordance with the provisions of this Agreement.

4. **Compensation**

   4.1 The Client agrees to pay the Service Provider an annual fee of [Amount] for the Services provided under this Agreement.

   Additional work beyond the direct scope of services outlined herein will not be provided without written approval (via email) by the Client in advance.

   4.2 Payment terms are as follows: 100% of the annual fee 30 days before the start of service.

   4.3 All payments shall be made to the Service Provider at the address provided above or to such other address as the Service Provider may specify in writing.

   4.4 Any payments not received by the Service Provider within 30 days of the due date shall accrue interest at the rate of 18% per annum, calculated daily from the due date until the date of payment in full.

5. **Confidentiality**

   5.1 The Service Provider agrees to keep confidential all information concerning the business and affairs of the Client and shall not disclose any such information to any third party without the prior written consent of the Client.

   5.2 This obligation of confidentiality shall survive the termination of this Agreement.

6. **Ownership of Work Product**

   Any and all work product resulting from the Services provided by the Service Provider to the Client under this Agreement shall be the property of the Client.

7. **Independent Contractor**

   The Service Provider is an independent contractor and shall not be deemed to be an employee of the Client. The Service Provider shall have no authority to bind the Client to any agreement.

8. **Termination**

DRAFT

8.1 Either party may terminate this Agreement upon 30 days' written notice to the other party.

8.2 In the event of termination, the Client shall pay the Service Provider for all Services rendered and expenses incurred up to the date of termination.

9. **Indemnification**

   The Service Provider agrees to indemnify and hold harmless the Client from any and all claims, losses, damages, liabilities, and expenses arising out of or in connection with the Services provided under this Agreement.

10. **Governing Law**

    This Agreement shall be governed by and construed in accordance with the laws of the Province of Ontario.

11. **Entire Agreement**

    This Agreement constitutes the entire agreement between the parties with respect to the subject matter hereof and supersedes all prior agreements, understandings, and representations, whether oral or written.

12. **Amendments**

    This Agreement may be amended or modified only by a written agreement signed by both parties.

13. **Notices**

    All notices required or permitted under this Agreement shall be in writing and shall be deemed delivered when delivered in person, sent by email (with confirmation of receipt), or deposited in the mail, postage prepaid, addressed to the respective party at the address set forth above.

14. **Severability**

    If any provision of this Agreement is found to be invalid or unenforceable by a court of competent jurisdiction, such provision shall be deemed modified to the extent necessary to make it enforceable, and the remaining provisions of this Agreement shall continue in full force and effect.

DRAFT

IN WITNESS WHEREOF, the parties hereto have executed this Agreement as of the Effective Date.

Mike Beswick
Executive Vice President
Lystek International Corp.

[Client Name]
[Client Title]
[Client Company Name]

DRAFT

Appendix E

Draft Example Maintenance Schedule Excerpt from Lystek O&M Manual

PREVENTATIVE MAINTENANCE AND SPARE PARTS

ROTATING EQUIPMENT GENERAL MAINTENANCE LIST

The major equipment in the Lystek Module, their tag numbers, and vendor contacts are listed in the Equipment List document in Appendix D. Every operator should become familiar with the individual maintenance manuals in Appendix D, Appendix E, and Appendix F to ensure equipment is maintained properly.

A general overview of the most frequently maintained rotating equipment is included below. This is not a comprehensive maintenance table. Specific equipment maintenance intervals and instructions can be found in each item's respective manual.

Lystek Module Rotating Equipment Maintenance Summary

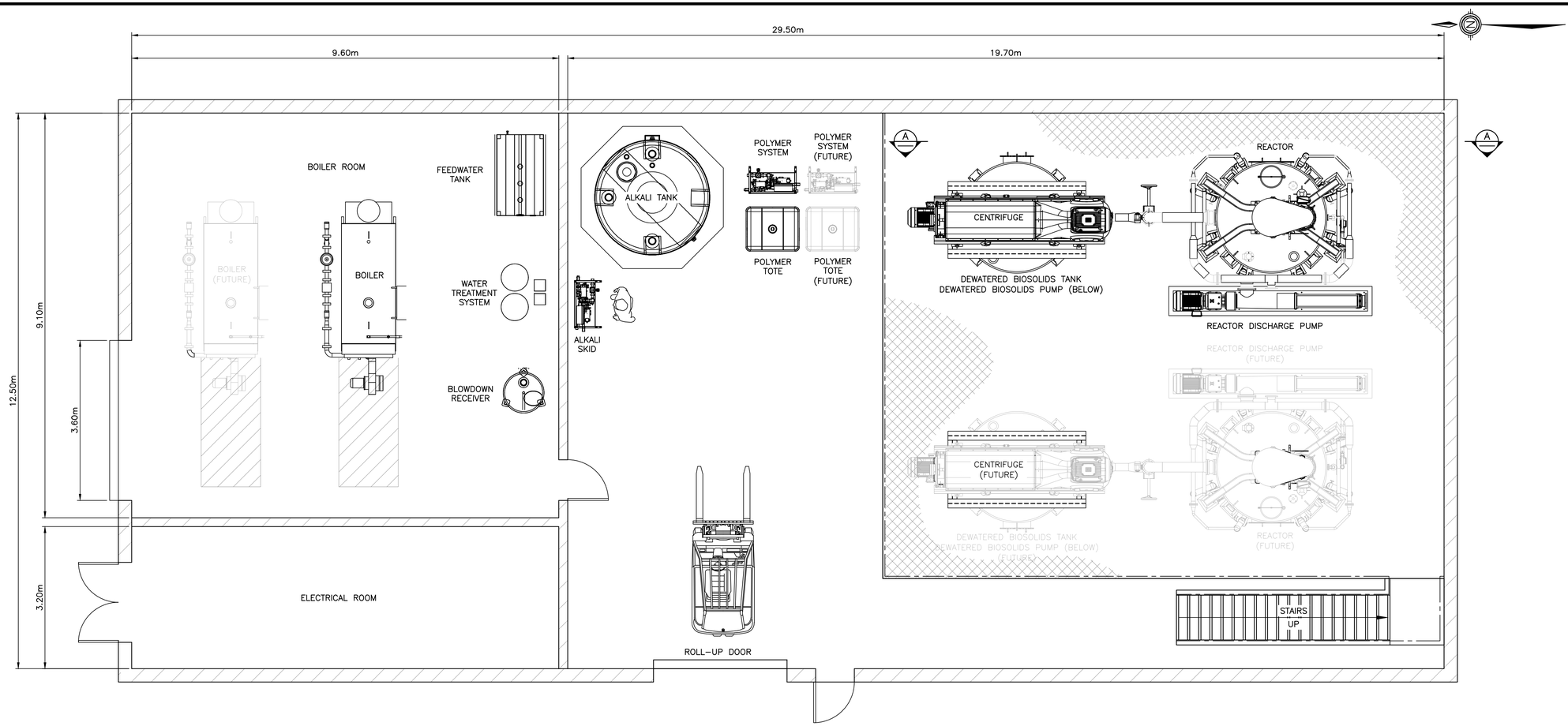
Equipment Name	Tag	Maintenance Required		O&M Manual Reference		
Reactor Disperser	MXR-300	Grease shaft bearings	200 hours	Appendix D	Disperser O&M	Page 21/22
		Grease motor bearings	8,000 hours			
		Check belt tension	6 months			Page 23
		Blade wear inspection & replacement (if necessary)	6 months			Page 14
Centrifuge	CFG-100	Check belt tension	200 hours after starting up then every 3000 hours	Appendix F	Centrifuge O&M – Volume II	Page 73 Pages 80-82
		Grease feed and discharge end bearings	200 hours			Page 86
		Change scroll thrust bearing and cyclo reducer lubricant, replace Redex pulley oil. Remove scroll for inspection, replace wear parts if required	3,000 hours			Page 73 Page 89-90
		Replace belts, overhaul front pillow block bearings Remove scroll for inspection,	6,000 hours			Page 74 Page 77-80

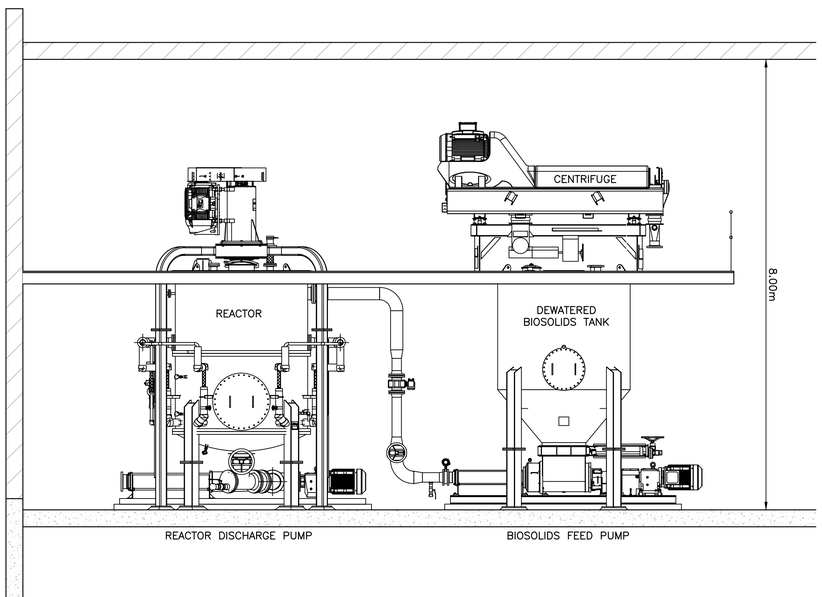
		replace wear parts if required				
		Overhaul front & rear pillow block bearings Remove scroll for inspection, replace wear parts if required	12,000 hours			Page 75, Page 106-107
		Torque limiter overhaul Remove scroll for inspection, replace wear parts if required	18,000 hours			Page 76, Page 78 (Figure 5-1)
		Replace scroll thrust bearing Remove scroll for inspection, replace wear parts if required	24,000 hours			Page 77, Page 110-111
Dewatered Biosolids Feed Pump	PMP-105	Clean out pump	Prior to extended downtime	Appendix D	Dewatered Biosolids Pump O&M	Page 42
		Replace rotor / stator	7,500 hours (dependant on wear)			Page 55
		Lubricate drive shaft bearings	Only If Replaced			Page 44-45
		Lubricate the pin joints with SM-pin joint seals	Only if replaced			Page 46-47
		Stuffing box packing replacement	As required following joint replacement			Page 48-51
Reactor Discharge Pump	PMP-305	Clean out pump	Prior to extended downtime	Appendix D	Dewatered Biosolids Pump O&M	Page 42
		Replace rotor / stator	7,500 hours (dependant on wear)			Page 55

		Lubricate drive shaft bearings	5,000 hours			Page 35
		Lubricate the pin joints with SM-pin joint seals	Only if replaced			Page 46-47
KOH Pump	PMP-605	Check foundation bolts for secure attachment	6 months	Appendix D	KOH Pump O&M	Page 23
Grinder	GRD-100	Visual Inspection	Monthly	Appendix F	Grinder O&M	Page 29
		Inspect/tighten external fasteners	At startup, then every year			Page 29
		Inspect drive assembly	At startup, then every year			Page 29
		Inspect cutter stack	At startup, then every year			Page 29
		Lubricate grinder drive couplings	Every 5 years			Page 29
		Lubricate drive gears	Every 5 years			Page 30
Steam Boiler	SB-500	Water quality check	3-5 times per week	Appendix F	Steam Boiler O&M	Page 19
		Blowdown	48 hours of high-fire operation (indicated on display)			Page 62
		Blower intake air filter cleaning / replacement	As shown on display			Page 64
		Feed-water strainer cleaning	4 months			Page 66
		Feed-water tank interior cleaning	4 months			Page 68
		Safety valve inspection	Yearly			Page 69
		Feedwater Pump bearing replacement	7,500 hours (pump operation)	Appendix F	Feedwater Pump O&M	Page 11
Make-up Air Unit	MUA-790	Inspect v-belt drives	Monthly	Appendix G		Page 79

		Blowing bear lubrication	Every 3,000 hours / 6 months			Page 80
		Motor lubrication	Every 500 hours / 3 months			Page 80
		Inspect filters	Monthly			Page 81

Appendix F
Conceptual Drawings





SECTION A
1 : 50

SCALE BAR (1 : 50)
0 1m 2m 3m

THE FOLLOWING DRAWING CONTAINS LYSTEK INTERNATIONAL PROPRIETARY INFORMATION AND IS THEREFORE DEEMED CONFIDENTIAL. REPRODUCTION IN WHOLE OR IN PART OR DISCLOSURE TO ANY PARTY NOT HAVING WRITTEN AUTHORIZATION FROM LYSTEK INTERNATIONAL IS STRICTLY PROHIBITED

ID.	REVISION	DATE

APPROVED BY:

NORFOLK COUNTY

-

CONCEPT DESIGN

BUILDING LAYOUT

LYSTEK INTERNATIONAL
Phone: 1-888-501-6508
Email: info@lystek.com
Web: www.lystek.com

DESIGNED BY:	REVIEWED BY:	DRAWN BY:	DATE:
A.W.	-	C.F.	SEE REV TABLE

SCALE:	PROJECT No.:	DRAWING No.:
AS SHOWN	-	M101

Appendix G
Advantages of LysteGro





Lystek

Advantages of LysteGro®

Class A Quality, High Solids Liquid Biosolids Fertilizer

The Lystek Thermal Hydrolysis Process (Lystek THP®) technology produces a concentrated high solids liquid product, LysteGro®, that is considered a Class A biosolids in the US and is registered with the California Department of Food and Agriculture (CDFA) in California. In Canada, LysteGro is regulated by the Canadian Food Inspection Agency (CFIA). LysteGro has a solids content ranging from 13 – 16% with a viscosity below 10,000 centipoise. This means that it is fully pumpable using traditional liquid manure handling and application equipment.



There are several advantages to producing and managing a Class A quality, high solids liquid biosolids fertilizer.

Simple and Cost Effective Liquid Pumping and Storage Systems

Pumping LysteGro from processing to storage and from storage to truck loading is completed with standard pumps proven within the industry. This allows for rapid, familiar and low maintenance pumping operations, and accurate quantification of the volumes. Liquid solutions offer automation that is not possible with solid loading operations which often requires manned loading equipment. Concentrated liquid storage solutions reduce site footprint compared to solid options as storage tanks can be constructed with practically unlimited vertical storage capacity unbound by the slumping properties of dewatered biosolids.



Transportation Loading and Unloading Efficiencies

Depending on the site requirements, loading of tanker trucks can be completed quickly (5 – 10 minutes at larger facilities) and accurately. Additionally, the product can be transferred to the application tank in the field in as little as 5 minutes. The result is an efficient and clean program at both the facility and field sites with minimal staffing requirements.

Odor Mitigation with Enclosed System

From the point of production to application in the field, the product is contained within enclosed Reactors, piping systems, storage, tanker trucks, and finally the soil. Lystek THP generates minimal process air compared to dry alternatives, which require the evaporation of water and the liberation of odorous compounds that must then be captured and treated. This is a significant advantage when managing odor throughout the life cycle of the process.

Efficient and Cost-Effective Land Application

Due to the loading methods at the facility and in the field, LysteGro application programs are highly efficient. At the field, the product is injected into the soil subsurface, requiring only one pass over the field with the application equipment. This translates to less equipment, less staffing, and less time spent on fields as well as minimizes compaction risk and facilitates application into living crops.

Application Accuracy and Nutrient Use Efficiency

The application rate is controlled with flow meters to ensure it is placed evenly and accurately throughout the field. This provides confidence that the customer can rely on the material as a synthetic fertilizer replacement. This also creates opportunities for farmers to utilize their GPS technology to place the seed close (within 2” for example) to the band of LysteGro to optimize carbon and nutrient use efficiency. The sub-surface injection of the product minimizes nitrogen loss, maximizing the effective nutrient value of the product.

Environmental Protection

LysteGro is sub-surface injected, which increases soil contact and removes the risk of run-off. Additionally, because the material is concentrated there is a dramatic reduction in the overall water volume applied per acre versus traditional liquid programs. As a result, application above the hydraulic loading rate of the soil is not a concern with this product.

