Enhancing our communities

9th Avenue East
Class Environmental Assessment

SCHEDULE B REPORT

City of Owen Sound

File 121387 | January 9, 2024

Document Control

File:

121387

Date:

January 9, 2024

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Issue	**Date**	**Description**
1	January 9, 2024	Final Report

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1 Introduction

1.1 PROJECT AREA

The City of Owen Sound has identified several infrastructure needs and deficiencies in an area of the City involving the 9th Avenue East (Highway 6/10) corridor which is a MTO Connecting Link. The project area, as identified in Figure 1, can generally be described as 9th Avenue East from Superior Street to 9th Street East (approximately 1,250 metres) including the block to the east extending to the terminuses of 6th Street East and 7th Street East.

1.2 IDENTIFIED NEEDS

There are concerns with the water distribution system which has dead ends on Superior Street, 6th Street East and 7th Street East. Furthermore, the 9th Avenue East watermain services several commercial and institutional properties such as hotels/motels, a courthouse, places of worship and long term care facilities. Given the pressure zone boundaries in the City and the aforementioned dead ends, there is no ability to back feed 9th Avenue East in the event of a watermain break leading to prolonged water outages.

The watermain, storm sewer and sanitary sewer systems date back to the 1960s and are deteriorated. The surface infrastructure (asphalt, curbs, guiderail, etc.) are also aged and in need of replacement.

1.3 REPORT STRUCTURE

This report is structured to follow the process of a Schedule B Class Environmental Assessment (Class EA) and includes the following:

- the problem/opportunity the project aims to address;
- a confirmation of the appropriate Class EA schedule;
- a summary of background reports and studies undertaken to inventory the applicable project area environments;
- the alternative solutions;
- a summary of stakeholder consultation activities; and
- the recommended solution.

2 Problem/Opportunity

The City of Owen Sound has initiated a Municipal Class EA to address infrastructure, road and sidewalk needs and deficiencies within the 9th Avenue East corridor. In consideration of the aforementioned background and in context of the City's objective to provide safe and reliable infrastructure, road and sidewalk systems, the following Problem Statement has been defined to set the framework for the completion of the Class EA study.

> *That existing infrastructure, road and sidewalk needs and deficiencies within the subject length of 9th Avenue East (100 metres south of Superior Street to 100 metres north of 9th Street East) be addressed in an environmentally sound manner, in consideration of City standards and policies, infrastructure requirements and active transportation opportunities, with the objective of providing safe and reliable service to the people of Owen Sound.*

The Problem Statement was formally issued in a Notice of Study Commencement dated June 23, 2022, a copy of which is provided in Appendix A. Further discussions with respect to the notice and associated stakeholder consultation is provided in Chapter 7.

3 Municipal Class EA Process

All infrastructure and road improvement projects in Ontario are subject to the Environmental Assessment Act. The Act allows the use of Class Environmental Assessments, such as the Municipal Class Environmental Assessment process[1] (amended 2023). Applying to all municipal infrastructure and road improvement projects, a number of study categories and schedules have been established recognizing the range of environmental impacts. These are briefly described below.

3.1.1 Class EA Schedule

Exempt Projects

These projects generally include normal or emergency operational and maintenance activities, rehabilitation works, minor reconstruction or replacement of existing facilities, and new facilities that are limited in scope. As the environmental effects of these activities are usually minimal, these projects are exempt from the Environmental Assessment Act and hence there are no requirements under the Class EA framework.

Schedule B Projects

Schedule B projects generally include improvements and minor expansions to existing facilities or smaller new projects. As there is the potential for some adverse environmental impacts, the proponent is required to conduct a screening process whereby members of the public and review agencies are informed of the project and given the opportunity to provide comment (warranting completion of Phases 1 and 2 of the Class EA process). Documentation of the planning and design process is required under a Schedule B study. As these studies are generally straightforward and do not require detailed technical investigations to arrive at the preferred solution, a comprehensive report is not required. Rather, a Project File shall be prepared to demonstrate that the appropriate steps have been followed. The Project File is to be submitted for review by the public and review agencies for comment and input. Once this is complete, the project can proceed to implementation (Phase 5).

Schedule C Projects

Schedule C projects generally include the construction of new facilities and major expansions to existing facilities. As they have the potential for significant environmental impacts, they must

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[1] *Municipal Class Environmental Assessment.* Municipal Engineers Association, October 2000, as amended in 2007, 2011, and 2015.

proceed under the full planning and documentation procedures specified by the *Municipal Class EA* document (Phase 1 to 5). Schedule C projects require that an Environmental Study Report be prepared and appropriately filed for review by the public and review agencies.

3.1.2 Class EA Terminology

Prior to determining the appropriate Class EA schedule, an understanding of the defining terminology is required as noted below:

Localized Operational Improvements

Refers to structural changes to an existing roadway at specific locations, and may include turning lanes at an intersection, storage lanes, U-turn lanes, bus bays, median changes, changing the curb radii, etc.

Road Capacity

Means capacity defined in terms of the number of travelled lanes and does not differentiate between various lane widths to accommodate differing traffic volumes.