Improved Optics (Out of Sight, Out of Mind)

Injection of the product minimizes soil disturbance and the outcome is a professional job with little product on the soil surface, avoiding public nuisance and concern.

Value Proposition for the Farmer

The value proposition to the farmer is to provide a consistent quality product they can rely on to improve yields and reduce input costs. LysteGro is enhanced with potassium during the treatment process, adding further benefit to the farmer. The Lystek approach to fertilizer management is preferred by farmers compared with historical application methods, as it only requires one pass to inject and incorporate the product. Additionally, it is compatible with minimum till systems, which are rapidly growing in popularity in agricultural systems throughout North America.

LysteGro Fertilizer

T. 226.444.0186
TF. 888.501.6508
E. info@lystek.com
lystek.com

Appendix H

Example Draft LysteGro Services Agreement

DRAFT MARKETING AND APPLICATION COORDINATION AGREEMENT

This MARKETING AND APPLICATION COORDINATION AGREEMENT dated as of the ____ day of xx, 20xx (the "**Effective Date**") is between Lystek International Inc., a corporation existing under the laws of the Province of Ontario, (the "**Company**") and **the Corporation of the Town of xx**, a Municipal corporation established under the laws of the Ontario (the **"Customer"**).

Background

The Customer uses the Company's technology to produce a Canadian Food Inspection Agency (**"CFIA"**) registered fertilizer product, with the registration number xxxxx (the **"Material"**) at the Customers Wastewater Treatment Plant (**"WWTP"**). The purpose of this Agreement is to establish a clearly outlined, cooperative and mutually beneficial business relationship between the Company and the Customer for the marketing and application coordination of the Material.

IN CONSIDERATION of the promises, covenants and consideration contained in this agreement and other good and valuable consideration, the parties agree as follows:

ARTICLE 1 EXCLUSIVITY OF SERVICES

1.1 The Company will be the sole provider of the marketing, sale and coordination of the hauling and application of the Material (the "**Services**") produced at the Customer's WWTP during the Term (as such term is defined herein).

1.2 The Customer shall be the sole producer of the Material at the WWTP during the Term. This clause will not limit the ability of the Customer to accept third party materials (such as septage or RV waste) for treatment at the WWTP.

ARTICLE 2 ANTICIPATED PRODUCTION

2.1 It is expected that a minimum of xx cubic metres of Material will be produced at the Customer's WWTP annually during the Term.

2.2 The Customer will provide monthly Material production volume estimates to the Company.

2.3 Should circumstances prevent or limit the production of Material from the Customer's WWTP or process optimization results in a more concentrated material resulting in a volume below that stated in Section 2.1, there shall be no penalties or consequences applied to the Customer.

ARTICLE 3 PRICE AND PROFIT SHARING

3.1 Subject to the adjustments, share of sale proceeds, and truck wait time charges described in this Agreement, the Company will invoice the Customer at $xx/cubic

meter (the "**Price**") for the Services. The Price shall be exclusive of HST and inclusive of all transportation, storage coordination, application and miscellaneous costs incurred by the Company related to the transfer, off-site storage and sale of the Material. Invoices will be delivered to the Customer immediately following removal of the material from the Customer's WWTP.

3.2 The Price shall be adjusted as of January 1st of each year, based on a 50/50 split between the Consumer Price Index ("**CPI**"), Ontario, all items, and CPI, Ontario, Transportation (Table 18-10-0004-13).

3.3 For any revenue generated by the Company for sales of the Material that exceeds $xx/cubic metre, such sales to be evidenced by the delivery of a copy of the applicable bill of sale to the Customer **[in accordance with Section 5.5]**, the Company will share the sale proceeds with the Customer on a 50/50 basis.

3.4 Should Material loading times incurred by the Company at the WWTP be greater than 30 minutes per 40 cubic metre load, and the reason for the extended loading times are due to the Customer, Customer staff or Customer loading equipment, the Customer will be required to pay for extra time incurred by the Company based on $xx/hour for truck waiting time, subject to annual price adjustments based on a 50/50 split of the CPI, Ontario, all items and CPI, Ontario, Transportation. For the purposes of this contract, loading start time will be defined as when the truck is in position to receive material and loading stop time will be when the Customer loading pumps are disengaged. Should loading be delayed due to the actions of the Company and/or contracted hauler, the Customer will not be responsible for any excess loading times.

3.5 The volumes hauled from the WWTP by the Company, which are used to calculate invoice amounts will be derived from the flow metre associated with the truck loading pump. A loading event is defined as a period of time in which Material is loaded and hauled off-site until the levels within the storage tank are lowered to a level that is satisfactory to the Customer and will allow for production of Material such that the operations of the WWTP are not obstructed or inhibited due to storage limitations. A loading event may encompass multiple days.

3.6 If, at any time during the Term, there is a change in any applicable law or an order is implemented by a governmental authority that has a material impact on the costs incurred by the Company to manage and apply the Material, the Company and Customer will re-negotiate terms that are mutually agreeable to both parties. In the scenario where a mutually agreeable price cannot be arranged between the Customer and Company, then either of the Parties has the right to invoke the termination of this Agreement as long as ninety (90) days prior written notice is provided to the other Party.

ARTICLE 4 CUSTOMER RESPONSIBILITIES

4.1 The Customer will ensure that all required testing of the Material is completed in accordance with the CFIA's testing requirements and that the concentration of metals, pathogens, dioxins and furans are within the limits set by the CFIA.

4.2 The Customer will ensure that the mean solids concentration of the Material from the Customers storage location is a minimum of xx percent (xx%). Mean solids will be

determined by monthly third party analytical results (which are already obtained by the Customer). The Company retains the right to collect samples, at its own expense, during loading events to ensure the solids concentration of the Material is consistent with the analytical results provided by the Customer. Should it be deemed that the solids content of the Material is indeed below xx%, through a testing program mutually agreed upon by the Company and Customer a fee of $xx/cubic metre/each % solids below xx% will be applied until which time the solids content of the Material has been confirmed to be greater than xx%.

4.3 Subject to Section 4.5, the Customer shall defend, fully indemnify and hold harmless the Company, its successors and assigns, and each of its officers, directors, employees, representatives and agents, from and against any and all claims, demands, suits, actions, causes of action and/or liability, of any kind whatsoever, for damages, losses, costs and/or expenses (including legal fees and disbursements) arising out of or relating to (i) circumstances in which the Material does not meet the minimum quality standards set out in this Agreement; and (ii) damages to persons or property, personal injury or death caused by the negligent or willful acts or omissions of the Customer, its officers, employees, agents, members of council, suppliers and any other person the Customer is responsible for at law, arising in connection with this Agreement.

4.4 Subject to Section 4.5, the Company shall defend, fully indemnify and hold harmless the Customer, its successors and assigns, and each of its officers, members of council, employees, representative and agents, from and against any and all claims, demands, suits actions, causes of action and/or liability, of any kind whatsoever, for damages, losses, costs and/or expenses (including legal fees and disbursements) arising out of or relating to (i) the Company breaching any terms of this Agreement; (ii) the actions of the Company, its officers, directors, employees, agents, contractors, subcontractors, suppliers and any other person the Company is responsible for at law in fulfilling the terms and obligations of this Agreement; and (ii) damages to persons or property, personal injury or death caused by the negligent or willful acts or omissions of the Company, its officers, directors, employees, agents, contractors, subcontractors, suppliers and any other person the Company is responsible for at law, arising in connection with this Agreement.

4.5 In no event shall either the Customer or the Company be liable for any indirect, special, incidental, consequential, punitive or exemplary damages including, without limitation, loss of revenue or loss of profits, regardless of the form of action, whether in contract or in tort including negligence, even if the Customer or the Company have been advised of the possibility of such damages. The foregoing limitation of liability shall not apply to either party's indemnity obligations (Section 4.3) nor to either party's breach of its confidentiality obligations (Article **Error! Reference source not found.**) under this Agreement.

ARTICLE 5 – COMPANY RESPONSIBILITIES

5.1 The Company will provide consultation to support the monitoring of product analytical reports and quality control parametres to assist in ensuring CFIA compliance for the Material.

5.2 The Company will manage all aspects of the marketing and application of the Material and will assume full responsibility for the Material once the Material is loaded into tankers at the Customer's WWTP. For greater certainty, in the event that extra costs are incurred, for example, due to longer than expected hauling distances from the WWTP, additional costs will not be charged to the Customer.

5.3 The Company will manage the loading of tankers and ensuring load times are accurately documented with the supervision and assistance from Customer staff, as required.

5.4 The Company will ensure Material storage at the WWTP is not exceeded at any time throughout the Term, subject to the Customer keeping the Company fully apprised of the storage available/remaining. The Company shall complete a loading event from the Customer's WWTP within 10 business days of receiving notice from the Customer that removal of material from storage is required. Should the Company fail to complete a loading event within the required timeframe, the Customer shall ensure suitable loading, handling and storage of material is completed and the Company shall be responsible for any and all costs incurred by the Customer.

5.5 Within 60 days following the end of the calendar year, each year, the Company will provide the Customer with a post-application report providing specific information about the fertilization program, operational logistics and proof of sale of the Material.

5.6 The Company agrees to ensure that during loading, transportation, storage and application that all applicable laws and regulations shall be strictly adhered to.

ARTICLE 6 INVOICING AND PAYMENT

6.1 The Company will invoice the Customer immediately following removal of the Material from the WWTP and the Customer shall pay all charges submitted by the Company within thirty (30) days from the date of such invoice. The Customer shall pay interest at a rate of 1.5% per month on overdue payments at a rate not to exceed applicable legal statute. Non-payment by the Customer of any invoiced amount shall not constitute termination of this Agreement by the parties hereto; provided, however, that the Company shall have the option, in its sole discretion, to terminate the Agreement if non-payment of any invoiced amount is not corrected within **[ninety (90) days]** from the date of such invoice.

ARTICLE 7 AMENDMENTS

7.1 This Agreement shall not be varied, amended or modified unless such variation, amendment or modification is endorsed in writing by the parties, save and except for any CPI Price adjustments discussed within Article 3.

ARTICLE 8 FORCE MAJEURE

8.1 Neither party shall be liable for failing or delaying performance of its obligations under this Agreement resulting from any condition beyond its reasonable control, including but not limited to, governmental action, acts of terrorism, earthquake, fire, flood or other acts of God, labour conditions, power failures, and Internet disturbances (each, a "**Force Majeure**"). The parties agree that the deadline for fulfilling the obligation in

question shall be extended for a period of time equal to that of the continuance of the Force Majeure and that the affected party shall use all commercially reasonable efforts to minimize the effect of the Force Majeure on its performance under this Agreement. **[Notwithstanding the continuance of an event of Force Majeure, neither party may delay performance of its obligations under any circumstances by more than twenty [(20) business days], otherwise the other party may terminate this Agreement on [thirty (30) days] prior written notice.]**

ARTICLE 9 CONFIDENTIALITY

9.1 Given that the Customer is a public entity with restrictions on confidentiality, the Parties agree that the only areas of concern in this regard are the Company's list of customers, contacts, prices and related market specific Confidential Information. Each party agrees that this information which is confidential in nature shall not be disclosed unless required by law. Receiving party shall not use disclosing party's Confidential Information for any purpose other than to exercise or perform its rights or obligations under this Agreement. Receiving party shall not copy or otherwise reproduce disclosing party's Confidential Information, or disclose, disseminate or otherwise communicate, in whole or in part, disclosing party's Confidential Information to any third party, without the prior written consent of disclosing party. Receiving party further agrees that it shall safeguard disclosing party's Confidential Information from disclosure and, at a minimum, use efforts commensurate with those receiving party employs for protecting the confidentiality of its own Confidential Information which it does not desire to disclose or disseminate, but in no event less than reasonable care. Immediately upon the demand of disclosing party, receiving party shall return disclosing party's Confidential Information (and any and all permitted copies thereof) to disclosing party**.**

9.2 Notwithstanding anything to the contrary herein, the following will not constitute Confidential Information for the purposes of this Agreement: (i) information that is or becomes publicly known through no wrongful act of the Receiving Party (ii) information that is received from a third party without restriction and without breach of any confidentiality obligation to the other party (iii) information that is independently developed by the Receiving Party or (iv) information that is required by law to be disclosed (provided that the other party is given advance notice of, and an opportunity to, contest any such requirement).

9.3 Receiving Party agrees that Disclosing Party may be irreparably injured by a breach of this Article and that Disclosing Party may be entitled to seek equitable relief, including a restraining order, injunctive relief, specific performance and any other relief that may be available from any court to prevent breaches of this Article and to enforce specifically the terms and provisions hereof in any action instituted in any court having subject matter jurisdiction, in addition to any other remedy to which Disclosing Party may be entitled at law or in equity in the event of any breach of this Article. Such remedies shall not be deemed to be the exclusive remedies for a breach of this Article but shall be in addition to all other remedies available at law or in equity.

ARTICLE 10 TERM OF AGREEMENT

10.1 This Agreement shall be binding on the parties hereto from the date on which it has been signed by both parties (the "**Effective Date**") and shall continue for a period of

xx (x) years (the "**Initial Term**"). Following the Initial Term, this Agreement can be renewed for successive additional terms of xx (x) years (each, a "**Renewal Term**") if both parties mutually agree to the existing terms. Following each Term, the conditions of the Agreement for a Renewal Term may be revisited based on market conditions and any other factors that arise. The Initial Term and any of the Renewal Terms are herein referred to as the "**Term**".

ARTICLE 11 TERMINATION

11.1 Either party may terminate this Agreement, upon written notice to the other party: (i) if such other party is subject to proceedings in bankruptcy or insolvency, voluntarily or involuntarily (ii) if a receiver is appointed with or without the other party's consent (iii) if the other party assigns its property to its creditors or performs any other act of bankruptcy (iv) if the other party becomes insolvent and cannot pay its debts when they are due, and such events are not dismissed and/or resolved within ninety (90) days or (v) if the provision of the services by the Company to the Customer are prohibited by law.

11.2 In addition to any other rights and remedies available to it, the parties, where applicable, may immediately terminate this Agreement in the event of a material breach by either party of its obligations herein, provided that such breach is not cured within thirty (30) business days of written notification by the non-breaching party of such breach. For greater certainty, where applicable, the non-payment provisions set forth at Section 6.1 shall take precedence over this Section 11.2.

11.3 The Customer may terminate this Agreement, upon written notice to the Company if the Customer no longer requires the services prior to the end of the Term, provided the reason for no longer requiring the services is not because the Customer wishes to use another company or person to provide the same or similar Services. Should the Customer no longer require the Services prior to the end of the Term, the Customer shall immediately pay all amounts that would be due to the Company pursuant to this Agreement. Such amount would be determined as any outstanding accounts receivable invoiced by the Company to the Customer and a cancellation fee being the product of: (x) the annual projected volumes multiplied by (y) 25% of the per-unit fee charged at the time of termination for an equivalent 1 year period from the notice of termination.

ARTICLE 12 GENERAL

12.1 This Agreement shall be governed by the laws of the Province of Ontario and the laws of Canada applicable therein.

12.2 Any finding that any provision of this Agreement or portion thereof is unenforceable shall apply only to such provision or portion thereof and same shall be severed from this Agreement without affecting the enforceability of the balance of this Agreement.

12.3 This Agreement may be executed in counterparts, each of which shall be deemed an original, but all of which shall constitute one and the same Agreement. A document signed and transmitted electronically by facsimile or PDF copy is to be treated as an original and shall have the same binding effect as an original signature on an original document.

12.4 This Agreement shall not be assigned by either party without the prior written consent of the other party.

12.5 This Agreement shall be binding upon the parties hereto and their respective successors and permitted assigns.

12.6 Any notice or other writing required or permitted to be given under this Agreement or for the purposes of this Agreement to any party shall be sufficiently given if delivered personally, or if sent by prepaid registered mail or if transmitted by fax or other form of recorded communication tested prior to transmission to such party:

(a) in the case of a notice to the Town at:

Attention:

Attn:

(b) in the case of a notice to Lystek at:

Lystek International Inc.
125 McGovern Drive, Unit #1
Cambridge, Ontario N3H 4R7

Attention: Michael Beswick

or at such other address as the party to whom such writing is to be given shall have last notified to the party giving the same in the manner provided in this section. Any notice delivered to the party to whom it is addressed as provided in this section shall be deemed to have been given and received on the day it is so delivered at such address, provided that if such day is not a Business Day then the notice shall be deemed to have been given and received on the Business Day next following such day. Any notice mailed to the address and in the manner provided for in this section shall be deemed to have been given and received on the fifth Business Day next following the date of its mailing. Any notice transmitted by fax or other form of recorded communication shall be deemed given and received on the first Business Day after its transmission.

[The remainder of this page is intentionally left blank – signature page follows]

Authorized representatives of the parties have executed this Agreement.

LYSTEK INTERNATIONAL CORP.

Per: _____
Name: Michael Beswick
Title: Executive Vice President
Date of Signature:

I have authority to bind the Corporation

The Corporation of the Town of xx

Per: _____
Name:
Title:
Date of Signature:

Per: _____
Name:
Title:
Date of Signature:

We have authority to bind the Corporation

Appendix B

Design Calculation Summaries

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

Table B.1 – Option 1(a) – Design Calculation Summary

Parameter	Design Value 2051 Population Growth	Design Value 2051 Rated Capacity
Digestion		
Raw Sludge to Digestion (kg/d) [1]		
Simcoe WWTF – co-thickened	2,876	4,475
Port Rowan WWTF – co-thickened	366	790
Delhi WWTF – co-thickened	1,035	1,563
Waterford WWTF – WAS	381	779
Port Dover WWTF – co-thickened	1,192	1,889
From Internal Recycle – supernatant	326.6	540.3
Total Average	6,176.6	10,036.3
Raw Sludge VS:TS (-)	0.77	0.77
Raw Sludge Average Concentration (%) [2]	2.50	2.47
Raw Sludge Average Flow Rate (m^3/d)	246.8	405.6
Maximum Month Factor (-) [1]	1.5	1.5
Maximum Month Flow Rate (m^3/d)	370.2	608.4
Maximum Month VS Loading Rate (kg/d)	7,134	11,592
Design HRT (d) [3]	15	15
Design VS Loading Rate ($kg/m^3/d$) [3]	1.6	1.6
Digester Volume Required – HRT (m^3)	5,553	9,126
Digester Volume Required – VS Loading (m^3)	4,459	7,245
Total Digester Volume Required (m^3)	5,553	9,126
Digester Volume Design Value (m^3)	**5,600**	**9,200**
Digested Sludge (Biosolids) Production		
Average VS Destruction in Digestion (%) [4]	60	60
Average Digested Sludge (kg/d)		
VS	1,902	3,091
IS	1,421	2,308
Total	3,323	5,399
Average Digested Sludge Flow Rate (m^3/d)	246.8	405.6
Average Digested Sludge Concentration (%)	1.35	1.33
Biosolids Storage Volume Requirements		
Average Biosolids Load (kg/d)	3,323	5,399
Number of Days of Storage Required (d)	240	240
Average Biosolids Concentration after Supernating (%) [5]	3.5	3.5
Total Volume Required (m^3)	22,786	37,022
Storage Tank Volume Design Value (m^3)	**22,800**	**37,100**
Internal Recycle Stream		
Average Supernatant Flow Rate (m^3/d)	151.9	251.3

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

Table B.1 – Option 1(a) – Design Calculation Summary

Parameter	Design Value 2051 Population Growth	Design Value 2051 Rated Capacity
Average Supernatant Concentrations (mg/L) [6]		
TSS	3,000	3,000
BOD	1,000	1,000
Sludge Generation Due to Internal Recycle Stream (kg/d)		
Raw (Primary) [7]	227.9	377
WAS [8]	98.7	163.3
Total	326.6	540.3

Notes:

1. See Section 3 for details.
2. Based on the design of the various sludge streams characteristics.
3. Design Guidelines for Sewage Works (MECP, 2008).
4. Typical value for anaerobic digestion (Metcalf & Eddy, 2014).
5. Based on historical operating data.
6. Based on typical supernatant quality from an anaerobic digester (WEF, 2005).
7. Assumes 50% TSS removal across the primary clarifiers.
8. Assumes 35% BOD removal across the primary clarifiers, and a yield of 1.0 kg WAS/kg BOD in the bioreactors.

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

Table B.2 – Option 1(b) – Design Calculation Summary

Parameter	Design Value 2051 Population Growth	Design Value 2051 Rated Capacity
Digestion		
Raw Sludge to Digestion (kg/d) [1]		
Simcoe WWTF – co-thickened	2,876	4,475
Port Rowan WWTF – co-thickened	366	790
Delhi WWTF – co-thickened	1,035	1,563
Waterford WWTF – WAS	381	779
Port Dover WWTF – co-thickened	1,192	1,889
From Internal Recycle – RDT filtrate	154.6	253.7
Total Average	6,004.6	9,749.7
Raw Sludge VS:TS (-)	0.77	0.77
Raw Sludge Average Concentration (%) [2]	2.50	2.47
Raw Sludge Average Flow Rate (m^3/d)	240.5	395.2
Maximum Month Factor (-) [1]	1.5	1.5
Maximum Month Flow Rate (m^3/d)	360.8	592.8
Maximum Month VS Loading Rate (kg/d)	6,935	1,1261
Design HRT (d) [3]	15	15
Design VS Loading Rate ($kg/m^3/d$) [3]	1.6	1.6
Digester Volume Required – HRT (m^3)	5,412	8,892
Digester Volume Required – VS Loading (m^3)	4,334	7,038
Total Digester Volume Required (m^3)	5,412	8,892
Digester Volume Design Value	**5,500**	**8,900**
Digested Sludge (Biosolids) Production		
Average VS Destruction in Digestion (%) [4]	60	60
Average Digested Sludge (Biosolids) (kg/d)		
VS	1,849	3,003
IS	1,381	2,242
Total	3,230	5,245
Average Biosolids Flow Rate (m^3/d)	240.5	395.2
Average Biosolids Concentration to RDTs (%)	1.34	1.33
RDT Operation		
Average RDT Feed Rate (kg/d)	3,230	5,245
Average RDT Feed Concentration (%)	1.34	1.33
RDT Capture Rate (%) [5]	98	98
Thickened Biosolids Concentration (%) [5]	6	6
Average Thickened Biosolids Mass Rate (kg/d)	3,165	5,140
Average Thickened Biosolids Flow Rate (m^3/d)	52.8	85.7
Average Filtrate Solids Load Rate (kg/d)	65	105

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

Table B.2 – Option 1(b) – Design Calculation Summary

Parameter	Design Value 2051 Population Growth	Design Value 2051 Rated Capacity
Average Filtrate Flow Rate (m^3/d)	187.7	309.5
Biosolids Storage Volume Requirements		
Average Thickened Biosolids Load (kg/d)	3,165	5,140
Number of Days of Storage Required (d)	240	240
Average Biosolids Concentration After Thickening (%)	6	6
Total Volume Required (m^3)	12,660	20,560
Storage Tank Volume Design Value (m^3)	**12,700**	**20,600**
Internal Recycle Stream		
Average RDT Filtrate Flow Rate (m^3/d)	187.8	309.5
Average RDT Filtrate Concentrations (mg/L)		
TSS [6]	346	339
BOD	1,000	1,000
Sludge Generation Due to Internal Recycle Stream (kg/d)		
Raw (Primary) [7]	32.5	52.5
WAS [8]	122.1	201.2
Total	154.6	253.7

Notes:

1. See Section 3 for details.
2. Based on the design of the various sludge streams characteristics.
3. Design Guidelines for Sewage Works (MECP, 2008).
4. Typical value for anaerobic digestion (Metcalf & Eddy, 2014).
5. Typical value for a well-operating RDT system for biosolids thickening.
6. Based on assumed 98% solids capture.
7. Assumes 50% TSS removal across the primary clarifiers.
8. Assumes 35% BOD removal across the primary clarifiers, and a yield of 1.0 kg WAS/kg BOD in the bioreactors.

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

Table B.3 – Option 1(c) – Design Calculation Summary

Parameter	Design Value 2051 Population Growth	Design Value 2051 Rated Capacity
Digestion		
Raw Sludge to Digestion (kg/d) [1]		
Simcoe WWTF – raw (primary)	1,346	2,165
Simcoe WWTF – TWAS	1,499	2,264
Port Rowan WWTF – co-thickened	366	790
Delhi WWTF – co-thickened	1,035	1,563
Waterford WWTF – TWAS	373	763
Port Dover WWTF – co-thickened	1,192	1,889
From Internal Recycle – filtrate + supernatant	258.7	419.7
Total Average	6,069.7	9,853.7
Raw Sludge VS:TS (-)	0.77	0.77
Raw Sludge Average Concentration (%) [2]	3.40	3.39
Raw Sludge Average Flow Rate (m^3/d)	178.6	290.4
Maximum Month Factor (-) [1]	1.5	1.5
Maximum Month Flow Rate (m^3/d)	267.9	435.6
Maximum Month VS Loading Rate (kg/d)	7,011	11,381
Design HRT (d) [3]	15	15
Design VS Loading Rate (kg/m^3/d) [3]	1.6	1.6
Digester Volume Required – HRT (m^3)	4,018.5	6,534
Digester Volume Required – VS Loading (m^3)	4,382	7,113
Total Digester Volume Required (m^3)	4,382	7,113
Digester Volume Design Value (m^3)	**4,400**	**7,200**
Digested Sludge (Biosolids) Production		
Average VS Destruction in Digestion (%) [4]	60	60
Average Digested Sludge (Biosolids) (kg/d)		
VS	1,869	3,035
IS	1,396	2,266
Total	3,265	5,301
Average Biosolids Flow Rate (m^3/d)	178.6	290.4
Average Biosolids Concentration to RDTs (%)	1.83	1.83
RDT Operation		
WAS RDT Feed Rate (kg/d) [1]		
Simcoe WWTF	1,530	2,310
Waterford WPCP	381	779
Total Average RDT Feed Rate	1,911	3,089
Average RDT Feed Concentration (%) [5]	1.50	1.50
RDT Capture Rate (%) [6]	98	98
TWAS Concentration (%) [6]	4.5	4.5

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

Table B.3 – Option 1(c) – Design Calculation Summary

Parameter	Design Value 2051 Population Growth	Design Value 2051 Rated Capacity
Simcoe TWAS Load Rate (kg/d)	1,499	2,264
Simcoe TWAS Flow Rate (m^3/d)	33.3	50.3
Waterford TWAS Load Rate (kg/d)	373	763
Waterford TWAS Flow Rate (m^3/d)	8.3	17
Average Filtrate Solids Load Rate (kg/d)	39	62
Average Filtrate Flow Rate (m^3/d)	85.8	138.6
Biosolids Storage Volume Requirements		
Average Thickened Biosolids Load (kg/d)	3,265	5,301
Number of Days of Storage Required (d)	240	240
Average Biosolids Concentration After Thickening (%) (7)	3.5	3.5
Total Volume Required (m^3)	22,389	36,350
Storage Tank Volume Design Value (m^3)	**22,400**	**36,400**
Internal Recycle Stream		
Average Supernatant Flow Rate (m^3/d)	85.3	138.9
Average Supernatant Concentrations (mg/L) (8)		
TSS	3,000	3,000
BOD	1,000	1,000
Average RDT Filtrate Flow Rate (m^3/d)	85.8	138.6
Average RDT Filtrate Concentrations (mg/L) (9)		
TSS	455	447
BOD	1,000	1,000
Overall Sludge Generation Due to Internal Recycle Stream (kg/d)		
Raw (Primary) (10)	147.5	239.3
WAS (11)	111.2	180.4
Total	258.7	419.7

Notes:

1. See Section 3 for details.
2. Assumes RDT thickening of WAS Simcoe WWTF and Waterford WWTF.
3. Design Guidelines for Sewage Works (MECP, 2008).
4. Typical value for anaerobic digestion (Metcalf & Eddy, 2014).
5. Typical WAS concentration in activated sludge facilities.
6. Typical value for a well-operating RDT system for WAS thickening.
7. Based on historical operating data.
8. Based on typical supernatant quality from an anaerobic digester (WEF, 2005).
9. Based on assumed 98% solids capture.
10. Assumes 50% TSS removal across the primary clarifiers.
11. Assumes 35% BOD removal across the primary clarifiers, and a yield of 1.0 kg WAS/kg BOD in the bioreactors.

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

Table B.4 – Option 1(d) – Design Calculation Summary

Parameter	Design Value 2051 Population Growth	Design Value 2051 Rated Capacity
Digestion		
Raw Sludge to Digestion (kg/d) [1]		
Simcoe WWTF – raw (primary)	1,346	2,165
Simcoe WWTF – TWAS	1,499	2,264
Port Rowan WWTF – raw + TWAS	366	790
Delhi WWTF – raw + TWAS	1,035	1,563
Waterford WWTF – TWAS	381	779
Port Dover WWTF – raw + TWAS	1,192	1,889
From Internal Recycle – filtrate + supernatant	140.7	221.4
Total Average	5,959.7	9,671.4
Raw Sludge VS:TS (-)	0.77	0.77
Raw Sludge Average Concentration (%) [2]	4.62	4.61
Raw Sludge Average Flow Rate (m^3/d)	129.1	209.6
Maximum Month Factor (-) [1]	1.5	1.5
Maximum Month Flow Rate (m^3/d)	193.7	314.4
Maximum Month VS Loading Rate (kg/d)	6,883	11,170
Design HRT (d) [3]	15	15
Design VS Loading Rate ($kg/m^3/d$) [3]	1.6	1.6
Digester Volume Required – HRT (m^3)	2,905.5	4,716
Digester Volume Required – VS Loading (m^3)	4,302	6,981
Total Digester Volume Required (m^3)	4,302	6,981
Digester Volume Design Value (m^3)	**4,400**	**7,000**
Digested Sludge (Biosolids) Production		
Average VS Destruction in Digestion (%) [4]	60	60
Average Digested Sludge (Biosolids) (kg/d)		
VS	1,836	2,979
IS	1,371	2,224
Total	3,207	5,203
Average Biosolids Flow Rate (m^3/d)	129.1	209.6
Average Biosolids Concentration to RDTs (%)	2.48	2.48
RDT Operation		
Simcoe WWTF WAS RDT Feed Rate (kg/d)	1,530	2,310
Average RDT Feed Concentration (%) [5]	1.50	1.50
RDT Capture Rate (%) [6]	98	98
TWAS Concentration (%) [6]	4.5	4.5
Simcoe TWAS Load Rate (kg/d)	1,499	2,264
Simcoe TWAS Flow Rate (m^3/d)	33.3	50.3

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

Table B.4 – Option 1(d) – Design Calculation Summary

Parameter	Design Value 2051 Population Growth	Design Value 2051 Rated Capacity
Average Filtrate Solids Load Rate (kg/d)	31	46
Average Filtrate Flow Rate (m^3/d)	68.7	103.7
Biosolids Storage Volume Requirements		
Average Thickened Biosolids Load (kg/d)	3,207	5,203
Number of Days of Storage Required (d)	240	240
Average Biosolids Concentration After Thickening (%) (7)	3.5	3.5
Total Volume Required (m^3)	21,991	35,678
Storage Tank Volume Design Value (m^3)	22,000	35,700
Internal Recycle Stream		
Average Supernatant Flow Rate (m^3/d)	37.5	60.9
Average Supernatant Concentrations (mg/L) (8)		
TSS	3,000	3,000
BOD	1,000	1,000
Average RDT Filtrate Flow Rate (m^3/d)	68.7	103.7
Average RDT Filtrate Concentrations (mg/L)		
TSS (9)	451	444
BOD	1,000	1,000
Overall Sludge Generation Due to Internal Recycle Stream (kg/d)		
Raw (Primary) (10)	71.7	114.4
WAS (11)	69	107
Total	140.7	221.4

Notes:

1. See Section 3 for details.
2. Assumes RDT thickening of WAS from Port Rowan, Delhi and Port Dover WWTPs prior to hauling to the Simcoe WWTF, and RDT thickening of WAS from Simcoe WWTF and Waterford WWTF at the Simcoe WWTF.
3. Design Guidelines for Sewage Works (MECP, 2008).
4. Typical value for anaerobic digestion (Metcalf & Eddy, 2014).
5. Typical WAS concentration in activated sludge facilities.
6. Typical value for a well-operating RDT system for WAS thickening.
7. Based on historical operating data.
8. Based on typical supernatant quality from an anaerobic digester (WEF, 2005).
9. Based on assumed 98% solids capture.
10. Assumes 50% TSS removal across the primary clarifiers.
11. Assumes 35% BOD removal across the primary clarifiers, and a yield of 1.0 kg WAS/kg BOD in the bioreactors.

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

Table B.5 – Option 2 – Design Calculation Summary

Parameter	Design Value 2051 Population Growth	Design Value 2051 Rated Capacity
Sludge Mass Loadings (Average Basis)		
Raw Sludge to Digestion (kg/d)		
Simcoe WWTF – co-thickened	2,876	4,475
Port Rowan WWTF – co-thickened	366	790
Delhi WWTF – co-thickened	1,035	1,563
Waterford WWTF – WAS	381	779
Port Dover WWTF – co-thickened	1,192	1,889
Total Average	5,850	9,496
Maximum Month Factor	1.5	1.5

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

Appendix C

Conceptual Level Site Layouts

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

PROJECT NORTH

ASPHALT PATH

SECONDARY CLARIFIER DISTRIBUTION BOX

STAND-BY GENERATOR BUILDING (ABANDONED)

SEPTAGE CHAMBER

FINAL CLARIFIER #5

FINAL CLARIFIER #4

AERATION TANK #8

AERATION TANK #7

AERATION TANK #6

AERATION TANK #5

OUTDOOR GENERATOR

PLANT 2 BLOWER BUILDING

PRIMARY CLARIFIER #5

PRIMARY CLARIFIER #3

DISTRIBUTION CHAMBER

GRIT BUILDING

SCREEN BUILDING FF=211.24

PUMPING STATION FF=211.14

SEPTAGE RECEIVING STATION FF=211.18

EFFLUENT FILTERS BUILDING

FINAL CLARIFIER #3

FINAL CLARIFIER #2 ABANDONED CONCRETE TANK STRUCTURE

RETURN SLUDGE PUMPHOUSE

CHAMBER

SUBSTATION

PRIMARY CLARIFIER #4

PRIMARY CLARIFIER #2

RAW SLUDGE PUMPHOUSE

T/C = 212.73

PUMP ENCLOSURE

LEACHATE RECEIVING FACILITY

HYDRO ONE PROPERTY

ASPHALT TURNAROUND AREA

METER CHAMBER

CHEMICAL TANK

BOILER BUILDING

GARAGE

PLANT 1 BLOWER BUILDING

CONC. PAD

WORK SHOP

AERATION TANK #4

AERATION TANK #3

AERATION TANK #2

AERATION TANK #1

PRIMARY CLARIFIER #1

EX. SIDEWALK

ADMINISTRATION BUILDING

CHLORINATION FACILITIES

CHLORINE CONTACT CHAMBER

WALKWAY

REFER TO DRAWING C007 FOR DETAILS

FUTURE LIQUID TRAIN UPGRADE AREA

PRIMARY DIGESTER

DIGESTER CONTROL BUILDING

SECONDARY DIGESTER #1

PUMPING STATION

SECONDARY DIGESTER #2

FINAL CLARIFIER #1

CHAMBER

GATE

NEW GATE

GRAVEL

GRASS

BIOSOLIDS HOLDING TANK No. 2
Volume=7600m³
30.0m dia

BIOSOLIDS CONTROL BUILDING

BIOSOLIDS HOLDING TANK No. 1
Volume=7600m³
30.0m dia

BIOSOLIDS CONTROL BUILDING

BIOSOLIDS HOLDING TANK No. 3
Volume=7600m³
30.0m dia

NEW SLUDGE RECEIVING BUILDING

DIGESTER CONTROL BUILDING

ANAEROBIC DIGESTER 2
Volume=2800m³
21.0m dia

ANAEROBIC DIGESTER 1
Volume = 2800m³
21.0m dia

DIGESTER GAS ROOM

DIESEL GENERATOR

NEW CHAIN LINK FENCE

NEW GATE

ELECTRICAL SUBSTATION

CO-THICKENED SLUDGE UNLOADING PAD

CO-THICKENED SLUDGE RECEIVING TANK

1.5x1.5m W/GB CONTROLLER PAD

NEW WASTE GAS BURNER

Bush

Pier

LEGEND

TENDERED CONTRACT

PROPOSED

NO.	REVISION	DATE	INIT.
0	FOR CONCEPTUAL REVIEW OF BIOSOLIDS FACILITIES	JULY 2024	MR

NOTES

1. ONLY PROPOSED NEW STRUCTURES ARE SHOWN IN COLOUR.

2. REAL LOCATION OF WASTER GAS BURNER AND DIGESTER GAS PIPE TO REALLOCATED FOR SELECTED OPTIONS, NOT SHOWN FOR CLARITY.

ISSUE

SCALE BAR

1:500 0 5 10 15 20m

DRAFTING YP

DESIGN IS

DESIGN CHECKED BY MR

APPROVED BY OK

Norfolk COUNTY

HATCH

SIMCOE WWTF UPGRADES

NORFOLK COUNTY

CIVIL

PROPOSED SITE PLAN - 2051 POPULATION GROWTH

Option 1a) Anaerobic Digestion Without Biosolids Thickening

CONSULTANT FILE No.353644

DATE 2024/07/08

SCALE

REF. No. EIS-ENG-22-42

DWG No.

REV. 0

PROJECT NORTH

ASPHALT PATH

SECONDARY CLARIFIER DISTRIBUTION BOX

STAND-BY GENERATOR BUILDING (ABANDONED)

SEPTAGE CHAMBER

GATE

FINAL CLARIFIER #5

FINAL CLARIFIER #4

AERATION TANK #8

AERATION TANK #7

AERATION TANK #6

AERATION TANK #5

OUTDOOR GENERATOR

PLANT 2 BLOWER BUILDING

DISTRIBUTION CHAMBER

GRIT BUILDING

SCREEN BUILDING TF=211.24

PUMPING STATION TF=211.14

SEPTAGE RECEIVING STATION TF=211.18

PRIMARY CLARIFIER #5

PRIMARY CLARIFIER #3

PRIMARY CLARIFIER #4

PRIMARY CLARIFIER #2

RAW SLUDGE PUMPHOUSE

T/C = 212.73

PUMP ENCLOSURE

LEACHATE RECEIVING FACILITY

HYDRO ONE PROPERTY

ASPHALT TURNAROUND AREA

EFFLUENT FILTERS BUILDING

CHAMBER

FINAL CLARIFIER #3

RETURN SLUDGE PUMPHOUSE

FINAL CLARIFIER #2 ABANDONED CONCRETE TANK STRUCTURE

GRASS

SUBSTATION

PLANT 1 BLOWER BUILDING

CONC. PAD

WORK SHOP

CHEMICAL TANK

METER CHAMBER

BOILER BUILDING

GARAGE

CHLORINATION FACILITIES

AERATION TANK #4

AERATION TANK #3

AERATION TANK #2

AERATION TANK #1

PRIMARY CLARIFIER #1

EX. SIDEWALK

ADMINISTRATION BUILDING

WALKWAY

REFER TO DRAWING C007 FOR DETAILS

FUTURE LIQUID TRAIN UPGRADE AREA

CHLORINE CONTACT CHAMBER

PRIMARY DIGESTER

DIGESTER CONTROL BUILDING

SECONDARY DIGESTER #1

SECONDARY DIGESTER #2

PUMPING STATION

FINAL CLARIFIER #1

GRAVEL

Gravel

NEW GATE

NEW SLUDGE RECEIVING BUILDING

0+100

0+240

BIOSOLIDS HOLDING TANK No. 2
Volume=9300m³
30.0m dia

BIOSOLIDS CONTROL BUILDING

BIOSOLIDS HOLDING TANK No. 1
Volume=9300m³
30.0m dia

BIOSOLIDS HOLDING TANK No. 3
Volume=9300m³
30.0m dia

BIOSOLIDS CONTROL BUILDING

BIOSOLIDS HOLDING TANK No. 4
Volume=9300m³
30.0m dia

ANAEROBIC DIGESTER 1
Volume=3100m³
21.0m dia

DIGESTER CONTROL BUILDING

ANAEROBIC DIGESTER 3
Volume=3100m³
21.0m dia

ANAEROBIC DIGESTER 2
Volume=3100m³
21.0m dia

NEW CHAIN LINK FENCE

NEW GATE

CO-THICKENED SLUDGE UNLOADING PAD

DIESEL GENERATOR

ELECTRICAL SUBSTATION

CO-THICKENED SLUDGE RECEIVING TANK

1.5x1.5m WGB CONTROLLER PAD

NEW WASTE GAS BURNER

Bush

Pier

LEGEND

TENDERED CONTRACT

PROPOSED

ADDITIONAL FOOTPRINT = 1,625 m²

NO.	REVISION	DATE	INIT.
0	FOR CONCEPTUAL REVIEW OF BIOSOLIDS FACILITIES	JULY 2024	MR

NOTES
1. ONLY PROPOSED NEW STRUCTURES ARE SHOWN IN COLOUR.
2. REAL LOCATION OF WASTER GAS BURNER AND DIGESTER GAS PIPE TO REALLOCATED FOR SELECTED OPTIONS, NOT SHOWN FOR CLARITY.

ISSUE

SCALE BAR
1:500 0 5 10 15 20m

DRAFTING YP
DESIGN IS
DESIGN CHECKED BY MR
APPROVED BY OK

Norfolk COUNTY

HATCH

SIMCOE WWTF UPGRADES

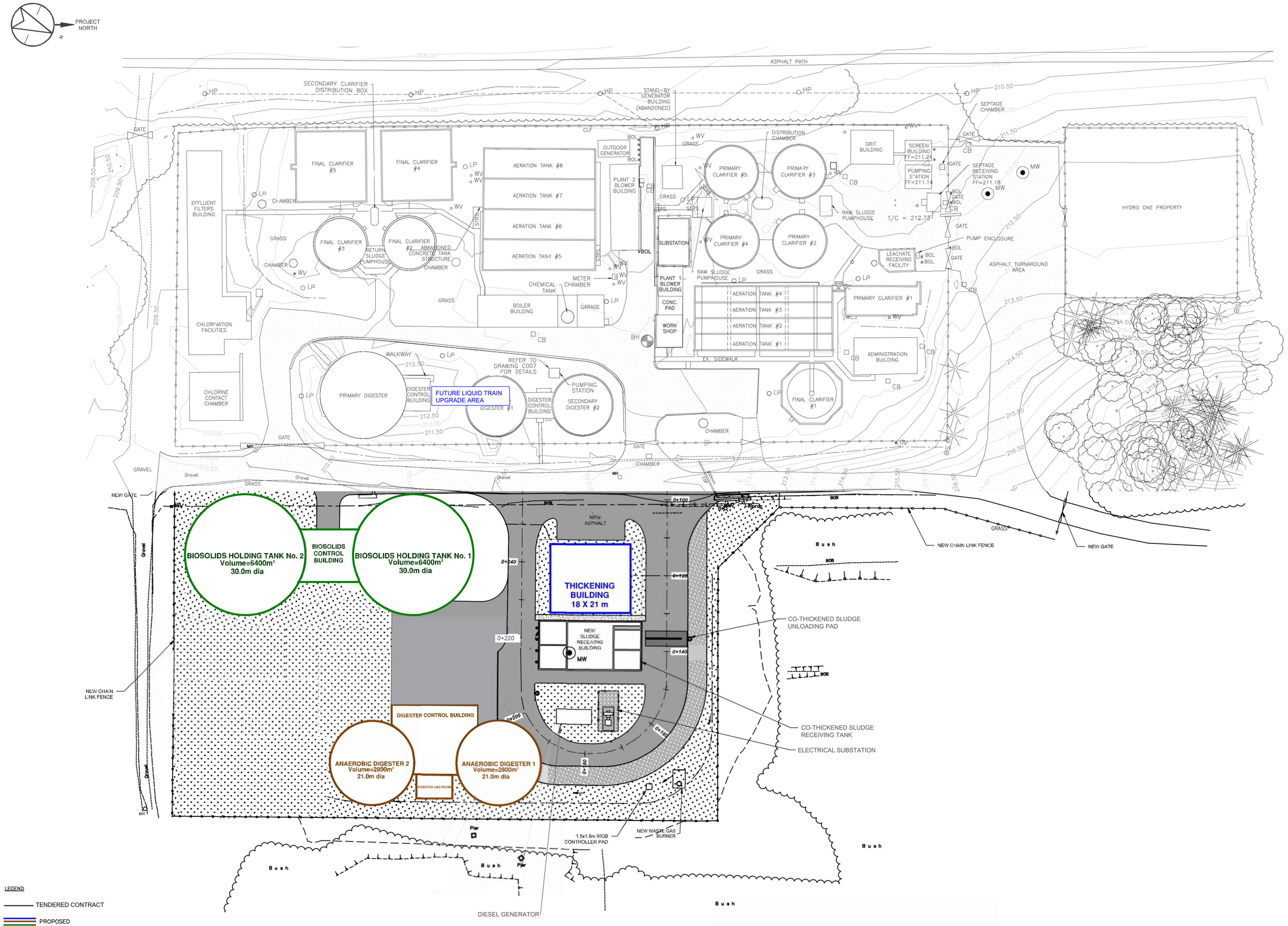
NORFOLK COUNTY

CIVIL

PROPOSED SITE PLAN - 2051 RATED CAPACITY

Option 1a) Anaerobic Digestion Without Biosolids Thickening

CONSULTANT FILE No.353644
DATE 2024/07/08
SCALE
REF. No. EIS-ENG-22-42
DWG No.
REV. 0



NO.	REVISION	DATE	INIT.
0	FOR CONCEPTUAL REVIEW OF BIOSOLIDS FACILITIES	JULY 2024	MR

NOTES

1. ONLY PROPOSED NEW STRUCTURES ARE SHOWN IN COLOUR.
2. REAL LOCATION OF WASTER GAS BURNER AND DIGESTER GAS PIPE TO REALLOCATED FOR SELECTED OPTIONS, NOT SHOWN FOR CLARITY.

ISSUE

SCALE BAR 1:500 (0 5 10 15 20m)

DRAFTING	YP
DESIGN	IS
DESIGN CHECKED BY	MR
APPROVED BY	OK

Norfolk County

HATCH

SIMCOE WWTF UPGRADES

NORFOLK COUNTY

CIVIL

PROPOSED SITE PLAN - 2051 POPULATION GROWTH

Option 1b Anaerobic Digestion With Biosolids Thickening

CONSULTANT FILE No.	353644
DATE	2024/07/08
SCALE	
REF. No.	EIS-ENG-22-42
DWG No.	
REV.	0

PROJECT NORTH

ASPHALT PATH

SECONDARY CLARIFIER DISTRIBUTION BOX

STAND-BY GENERATOR BUILDING (ABANDONED)

SEPTAGE CHAMBER

SEPTAGE RECEIVING STATION FF=211.18

SCREEN BUILDING FF=211.24

PUMPING STATION FF=211.14

GRIT BUILDING

DISTRIBUTION CHAMBER

OUTDOOR GENERATOR

PLANT 2 BLOWER BUILDING

PRIMARY CLARIFIER #5

PRIMARY CLARIFIER #3

PRIMARY CLARIFIER #4

PRIMARY CLARIFIER #2

PRIMARY CLARIFIER #1

RAW SLUDGE PUMPHOUSE

T/C = 212.73

PUMP ENCLOSURE

LEACHATE RECEIVING FACILITY

ASPHALT TURNAROUND AREA

HYDRO ONE PROPERTY

FINAL CLARIFIER #5

FINAL CLARIFIER #4

FINAL CLARIFIER #3

FINAL CLARIFIER #2 ABANDONED CONCRETE TANK STRUCTURE

RETURN SLUDGE PUMPHOUSE

EFFLUENT FILTERS BUILDING

AERATION TANK #8

AERATION TANK #7

AERATION TANK #6

AERATION TANK #5

AERATION TANK #4

AERATION TANK #3

AERATION TANK #2

AERATION TANK #1

SUBSTATION

PLANT 1 BLOWER BUILDING

CONC. PAD

WORK SHOP

BOILER BUILDING

GARAGE

CHEMICAL TANK

METER CHAMBER

CHLORINATION FACILITIES

CHLORINE CONTACT CHAMBER

ADMINISTRATION BUILDING

EX. SIDEWALK

WALKWAY

REFER TO DRAWING C007 FOR DETAILS

FUTURE LIQUID TRAIN UPGRADE AREA

PRIMARY DIGESTER

DIGESTER CONTROL BUILDING

SECONDARY DIGESTER #1

PUMPING STATION

SECONDARY DIGESTER #2

FINAL CLARIFIER #1

CHAMBER

GATE

NEW GATE

GRAVEL

GRASS

NEW ASPHALT

BOSOLIDS HOLDING TANK No. 2
Volume=6900m³
30.0m dia

BIOSOLIDS CONTROL BUILDING

BIOSOLIDS HOLDING TANK No. 3
Volume=6900m³
30.0m dia

THICKENING BUILDING
18 X 21 m

NEW SLUDGE RECEIVING BUILDING

ANAEROBIC DIGESTER 1
Volume=3000m³
21.0m dia

DIGESTER CONTROL BUILDING

BIOSOLIDS HOLDING TANK No. 1
Volume=6900m³
30.0m dia

ANAEROBIC DIGESTER 3
Volume=3000m³
21.0m dia

ANAEROBIC DIGESTER 2
Volume=3000m³
21.0m dia

NEW CHAIN LINK FENCE

CO-THICKENED SLUDGE UNLOADING PAD

CO-THICKENED SLUDGE RECEIVING TANK

ELECTRICAL SUBSTATION

1.5x1.5m WGB CONTROLLER PAD

NEW WASTE GAS BURNER

DIESEL GENERATOR

Pier

Bush

LEGEND

TENDERED CONTRACT

PROPOSED

NO.	REVISION	DATE	INIT.
0	FOR CONCEPTUAL REVIEW OF BIOSOLIDS FACILITIES	JULY 2024	MR

NOTES
1. ONLY PROPOSED NEW STRUCTURES ARE SHOWN IN COLOUR.
2. REAL LOCATION OF WASTER GAS BURNER AND DIGESTER GAS PIPE TO REALLOCATED FOR SELECTED OPTIONS, NOT SHOWN FOR CLARITY.

ISSUE

SCALE BAR
1:500 0 5 10 15 20m

DRAFTING YP
DESIGN IS
DESIGN CHECKED BY MR
APPROVED BY OK

Norfolk COUNTY

HATCH

SIMCOE WWTF UPGRADES

NORFOLK COUNTY

CIVIL

PROPOSED SITE PLAN - 2051 RATED CAPACITY

Option 1b Anaerobic Digestion With Biosolids Thickening

CONSULTANT FILE No. 353644
DATE 2024/07/03
SCALE
REF. No. EIS-ENG-22-42
DWG No.
REV. 0

PROJECT NORTH

ASPHALT PATH

SECONDARY CLARIFIER DISTRIBUTION BOX

STAND-BY GENERATOR BUILDING (ABANDONED)

SEPTAGE CHAMBER

GATE

FINAL CLARIFIER #5

FINAL CLARIFIER #4

AERATION TANK #8

AERATION TANK #7

AERATION TANK #6

AERATION TANK #5

OUTDOOR GENERATOR

PLANT 2 BLOWER BUILDING

DISTRIBUTION CHAMBER

PRIMARY CLARIFIER #5

PRIMARY CLARIFIER #3

GRIT BUILDING

SCREEN BUILDING FF=211.24

PUMPING STATION FF=211.14

SEPTAGE RECEIVING STATION FF=211.18

MW

HYDRO ONE PROPERTY

EFFLUENT FILTERS BUILDING

CHAMBER

FINAL CLARIFIER #3

FINAL CLARIFIER #2 ABANDONED CONCRETE TANK STRUCTURE

RETURN SLUDGE PUMPHOUSE

RAW SLUDGE PUMPHOUSE

T/C = 212.73

PRIMARY CLARIFIER #4

PRIMARY CLARIFIER #2

SUBSTATION

PUMP ENCLOSURE

LEACHATE RECEIVING FACILITY

ASPHALT TURNAROUND AREA

METER CHAMBER

CHEMICAL TANK

PLANT 1 BLOWER BUILDING

CONC. PAD

WORK SHOP

BOILER BUILDING

GARAGE

AERATION TANK #4

AERATION TANK #3

AERATION TANK #2

AERATION TANK #1

PRIMARY CLARIFIER #1

EX. SIDEWALK

ADMINISTRATION BUILDING

CHLORINATION FACILITIES

CHLORINE CONTACT CHAMBER

WALKWAY

REFER TO DRAWING C007 FOR DETAILS

FUTURE LIQUID TRAIN UPGRADE AREA

PRIMARY DIGESTER

DIGESTER CONTROL BUILDING

SECONDARY DIGESTER #1

PUMPING STATION

SECONDARY DIGESTER #2

FINAL CLARIFIER #1

GRAVEL

GRASS

NEW GATE

NEW ASPHALT

BIOSOLIDS HOLDING TANK No. 2
Volume=7500m³
30.0m dia

BIOSOLIDS CONTROL BUILDING

BIOSOLIDS HOLDING TANK No. 3
Volume=7500m³
30.0m dia

THICKENING BUILDING
18 X 21 m

NEW SLUDGE RECEIVING BUILDING

BIOSOLIDS CONTROL BUILDING

BIOSOLIDS HOLDING TANK No. 1
Volume=7500m³
30.0m dia

DIGESTER CONTROL BUILDING

ANAEROBIC DIGESTERS 1
Volume=2200m³
21.0m dia

DIGESTER GAS ROOM

ANAEROBIC DIGESTERS 2
Volume=2200m³
21.0m dia

NEW CHAIN LINK FENCE

CO-THICKENED SLUDGE UNLOADING PAD

CO-THICKENED SLUDGE RECEIVING TANK

ELECTRICAL SUBSTATION

NEW WASTE GAS BURNER

1.5x1.5m V/GB CONTROLLER PAD

DIESEL GENERATOR

Bush

Pier

LEGEND

EXISTING

PROPOSED

NO.	REVISION	DATE	INIT.
0	FOR PRELIMANRY REVIEW OF BIOSOLIDS FACILITIES	JULY 2024	MR

NOTES

1. ONLY PROPOSED NEW STRUCTURES ARE SHOWN IN COLOUR.

2. REAL LOCATION OF WASTER GAS BURNER AND DIGESTER GAS PIPE TO REALLOCATED FOR SELECTED OPTIONS, NOT SHOWN FOR CLARITY.

ISSUE

SCALE BAR

1:500 0 5 10 15 20m

DRAFTING YP

DESIGN IS

DESIGN CHECKED BY MR

APPROVED BY OK

Norfolk COUNTY

HATCH

SIMCOE WWTF UPGRADES

NORFOLK COUNTY

CIVIL

PROPOSED SITE PLAN - 2051 POPULATION GROWTH

Option 1c)

CONSULTANT FILE No. 353644

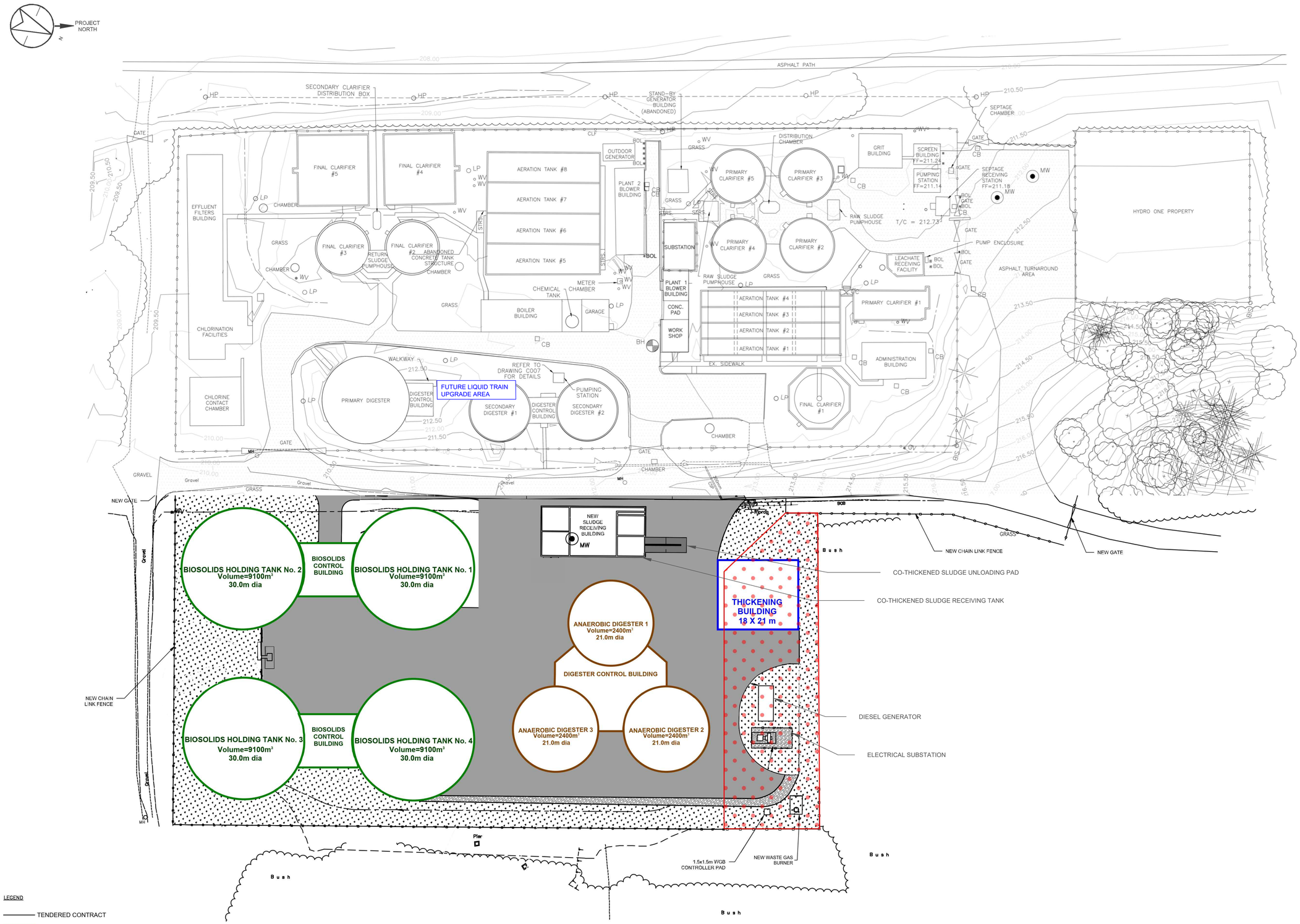
DATE 2024/07/03

SCALE

REF. No. EIS-ENG-22-42

DWG No.

REV. 0



NO.	REVISION	DATE	INIT.
0	FOR CONCEPTUAL REVIEW OF BIOSOLIDS FACILITIES	JULY 2024	MR

NOTES
1. ONLY PROPOSED NEW STRUCTURES ARE SHOWN IN COLOUR.
2. REAL LOCATION OF WASTER GAS BURNER AND DIGESTER GAS PIPE TO REALLOCATED FOR SELECTED OPTIONS, NOT SHOWN FOR CLARITY.

ISSUE

SCALE BAR
1:500 0 5 10 15 20m

DRAFTING YP
DESIGN IS
DESIGN CHECKED BY MR
APPROVED BY OK

Norfolk COUNTY
HATCH

SIMCOE WWTF UPGRADES
NORFOLK COUNTY
CIVIL
PROPOSED SITE PLAN - 2051 RATED CAPACITY
Option 1c

CONSULTANT FILE No. 353644
DATE 2024/07/08
SCALE
REF. No. EIS-ENG-22-42
DWG No.
REV. 0

PROJECT NORTH

ASPHALT PATH

SECONDARY CLARIFIER DISTRIBUTION BOX

STAND-BY GENERATOR BUILDING (ABANDONED)

SEPTAGE CHAMBER

OUTDOOR GENERATOR

DISTRIBUTION CHAMBER

GRIT BUILDING

SCREEN BUILDING FF=211.24

PUMPING STATION FF=211.14

SEPTAGE RECEIVING STATION FF=211.18

HYDRO ONE PROPERTY

EFFLUENT FILTERS BUILDING

FINAL CLARIFIER #5

FINAL CLARIFIER #4

FINAL CLARIFIER #3

FINAL CLARIFIER #2 ABANDONED CONCRETE TANK STRUCTURE

RETURN SLUDGE PUMPHOUSE

AERATION TANK #8

AERATION TANK #7

AERATION TANK #6

AERATION TANK #5

PLANT 2 BLOWER BUILDING

PRIMARY CLARIFIER #5

PRIMARY CLARIFIER #3

PRIMARY CLARIFIER #4

PRIMARY CLARIFIER #2

RAW SLUDGE PUMPHOUSE

T/C = 212.73

SUBSTATION

PLANT 1 BLOWER BUILDING

CONC. PAD

WORK SHOP

LEACHATE RECEIVING FACILITY

PUMP ENCLOSURE

ASPHALT TURNAROUND AREA

CHEMICAL METER CHAMBER

BOILER BUILDING

GARAGE

CHLORINATION FACILITIES

CHLORINE CONTACT CHAMBER

AERATION TANK #4

AERATION TANK #3

AERATION TANK #2

AERATION TANK #1

EX. SIDEWALK

PRIMARY CLARIFIER #1

ADMINISTRATION BUILDING

FINAL CLARIFIER #1

WALKWAY

REFER TO DRAWING C007 FOR DETAILS

FUTURE LIQUID TRAIN UPGRADE AREA

PRIMARY DIGESTER

DIGESTER CONTROL BUILDING

SECONDARY DIGESTER #1

DIGESTER CONTROL BUILDING

PUMPING STATION

SECONDARY DIGESTER #2

CHAMBER

GRAVEL

GRASS

NEW GATE

NEW ASPHALT

BIOSOLIDS HOLDING TANK No. 2
Volume=7500m³
30.0m dia

BIOSOLIDS CONTROL BUILDING

BIOSOLIDS HOLDING TANK No. 3
Volume=7500m³
30.0m dia

THICKENING BUILDING
18 X 21 m

NEW SLUDGE RECEIVING BUILDING

MW

BIOSOLIDS CONTROL BUILDING

DIGESTER CONTROL BUILDING

BIOSOLIDS HOLDING TANK No. 1
Volume=7500m³
30.0m dia

ANAEROBIC DIGESTERS 1
Volume=2200m³
21.0m dia

DIGESTER GAS ROOM

ANAEROBIC DIGESTERS 2
Volume=2200m³
21.0m dia

NEW CHAIN LINK FENCE

NEW GATE

CO-THICKENED SLUDGE UNLOADING PAD

CO-THICKENED SLUDGE RECEIVING TANK

ELECTRICAL SUBSTATION

1.5x1.5m WGB CONTROLLER PAD

NEW WASTE GAS BURNER

DIESEL GENERATOR

Bush

Pier

LEGEND

TENDERED CONTRACT

PROPOSED

NOTES
1. ONLY PROPOSED NEW STRUCTURES ARE SHOWN IN COLOUR.

2. REAL LOCATION OF WASTER GAS BURNER AND DIGESTER GAS PIPE TO REALLOCATED FOR SELECTED OPTIONS, NOT SHOWN FOR CLARITY.

NO.	REVISION	DATE	INIT.
0	FOR CONCEPTUAL REVIEW OF BIOSOLIDS FACILITIES	JULY 2024	MR

ISSUE

SCALE BAR
1:500 0 5 10 15 20m

DRAFTING YP
DESIGN IS
DESIGN CHECKED BY MR
APPROVED BY OK

Norfolk County

HATCH

SIMCOE WWTF UPGRADES
NORFOLK COUNTY
CIVIL
PROPOSED SITE PLAN - 2051 POPULATION GROWTH
Option 1d)

CONSULTANT FILE No.353644
DATE 2024/07/03
SCALE
REF. No. EIS-ENG-22-42
DWG No.
REV. 0

PROJECT NORTH

ASPHALT PATH

SECONDARY CLARIFIER DISTRIBUTION BOX

STAND-BY GENERATOR BUILDING (ABANDONED)

SEPTAGE CHAMBER

GATE

CLF

OUTDOOR GENERATOR

PLANT 2 BLOWER BUILDING

DISTRIBUTION CHAMBER

GRIT BUILDING

SCREEN BUILDING FF=211.24

PUMPING STATION FF=211.14

SEPTAGE RECEIVING STATION FF=211.18

HYDRO ONE PROPERTY

FINAL CLARIFIER #5

FINAL CLARIFIER #4

AERATION TANK #8

AERATION TANK #7

AERATION TANK #6

AERATION TANK #5

PRIMARY CLARIFIER #5

PRIMARY CLARIFIER #3

EFFLUENT FILTERS BUILDING

CHAMBER

GRASS

FINAL CLARIFIER #3

RETURN SLUDGE PUMPHOUSE

FINAL CLARIFIER #2 ABANDONED CONCRETE TANK STRUCTURE

RAW SLUDGE PUMPHOUSE

T/C = 212.73

SUBSTATION

PRIMARY CLARIFIER #4

PRIMARY CLARIFIER #2

PUMP ENCLOSURE

LEACHATE RECEIVING FACILITY

ASPHALT TURNAROUND AREA

METER CHAMBER

CHEMICAL TANK

BOILER BUILDING

GARAGE

PLANT 1 BLOWER BUILDING

CONC. PAD

WORK SHOP

AERATION TANK #4

AERATION TANK #3

AERATION TANK #2

AERATION TANK #1

PRIMARY CLARIFIER #1

EX. SIDEWALK

ADMINISTRATION BUILDING

CHLORINATION FACILITIES

CHLORINE CONTACT CHAMBER

WALKWAY

REFER TO DRAWING C007 FOR DETAILS

FUTURE LIQUID TRAIN UPGRADE AREA

PRIMARY DIGESTER

DIGESTER CONTROL BUILDING

SECONDARY DIGESTER #1

PUMPING STATION

SECONDARY DIGESTER #2

FINAL CLARIFIER #1

GRAVEL

Gravel

NEW GATE

NEW SLUDGE RECEIVING BUILDING

MW

BIOSOLIDS HOLDING TANK No. 2
Volume=9000m³
30.0m dia

BIOSOLIDS CONTROL BUILDING

BIOSOLIDS HOLDING TANK No. 1
Volume=9000m³
30.0m dia

THICKENING BUILDING
18 X 21 m

ANAEROBIC DIGESTER 1
Volume=2400m³
21.0m dia

DIGESTER CONTROL BUILDING

ANAEROBIC DIGESTER 3
Volume=2400m³
21.0m dia

ANAEROBIC DIGESTER 2
Volume=2400m³
21.0m dia

BIOSOLIDS HOLDING TANK No. 3
Volume=9000m³
30.0m dia

BIOSOLIDS CONTROL BUILDING

BIOSOLIDS HOLDING TANK No. 4
Volume=9000m³
30.0m dia

NEW CHAIN LINK FENCE

NEW GATE

CO-THICKENED SLUDGE UNLOADING PAD

CO-THICKENED SLUDGE RECEIVING TANK

DIESEL GENERATOR

ELECTRICAL SUBSTATION

1.5x1.5m W/GB CONTROLLER PAD

NEW WASTE GAS BURNER

Bush

Pier

LEGEND

TENDERED CONTRACT

PROPOSED

ADDITIONAL FOOTPRINT = 1,920 m²

NO.	REVISION	DATE	INIT.
0	FOR CONCEPTUAL REVIEW OF BIOSOLIDS FACILITIES	JULY 2024	MR

NOTES

1. ONLY PROPOSED NEW STRUCTURES ARE SHOWN IN COLOUR.

2. REAL LOCATION OF WASTER GAS BURNER AND DIGESTER GAS PIPE TO REALLOCATED FOR SELECTED OPTIONS, NOT SHOWN FOR CLARITY.

ISSUE

SCALE BAR 1:500 0 5 10 15 20m

DRAFTING YP

DESIGN IS

DESIGN CHECKED BY MR

APPROVED BY OK

Norfolk County

HATCH

SIMCOE WWTF UPGRADES

NORFOLK COUNTY

CIVIL

PROPOSED SITE PLAN - 2051 RATED CAPACITY

Option 1d

CONSULTANT FILE No.353644

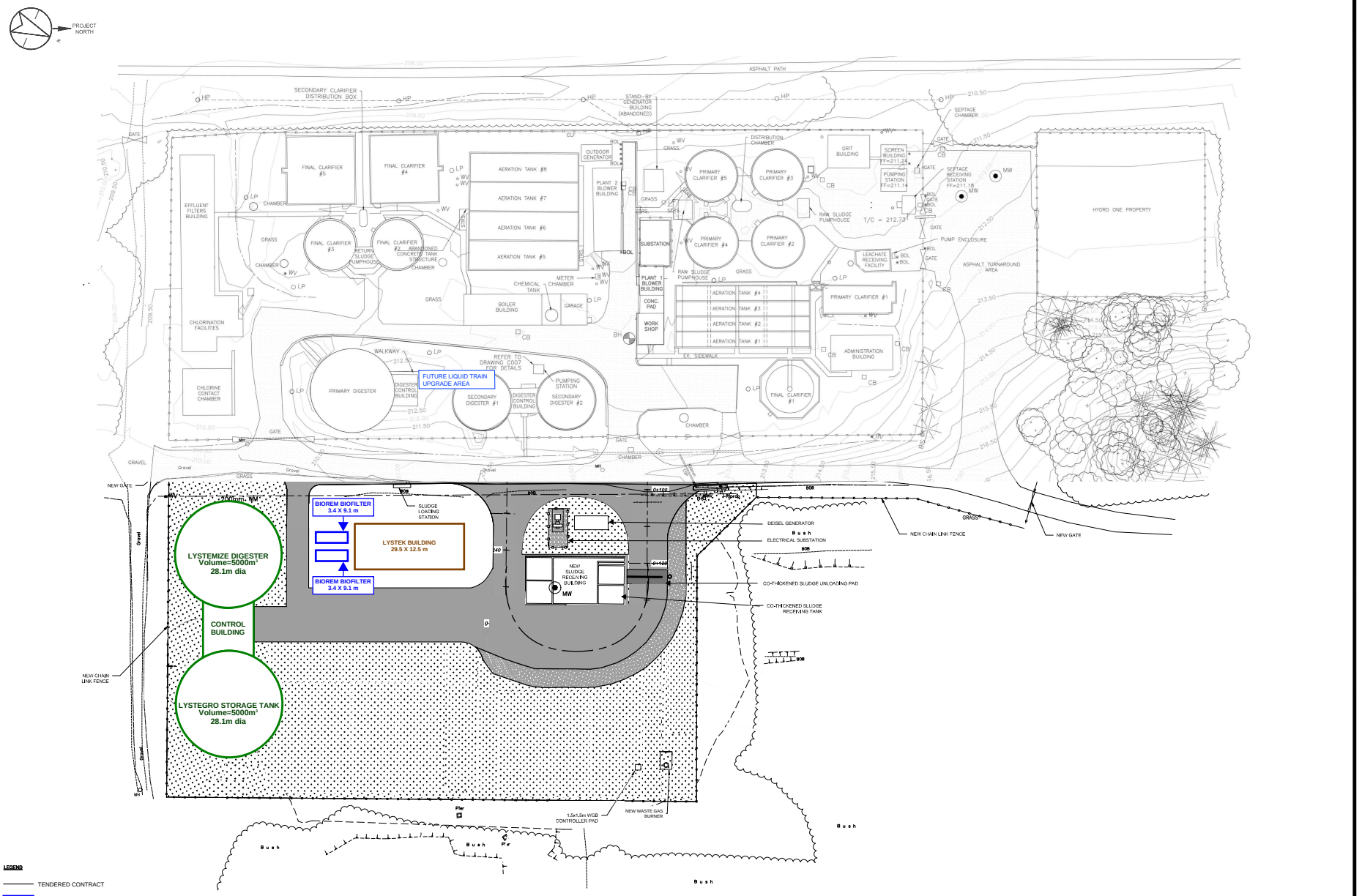
DATE 2024/07/08

SCALE

REF. No. EIS-ENG-22-42

DWG No.

REV. 0



no.	REVISION	DATE	INIT.
0	FOR CONCEPTUAL REVIEW OF BIOSOLIDS FACILITIES	JULY 2024	MR

NOTES
1. ONLY PROPOSED NEW STRUCTURES ARE SHOWN IN COLOUR.
2. REAL LOCATION OF WASTER GAS BURNER AND DIGESTER GAS PIPE TO REALLOCATED FOR SELECTED OPTIONS, NOT SHOWN FOR CLARITY.

ISSUE

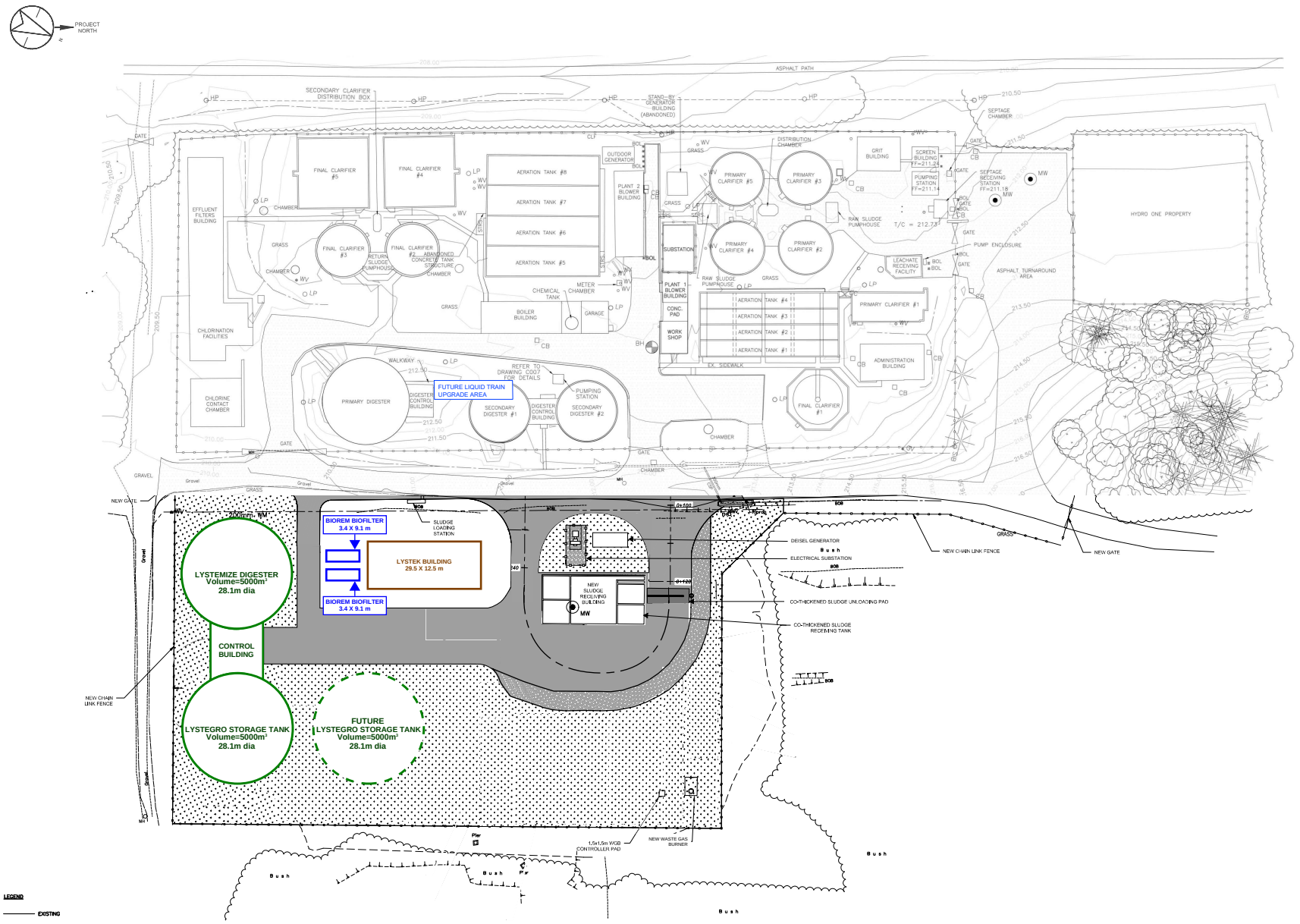
SCALE BAR 1:500 0 5 10 15 20m

DRAFTING YP
DESIGN IS
DESIGN CHECKED BY MR
APPROVED BY OK

Norfolk County
HATCH

SIMCOE WWTF UPGRADES
NORFOLK COUNTY
CIVIL
PROPOSED SITE PLAN - 2051 POPULATION GROWTH
Option 2

CONSULTANT FILE No.353644
DATE 2024/07/08
SCALE
REF. No. EIS-ENG-22-42
DWG No.
REV. 0



NO.	REVISION	DATE	INIT.
0	FOR CONCEPTUAL REVIEW OF BIOSOLIDS FACILITIES	JULY 2024	MR

NOTES
1. ONLY PROPOSED NEW STRUCTURES ARE SHOWN IN COLOUR.
2. REAL LOCATION OF WASTER GAS BURNER AND DIGESTER GAS PIPE TO REALLOCATED FOR SELECTED OPTIONS, NOT SHOWN FOR CLARITY.

ISSUE

SCALE BAR 1:500 (0 5 10 15 20m)

DRAFTING YP
DESIGN IS
DESIGN CHECKED BY MR
APPROVED BY OK

Norfolk County
HATCH

SIMCOE WWTF UPGRADES
NORFOLK COUNTY
CIVIL
PROPOSED SITE PLAN - 2051 RATED CAPACITY
Option 2

CONSULTANT FILE No. 353644
DATE 2024/07/08
SCALE
REF. No. EIS-ENG-22-42
DWG No.
REV. 0

Appendix D

Capital Costs – Option 1b and Option 2

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

Simcoe Waste Water Treatment Plant

Cost Estimate Breakdown ***Option 1B Anaerobic Digestion and Biosolids Storage (2051 Population Growth)***

This will represent an approximate cost breakdown of the entire construction project.

Monday, November 18, 2024

Item #	Description	Unit	Quantity	Unit Cost	Total Cost	Notes
1	**Mobilization, Demobilization and Restoration**	Lump Sum	1	$ 357,262	$ 357,262	
2	**Division 1 Costs** (Permits, Bonds and Insurance, Environmental Protection, Temporary Staging and Facilities, Material Management, Dewatering, As-Builts, Commissioning)	Lump Sum	1	$ 1,429,048	$ 1,429,048	
3	**Civil Works: Not included in Items #7** (Grading, Excavation, Yard Pipe/Site Servicing, Backfill, Concrete, Asphalt, Utility Coordination, etc.)	Lump Sum	1	$ 2,798,522	$ 2,798,522	Costs include Grading, Excavation, Yard Pipe/Site Servicing, Backfill, Asphalt and Utility Coordination. No concrete is required for civil works. Concrete costs for specific building/tanks are included in the respective line items.
4	**Sludge Receiving Facility**	Lump Sum	1	$ 6,150,488	$ 6,150,488	Costs associated with Process Piping, Flow Meters and Sensors, Valves, Pumps, and Fittings/Joints have been removed from this item and been added to item 13 as requested. Please refer to the Divisional Breakdown Summary for the Sludge Receiving Facility.
5	**Anaerobic Digesters**	Each	2	$ 8,640,340	$ 17,280,681	
6	**Digester Control Building**	Each	1	$ 7,023,389	$ 7,023,389	Costs associated with Process Piping, Flow Meters and Sensors, Valves, Pumps, and Fittings/Joints have been removed from this item and been added to item 13 as requested. Please refer to the Divisional Breakdown Summary for the Option 1b Digester Control Building.
7	**Thickening Facility**				$ 633,500	
7a	Rotary Drum Thickener Feed Tank	Each	1	$ 13,000	$ 13,000	
7b	Chemical System (Polymer addition and new flocculation tank)	Each	1	$ 78,000	$ 78,000	
7c	Rotary Drum Thickeners	Each	2	$ 255,000	$ 510,000	
7d	Filtrate Tank (supernatant tank)	Each	1	$ 32,500	$ 32,500	
8	**Biosolids Storage Tanks**	Each	2	$ 3,454,068	$ 6,908,135	
9	**Biosolids Control Building**	Lump Sum	1	$ 2,647,341	$ 2,647,341	Costs associated with Process Piping, Flow Meters and Sensors, Valves, Pumps, and Fittings/Joints have been removed from this item and been added to item 13 as requested. Please refer to the Divisional Breakdown Summary for the Option 1b Biosolids Control Building.
10	**Waste Gas Burner**	Each	1	$ 1,069,978	$ 1,069,978	
11	**Power Supply** (service upgrade by HONI and electrical duct upgrades by NC/Contractor)	Each	1	$ 2,141,573	$ 2,141,573	
12	**Emergency Generator**	Lump Sum	1	$ 1,050,074	$ 1,050,074	
13	**Process Piping, Flow Meters and Sensors, Valves, Pumps, and Fittings/Joints**	Each	1	$ 7,231,239	$ 7,231,239	
14	**Instrumentation and Control and SCADA Integration** (not included above)	Lump Sum	0		$ -	
15	**Process and Mechanical Equipment** (not included above)	Lump Sum	0		$ -	
16	**Electrical Equipment and Upgrades** (not included above)	Lump Sum	0		$ -	
17	**Building-Mechanical (HVAC Systems, Electrical Systems, Mechanical, Plumbing, Structural Components, Safety and Compliance Features, Instrumentation and Controls, Loading and Unloading Areas, Equipment, Piping)**	Lump Sum	1	$ 2,818,233	$ 2,818,233	Cost for item 17 is associated with the Thickening Facility (item 7) only. Building mechanical costs associated with other facilities are included in their line items and respective Divisional Breakdown Summaries.
	Sub-Total Base Scope				**$ 59,539,461.59**	
	Contingency (35%)				$ 20,838,811.56	
	Grand Total				$ 80,378,273.15	

Simcoe Waste Water Treatment Plant

Cost Estimate Breakdown ***Option 1B Anaerobic Digestion and Biosolids Storage (2051 Rated Capacity)***

This will represent an approximate cost breakdown of the entire construction project.

Monday, November 18, 2024

Item #	Description	Unit	Quantity	Unit Cost	Total Cost	Notes
1	**Mobilization, Demobilization and Restoration**	Lump Sum	1	$ 357,262	$ 357,262	
2	**Division 1 Costs** (Permits, Bonds and Insurance, Environmental Protection, Temporary Staging and Facilities, Material Management, Dewatering, As-Builts, Commissioning)	Lump Sum	1	$ 1,429,048	$ 1,429,048	
3	**Civil Works: Not included in Items #7** (Grading, Excavation, Yard Pipe/Site Servicing, Backfill, Concrete, Asphalt, Utility Coordination, etc.)	Lump Sum	1	$ 2,798,522	$ 2,798,522	Costs include Grading, Excavation, Yard Pipe/Site Servicing, Backfill, Asphalt and Utility Coordination. No concrete is required for civil works. Concrete costs for specific building/tanks are included in the respective line items.
4	**Sludge Receiving Facility**	Lump Sum	1	$ 6,150,488	$ 6,150,488	Costs associated with Process Piping, Flow Meters and Sensors, Valves, Pumps, and Fittings/Joints have been removed from this item and been added to item 13 as requested. Please refer to the Divisional Breakdown Summary for the Sludge Receiving Facility.
5	**Anaerobic Digesters**	Each	3	$ 8,640,340	$ 25,921,021	
6	**Digester Control Building**	Each	1	$ 7,023,389	$ 7,023,389	Costs associated with Process Piping, Flow Meters and Sensors, Valves, Pumps, and Fittings/Joints have been removed from this item and been added to item 13 as requested. Please refer to the Divisional Breakdown Summary for the Option 1b Digester Control Building.
7	**Thickening Facility**				$ 633,500	
7a	Rotary Drum Thickener Feed Tank	Each	1	$ 13,000	$ 13,000	
7b	Chemical System (Polymer addition and new flocculation tank)	Each	1	$ 78,000	$ 78,000	
7c	Rotary Drum Thickeners	Each	2	$ 255,000	$ 510,000	
7d	Filtrate Tank (supernatant tank)	Each	1	$ 32,500	$ 32,500	
8	**Biosolids Storage Tanks**	Each	3	$ 3,454,068	$ 10,362,203	
9	**Biosolids Control Building**	Lump Sum	2	$ 2,647,341	$ 5,294,682	Costs associated with Process Piping, Flow Meters and Sensors, Valves, Pumps, and Fittings/Joints have been removed from this item and been added to item 13 as requested. Please refer to the Divisional Breakdown Summary for the Option 1b Biosolids Control Building.
10	**Waste Gas Burner**	Each	1	$ 1,069,978	$ 1,069,978	
11	**Power Supply** (service upgrade by HONI and electrical duct upgrades by NC/Contractor)	Each	1	$ 2,141,573	$ 2,141,573	
12	**Emergency Generator**	Lump Sum	1	$ 1,050,074	$ 1,050,074	
13	**Process Piping, Flow Meters and Sensors, Valves, Pumps, and Fittings/Joints**	Lump Sum	1	$ 7,231,239	$ 7,231,239	
14	**Instrumentation and Control and SCADA Integration** (not included above)	Lump Sum	0		$ -	
15	**Process and Mechanical Equipment** (not included above)	Lump Sum	0		$ -	
16	**Electrical Equipment and Upgrades** (not included above)	Lump Sum	0		$ -	
17	**Building-Mechanical (HVAC Systems, Electrical Systems, Mechanical, Plumbing, Structural Components, Safety and Compliance Features, Instrumentation and Controls, Loading and Unloading Areas, Equipment, Piping)**	Lump Sum	1	$ 2,855,733	$ 2,855,733	Cost for item 17 is associated with the Thickening Facility (item 7) only. Building mechanical costs associated with other facilities are included in their line items and respective Divisional Breakdown Summaries.
	Sub-Total Base Scope				**$ 74,318,710.39**	
	Contingency (35%)				$ 26,011,548.63	
	Grand Total				$ 100,330,259.02	

Simcoe Waste Water Treatment Plant

Cost Estimate Breakdown ***Option 2 Biosolids Management*** *(2051 Population Growth)*

This will represent an approximate cost breakdown of the entire construction project.

Monday, November 18, 2024

Item #	*Description*	*Unit*	*Quantity*	*Unit Cost*	*Total Cost*	*Notes*
1	**Mobilization, Demobilization and Restoration**	Lump Sum	1	$ 283,852	$ 283,852	
2	**Division 1 Costs** (Permits, Bonds and Insurance, Environmental Protection, Temporary Staging and Facilities, Material Management, Dewatering, As-Builts, Commissioning)	Lump Sum	1	$ 1,135,408	$ 1,135,408	
3	**Civil Works: Not included in Items #5** (Grading, Excavation, Yard Pipe/Site Servicing, Backfill, Concrete, Asphalt, Utility Coordination, etc.)	Lump Sum	1	$ 2,757,042	$ 2,757,042	Costs include Grading, Excavation, Yard Pipe/Site Servicing, Backfill, Asphalt and Utility Coordination. No concrete is required for civil works. Concrete costs for specific building/tanks are included in the respective line items.
4	**Sludge Receiving Facility**	Lump Sum	1	$ 6,150,488	$ 6,150,488	Costs associated with Process Piping, Flow Meters and Sensors, Valves, Pumps, and Fittings/Joints have been removed from this item and been added to item 13 as requested. Please refer to the Divisional Breakdown Summary for the Sludge Receiving Facility.
5	***Biosolids Management Facility***	Lump Sum	1		$ 19,512,744	
5a	**Macerator and Grinder**	Each	1	$ 132,875	$ 132,875	
5b	**Blend Tank**	Each			$ -	The blend tank is located in the Sludge Receiving Facility, not the Biosolids Management Facility. As such, the cost has been included in item 4.
5c	**Chemical System** (Polymer addition and new flocculation tank)	Lump Sum	1	$ 193,000	$ 193,000	
5d	**Dewatering Centrifuge**	Each	2	$ 954,375	$ 1,908,750	
5e	**Dewatered Sludge Tank**	Lump Sum			$ -	The dewatered biosolids tank is supplied as part of the LY10 Module equipment package, and as such the costs are included in the LY10 modules line item (item 5f). After speaking to Lystek, they will not break this price out as the supply and design of this equipment is unique to their Module as a whole.
5f	**Thermal Hydrolysis Reactor** (THP LY10) Including Chemical addition (KOH)	Each	2	$ 3,825,375	$ 7,650,750	Includes Duty/Standby pump arrangement.
5g	**Filtrate Tank** (supernatant tank)	Each	1	$ 32,500	$ 32,500	
5h	**Digesters** (LysteMize)	Each	1	$ 2,091,000	$ 2,091,000	
5i	**Storage Tanks** (LysteGro)	Each	1	$ 2,057,850	$ 2,057,850	
5j	**Control Building**	Each	1	$ 2,255,909	$ 2,255,909	Costs associated with Process Piping, Flow Meters and Sensors, Valves, Pumps, and Fittings/Joints have been removed from this item and been added to item 13 as requested. Please refer to the Divisional Breakdown Summary for the Option 2 Control Building.
5k	**Building-Mechanical** (HVAC Systems, Electrical Systems, Mechanical, Plumbing, Structural Components, Safety and Compliance Features, Instrumentation and Controls, Loading and Unloading Areas, Thermal Insulation, Equipment, Piping)	Lump Sum	1	$ 3,190,111	$ 3,190,111	Costs associated with Process Piping, Flow Meters and Sensors, Valves, Pumps, and Fittings/Joints have been removed from this item and been added to item 13 as requested. Please refer to the Divisional Breakdown Summary for the Option 2 Biosolids Management Building.
6	**Odour Control**	Each	2	$ 598,500	$ 1,197,000	
7	**Waste Gas Burner**	Each	1	$ 1,069,978	$ 1,069,978	
8	**Power Supply Upgrade** (service upgrade by HONI and electrcal ducts within the plant by NC/Contractor)	Lump Sum	1	$ 2,141,573	$ 2,141,573	
9	**Standby Generator**	Each	1	$ 1,050,074	$ 1,050,074	
10	**Process Piping, Flow Meters and Sensors, Valves, Pumps, and Fittings/Joints**	Lump Sum	1	$ 3,974,415	$ 3,974,415	
11	**Instrumentation and Control and SCADA Integration** (not included above)	Lump Sum	0	$ -	$ -	
12	**Process and Mechanical Equipment** (not included above)	Lump Sum	0	$ -	$ -	
13	**Electrical Equipment and Upgrades** (not included above)	Lump Sum	0	$ -	$ -	
	Sub-Total Base Scope				**$ 39,272,574.56**	
	Contingency (35%)				**$ 13,745,401.09**	
	Grand Total				**$ 53,017,975.65**	

Simcoe Waste Water Treatment Plant

Cost Estimate Breakdown ***Option 2 Biosolids Management*** *(2051 Rated Capacity)*

This will represent an approximate cost breakdown of the entire construction project.

Monday, November 18, 2024

Item #	*Description*	*Unit*	*Quantity*	*Unit Cost*	*Total Cost*	*Notes*
1	**Mobilization, Demobilization and Restoration**	Lump Sum	1	$ 283,852	$ 283,852	
2	**Division 1 Costs** (Permits, Bonds and Insurance, Environmental Protection, Temporary Staging and Facilities, Material Management, Dewatering, As-Builts, Commissioning)	Lump Sum	1	$ 1,135,408	$ 1,135,408	
3	**Civil Works: Not included in Items #5** (Grading, Excavation, Yard Pipe/Site Servicing, Backfill, Concrete, Asphalt, Utility Coordination, etc.)	Lump Sum	1	$ 2,757,042	$ 2,757,042	Costs include Grading, Excavation, Yard Pipe/Site Servicing, Backfill, Asphalt and Utility Coordination. No concrete is required for civil works. Concrete costs for specific building/tanks are included in the respective line items.
4	**Sludge Receiving Facility**	Lump Sum	1	$ 6,150,488	$ 6,150,488	Costs associated with Process Piping, Flow Meters and Sensors, Valves, Pumps, and Fittings/Joints have been removed from this item and been added to item 13 as requested. Please refer to the Divisional Breakdown Summary for the Sludge Receiving Facility.
5	***Biosolids Management Facility***	Lump Sum	1		$ 21,917,394	
5a	**Macerator and Grinder**	Each	1	$ 132,875	$ 132,875	
5b	**Blend Tank**	Each	1		$ -	The blend tank is located in the Sludge Receiving Facility, not the Biosolids Management Facility. As such, the cost has been included in item 4.
5c	**Chemical System** (Polymer addition and new flocculation tank)	Lump Sum	1	$ 193,000	$ 193,000	
5d	**Dewatering Centrifuge**	Each	2	$ 954,375	$ 1,908,750	
5e	**Dewatered Sludge Tank**	Lump Sum			$ -	The dewatered biosolids tank is supplied as part of the LY10 Module equipment package, and as such the costs are included in the LY10 modules line item (item 5f). After speaking to Lystek, they will not break this price out as the supply and design of this equipment is unique to their Module as a whole.
5f	**Thermal Hydrolysis Reactor** (THP LY10) Including Chemical addition (KOH)	Each	2	$ 3,825,375	$ 7,650,750	Includes Duty/Standby pump arrangement.
5g	**Filtrate Tank** (supernatant tank)	Each	1	$ 32,500	$ 32,500	
5h	**Digesters** (LysteMize)	Each	1	$ 2,091,000	$ 2,091,000	
5i	**Storage Tanks** (LysteGro)	Each	2	$ 2,057,850	$ 4,115,700	
5j	**Control Building**	Each	1	$ 2,255,909	$ 2,255,909	Costs associated with Process Piping, Flow Meters and Sensors, Valves, Pumps, and Fittings/Joints have been removed from this item and been added to item 13 as requested. Please refer to the Divisional Breakdown Summary for the Option 2 Control Building.
5k	**Building-Mechanical** (HVAC Systems, Electrical Systems, Mechanical, Plumbing, Structural Components, Safety and Compliance Features, Instrumentation and Controls, Loading and Unloading Areas, Thermal Insulation, Equipment, Piping)	Lump Sum	1	$ 3,536,911	$ 3,536,911	Costs associated with Process Piping, Flow Meters and Sensors, Valves, Pumps, and Fittings/Joints have been removed from this item and been added to item 13 as requested. Please refer to the Divisional Breakdown Summary for the Option 2 Biosolids Management Building.
6	**Odour Control**	Each	2	$ 598,500	$ 1,197,000	
7	**Waste Gas Burner**	Each	1	$ 1,069,978	$ 1,069,978	
8	**Power Supply Upgrade** (service upgrade by HONI and electrcal ducts within the plant by NC/Contractor)	Lump Sum	1	$ 2,141,573	$ 2,141,573	
9	**Standby Generator**	Each	1	$ 1,050,074	$ 1,050,074	
10	**Process Piping, Flow Meters and Sensors, Valves, Pumps, and Fittings/Joints**	Lump Sum	1	$ 3,974,415	$ 3,974,415	
11	**Instrumentation and Control and SCADA Integration** (not included above)	Lump Sum	0	$ -	$ -	
12	**Process and Mechanical Equipment** (not included above)	Lump Sum	0		$ -	
13	**Electrical Equipment and Upgrades** (not included above)	Lump Sum	0	$ -	$ -	
	Sub-Total Base Scope				**$ 41,677,224.56**	
	Contingency (35%)				**$ 14,587,028.59**	
	Grand Total				**$ 56,264,253.15**	

Norfolk County	Simcoe Wastewater Treatment Facility Upgrades	
Divisional Summary	**Option 1b - Biosolids Control Building**	353644

Divisions	**Summary of Costs**
Division 1 - General Requirements	*$0.00*
Division 2 - Site Works	*$139,978.23*
Division 3 - Concrete	*$580,236.98*
Division 4 - Masonry	*$513,760.84*
Division 5 - Metals	*$573.54*
Division 6 - Wood & Plastics	*$0.00*
Division 7 - T&M Protection	*$177,772.75*
Division 8 - Doors & Windows	*$32,950.08*
Division 9 - Finishes	*$80,526.05*
Division 10 - Specialties	$0.00
Division 11 - Equipment	$0.00
Division 12 - Furnishings	$0.00
Division 13 - Instrumentation & Controls	$0.00
Division 14 - Conveying System	$0.00
Division 15A - Process Mechanical	$0.00
Division 15B - Building Mechanical	$385,087.41
Division 16 - Electrical	$736,455.00
Sub Total Basic Facility Costs	**$2,647,341**

Note: Refer to Cost Estimate Breakdown - Option 1B - Anaerobic Digestion and Biosolids Storage. Costs associated with Process Piping, Flow Meters and Sensors, Valves, Pumps, and Fittings/Joints (Divisions 11, 13, and 15A) have been removed from this item and been added to item 13 as requested. Costs associated with Division 1 have been added to item 2 as requested.

Norfolk County	Simcoe Wastewater Treatment Facility Upgrades	
Divisional Summary	**Option 1b - Digester Control Building**	353644

Divisions	**Summary of Costs**
Division 1 - General Requirements	*$0.00*
Division 2 - Site Works	*$742,035.50*
Division 3 - Concrete	*$1,990,408.73*
Division 4 - Masonry	*$858,055.68*
Division 5 - Metals	*$87,749.25*
Division 6 - Wood & Plastics	*$0.00*
Division 7 - T&M Protection	*$518,080.58*
Division 8 - Doors & Windows	*$45,181.54*
Division 9 - Finishes	*$282,224.63*
Division 10 - Specialties	$0.00
Division 11 - Equipment	$0.00
Division 12 - Furnishings	$0.00
Division 13 - Instrumentation & Controls	$0.00
Division 14 - Conveying System	$39,630.43
Division 15A - Process Mechanical	$0.00
Division 15B - Building Mechanical	$1,291,853.01
Division 16 - Electrical	$1,168,170.00
Sub Total Basic Facility Costs	**$7,023,389**

Note: Refer to Cost Estimate Breakdown - Option 1B - Anaerobic Digestion and Biosolids Storage. Costs associated with Process Piping, Flow Meters and Sensors, Valves, Pumps, and Fittings/Joints (Divisions 11, 13, and 15A) have been removed from this item and been added to item 13 as requested. Costs associated with Division 1 have been added to item 2 as requested.

Norfolk County	Simcoe Wastewater Treatment Facility Upgrades	
Divisional Summary	**Option 1b - Thickening Building**	353644

Divisions	**Summary of Costs**
Division 1 - General Requirements	*$0.00*
Division 2 - Site Works	*$100,000.00*
Division 3 - Concrete	*$362,880.00*
Division 4 - Masonry	*$0.00*
Division 5 - Metals	*$1,095,000.00*
Division 6 - Wood & Plastics	*$0.00*
Division 7 - T&M Protection	*$0.00*
Division 8 - Doors & Windows	*$0.00*
Division 9 - Finishes	*$0.00*
Division 10 - Specialties	$0.00
Division 11 - Equipment	$0.00
Division 12 - Furnishings	$0.00
Division 13 - Instrumentation & Controls	$0.00
Division 14 - Conveying System	$0.00
Division 15A - Process Mechanical	$0.00
Division 15B - Building Mechanical	$626,800.00
Division 16 - Electrical	$633,552.50
Sub Total Basic Facility Costs	**$2,818,233**

Note: Refer to Cost Estimate Breakdown - Option 1B - Anaerobic Digestion and Biosolids Storage. Costs associated with Process Piping, Flow Meters and Sensors, Valves, Pumps, and Fittings/Joints (Divisions 11, 13, and 15A) have been removed from this item and been added to item 13 as requested. Costs associated with Division 1 have been added to item 2 as requested.

Norfolk County	Simcoe Wastewater Treatment Facility Upgrades	
Divisional Summary	**Sludge Receiving Facility**	353644

Divisions	Summary of Costs
Division 1 - General Requirements	*$0.00*
Division 2 - Site Works	*$515,913.34*
Division 3 - Concrete	*$1,526,621.30*
Division 4 - Masonry	*$337,859.42*
Division 5 - Metals	*$51,330.44*
Division 6 - Wood & Plastics	*$0.00*
Division 7 - T&M Protection	*$355,545.50*
Division 8 - Doors & Windows	*$53,169.44*
Division 9 - Finishes	*$76,691.47*
Division 10 - Specialties	$0.00
Division 11 - Equipment	$0.00
Division 12 - Furnishings	$0.00
Division 13 - Instrumentation & Controls	$0.00
Division 14 - Conveying System	$39,630.43
Division 15A - Process Mechanical	$0.00
Division 15B - Building Mechanical	$1,771,607.04
Division 16 - Electrical	$1,422,120.00
Sub Total Basic Facility Costs	**$6,150,488**

Note: Refer to Cost Estimate Breakdown - Option 1B - Anaerobic Digestion and Biosolids Storage. Costs associated with Process Piping, Flow Meters and Sensors, Valves, Pumps, and Fittings/Joints (Divisions 11, 13, and 15A) have been removed from this item and been added to item 13 as requested. Costs associated with Division 1 have been added to item 2 as requested.
Refer to Cost Estimate Breakdown - Option 2 - Biosolids Management. Costs associated with Process Piping, Flow Meters and Sensors, Valves, Pumps, and Fittings/Joints (Divisions 11, 13, and 15A) have been removed from this item and been added to item 10 as requested. Costs associated with Division 1 have been added to item 2 as requested.

Norfolk County	Simcoe Wastewater Treatment Facility Upgrades	
Divisional Summary	**Option 2 - Biosolids Management Facility**	353644

Divisions	**Summary of Costs**
Division 1 - General Requirements	*$0.00*
Division 2 - Site Works	*$0.00*
Division 3 - Concrete	*$354,000.00*
Division 4 - Masonry	*$0.00*
Division 5 - Metals	*$1,050,000.00*
Division 6 - Wood & Plastics	*$0.00*
Division 7 - T&M Protection	*$0.00*
Division 8 - Doors & Windows	*$0.00*
Division 9 - Finishes	*$0.00*
Division 10 - Specialties	$0.00
Division 11 - Equipment	$0.00
Division 12 - Furnishings	$0.00
Division 13 - Instrumentation & Controls	$0.00
Division 14 - Conveying System	$0.00
Division 15A - Process Mechanical	$0.00
Division 15B - Building Mechanical	$1,086,110.58
Division 16 - Electrical	$700,000.00
Sub Total Basic Facility Costs	**$3,190,111**

Note: Refer to Cost Estimate Breakdown - Option 2 - Biosolids Management. Costs associated with Process Piping, Flow Meters and Sensors, Valves, Pumps, and Fittings/Joints (Divisions 11, 13, and 15A) have been removed from this item and been added to item 10 as requested. Costs associated with Division 1 have been added to item 2 as requested.

Norfolk County	Simcoe Wastewater Treatment Facility Upgrades	
Divisional Summary	**Option 2 - Control Building**	353644

Divisions	**Summary of Costs**
Division 1 - General Requirements	*$0.00*
Division 2 - Site Works	*$139,978.23*
Division 3 - Concrete	*$188,805.04*
Division 4 - Masonry	*$513,760.84*
Division 5 - Metals	*$573.54*
Division 6 - Wood & Plastics	*$0.00*
Division 7 - T&M Protection	*$177,772.75*
Division 8 - Doors & Windows	*$32,950.00*
Division 9 - Finishes	*$80,526.05*
Division 10 - Specialties	$0.00
Division 11 - Equipment	$0.00
Division 12 - Furnishings	$0.00
Division 13 - Instrumentation & Controls	$0.00
Division 14 - Conveying System	$0.00
Division 15A - Process Mechanical	$0.00
Division 15B - Building Mechanical	$385,087.41
Division 16 - Electrical	$736,455.00
Sub Total Basic Facility Costs	**$2,255,909**

Note: Refer to Cost Estimate Breakdown - Option 2 - Biosolids Management. Costs associated with Process Piping, Flow Meters and Sensors, Valves, Pumps, and Fittings/Joints (Divisions 11, 13, and 15A) have been removed from this item and been added to item 10 as requested. Costs associated with Division 1 have been added to item 2 as requested.

Appendix E

Detailed Breakdown of Projected GHG Emissions by Hatch

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

Table E.1 – Breakdown of 2051 Projected Annual GHG Emissions for Option 1B

2051 GHG Emissions (tonnes CO2e)			
Source	**Requirements**	**Input Values**	**Calculation**
CONVENTIONAL/LYSTEMIZE DIGESTION			
Fugitive emissions from biogas combustion and flaring	CH_4 Emission (m^3/yr)	395460	16
	CH_4 density (kg/m^3)	0.657	
	Flaring/combustion efficiency (%)	99.75	
	CH4 - Global Warming Potential ($kgCO_2e/kgCH_4$)	25	
Digester mixing electrical consumption	Electricity use for anaerobic digester mixing systems (kW/m3 of digester volume)	0.0065	12
	Design Digester Volume (m^3) (for 2 digesters)	5500	
	Energy intensity factor (gCO_2e/kWh)	38	
THICKENING/DEWATERING			
Polymer manufacturing	Polymer Use (kg/dry tonne)	5	9
	Loading to RTDs (tonne/yr)	1179	
	Emissions per tonne (kgCO2e/kgPoly)	1.6	
Electrical consumption	Energy usage (kWh/dry tonne)	6.0	0.3
	Loading to RTDs (tonne/d)	1179	
	Energy intensity factor (gCO_2e/kWh)	38	
TRANSPORTATION			
Biosolids to land application	Hauled Sludge (m^3/yr)	19254	25
	Truck Capacity (m^3/truck)	40	
	Distance (km) (40 is round trip)	40	
	Truck Efficiency (L/km)	0.48	
	kg of CO_2 per L of diesel consumed ($kgCO_2$/L Diesel)	2.7	
Polymer to Simcoe WWTP	Polymer Use (kg/dry tonne)	5	0.1
	Loading to RDTs (tonne/yr)	1179	
	Polymer Density (kg/m^3)	1350	
	Truck Capacity (m^3/truck)	20	
	Distance (km) (Toronto to Norfolk County round trip)	300	
	Truck Efficiency (L/km)	0.48	
	kg of CO_2 per L of diesel consumed ($kgCO_2$/L Diesel)	2.7	
LAND APPLICATION			
Tractor diesel consumption	Hauled Sludge (m_3/yr)	19254	33
	Diesel per tractor load (Ldiesel/load)	8	
	Size of tractor load (m^3/load)	13	

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

	kg of CO_2 per L of diesel consumed ($kgCO_2$/L Diesel)	2.7	
Fertilizer offset credit for nitrogen	Nitrogen offset credits (t CO_2e/day)	-0.79x0.4	-115
Fertilizer offset credit for phosphorus	Phosphorus offset credits (t CO_2e/day)	-0.1	-36.5
Fertilizer offset credit for potassium	N/A	N/A	N/A
Fertilizer offset credit for carbon sequestration	Carbon sequestration as result of land application (tCO_2/day) Carbon sequestration emissions (kg CO2e/dry tonne of biosolids)	-0.8 250	-292
		TOTAL	**-348**

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

Table E.2 – Breakdown of 2051 Projected Annual GHG Emissions for Option

2051 GHG Emissions (tonne CO_2e/year)			
Source	**Requirements**	**Input Values**	**Calculation**
THP MODULE			
Electrical consumption	Energy used per year (kWh/yr)	81140	3
	Energy intensity factor (gCO_2e/kWh)	38	
45% KOH solution manufacturing	45% KOH is higher (tonne/year)	203	174
	Emissions (tCO_2e/tKOH)	1.9	
	Percent KOH in solution (%)	45%	
CONVENTIONAL/LYSTEMIZE DIGESTION			
Fugitive emissions from biogas combustion and flaring	CH_4 Emission (m^3/yr)	395460	16
	CH_4 density (kg/m^3)	0.657	
	Flaring/combustion efficiency (%)	99.75	
	CH_4 - Global Warming Potential ($kgCO_2e/kgCH_4$)	25	
THICKENING/DEWATERING			
Polymer manufacturing	Polymer Use (kg/dry tonne)	10	34
	Loading to centrifuge(tonne/yr)	2135.00	
	Emissions per tonne (kgCO2e/kgPolymer)	1.6	
Electrical consumption	Energy usage (kWh/dry tonne)	35	2.8
	Loading to centrifuge (tonne/d)	2135	
	Energy intensity factor (gCO_2e/kWh)	38	
TRANSPORTATION			
Biosolids to land application	Hauled Sludge (m^3/yr)	14440	19
	Truck Capacity (m^3/truck)	40	
	Distance (km) (40 is round trip)	40	
	Truck Efficiency (L/km)	0.48	
	kg of CO^2 per L of diesel consumed ($kgCO^2$/L Diesel)	2.7	
Polymer to Simcoe WWTP	Polymer Use (kg/dry tonne)	10	0.3
	Loading to centrifuges (tonne/yr)	2135	
	Polymer Density (kg/m^3)	1350	
	Truck Capacity (m^3/truck)	20	
	Distance (km) (Toronto to Norfolk County round trip)	300	
	Truck Efficiency (L/km)	0.48	

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.

	kg of CO_2 per L of diesel consumed (kgCO_2/L Diesel)	2.7	
KOH to Simcoe WWTP	KOH used per year (tonne/year)	203	2
	KOH solution Density (tonne/m^3)	1.5	
	Truck Capacity (m^3/truck)	16	
	Distance (km) (Guelph to Norfolk County round trip)	190	
	Truck Efficiency (L/km)	0.48	
	kg of CO_2 per L of diesel consumed (kgCO_2/L Diesel)	2.7	
LAND APPLICATION			
Tractor diesel consumption	Hauled Sludge (m^3/yr)	14440	25
	Diesel per tractor load (Ldiesel/load)	8	
	Size of tractor load (m^3/load)	13	
	kg of CO_2 per L of diesel consumed (kgCO_2/L Diesel)	2.7	
Fertilizer offset credit for nitrogen	Nitrogen offset credits (t CO_2e/day)	-1.49x0.4	-218
Fertilizer offset credit for phosphorus	Phosphorus offset credits (t CO_2e/day)	-0.15	-54.75
Fertilizer offset credit for potassium	45% KOH used per year (tonne/year)	203	-61
	KOH molecular weight (g/mol)	56.11	
	Potassium molecular weight (g/mol)	39.1	
	Percent KOH in solution (%)	45%	
	Potassium offset credits (kg CO2e/kgK)	0.96	
Fertilizer offset credit for carbon sequestration	Carbon sequestration as result of land application (tCO_2/day)	-0.93	-339
	Carbon sequestration emissions (kg CO2e/dry tonne of biosolids)	250	
TOTAL			**-396**

© Hatch 2024 All rights reserved, including all rights relating to the use of this document or its contents.