Same Purpose, Use, Capacity & Location

Refers to the replacement or upgrading of a structure or facility or its performance, where the objective and application remain unchanged, and the volume, size and capability do not exceed the minimum municipal standard, or the existing rated capacity, and there is no substantial change in location. Works carried out within an existing road allowance such that no land acquisition is required are considered to be in the same location. Conversely, it is thus inferred that should improvements extend beyond the existing road allowance and additional property is required, the location is considered to have changed.

3.1.3 Selected Class EA Schedule

The Municipal Class EA document details a number of infrastructure and road improvement projects and defines the corresponding Class EA schedule to be applied based on the result of a screening process.

Exempt Projects

- Road resurfacing with no change to the horizontal alignment.
- Reconstruction where the reconstructed road will be for the same purpose, use, capacity and at the same location.

- Establish, extend or enlarge a water distribution system and all works necessary to connect the system to an existing system or water source, provided all such facilities are either in an existing road allowance or an existing utility corridor including the use of Trenchless Technology for water crossings.
- Establish, extend, or enlarge a sewage collection system and all necessary works to connect the system to an existing sewage or natural drainage outlet, provided all such facilities are in either an existing road allowance or an existing utility corridor, including the use of Trenchless Technology for water crossings.

Schedule B

- Reconstruction or widening where the reconstructed road will not be for the same purpose, use, capacity or at the same location (e.g. additional motor vehicle lanes, continuous centre turn lane that requires property, i.e. not at the same location), provided the construction value is less than $3 M (otherwise a Schedule C undertaking would apply).
- Establish, extend or enlarge a water distribution system and all works necessary to connect the system to an existing system or water source, where such facilities are not in either an existing road allowance or an existing utility corridor.
- Establish, extend or enlarge a sewage collection system and all works necessary to connect the system to an existing sewage outlet where such facilities are not located in an existing road allowance, or existing utility corridor.

Applicable Schedule

In consideration of the above, a Schedule B undertaking has been selected. The requirements of such would be to complete Phase 1 and Phase 2 of the overall Class EA process (refer to Appendix B for the Municipal Class EA Planning and Design Process), which involves identifying the problem, developing alternative solutions and selecting a preferred solution prior to proceeding to Phase 5: Implementation (i.e. design and construction).

4 Alternative Solutions

In consideration of the noted system deficiencies, City standards and guidelines, and the project area, alternative improvement solutions were considered, as detailed below.

4.1 ROADS

The City's scope of work for road infrastructure includes resurfacing the existing asphalt pavement, replacing deteriorated concrete curbs and replacing deficient steel beam guiderail on 9th Avenue East. Localized sidewalk replacements and extensions may also be included in the reconstruction program. Given that the intent is simply to replace that which is aged and requires replacement, the road will remain in its current location and maintain its current configuration. As such, there is no need for alternative solutions for the road improvements.

4.2 STORM SEWER

A closed-circuit television (CCTV) investigation of all storm sewers and structures on 9th Avenue East within the project area was completed, and several deficiencies were identified including sagging, cracked and collapsed pipes. Given these deficiencies, coupled with the overall age of the system, full replacement of the storm sewer system within the project area is recommended, maintaining its existing location. In this regard, there are no alternative solutions pertaining to the storm sewer system.

4.3 SANITARY SEWER

The City has determined that the sanitary sewers in the project area are generally in good condition and are not in need of replacement. During the reconstruction of 9th Avenue East, all existing sanitary services will be replaced as a proactive maintenance activity. In this regard, there are no alternative solutions pertaining to the sanitary sewer system.

4.4 WATERMAIN

4.4.1 9th Avenue East

There are two watermains on 9th Avenue East within the project area:

- a 400 millimetre diameter trunk watermain from 8th Street East to the north project limit; and
- a 150 millimetre diameter distribution watermain along the entire length, providing individual water services to all properties fronting the road and providing service to fire hydrants.

Through the City's water model, the size of the trunk watermain is confirmed as appropriate. City operations staff have also confirmed the trunk watermain is in satisfactory condition and thus replacement is not required, albeit there are several valves which will be replaced.

With respect to the distribution watermain, as noted previously, there are significant risks in the distribution system when breaks result in outages to several critical properties. The existing distribution watermain ranges in size from 150 to 200 millimetres in diameter and has sections of cast iron and ductile iron. Based on numerous modelling scenarios undertaken for this study, it is recommended that the existing distribution watermain will be replaced with a 200 millimetre diameter watermain; the modelling report and summary is included in Appendix C Replacement of the distribution watermain is an exempt activity under the MEA Class EA framework and thus alternative solutions are not required.

4.4.2 Looping Watermain

To mitigate the risks previously alluded to, a second distribution watermain in the area is required to provide redundancy and looping to increase system reliability during both normal operations and watermain repairs. When determining alternative solutions for the looping watermain alignment, the following sections were considered:

- 6th Street East to 8th Street East; and
- Superior Street to 6th Street East.

6th Street East to 8th Street East

From 6th Street East to 8th Street East, there is a City-owned utility corridor parallel to 9th Avenue East which intersects the dead ends of 6th Street East and 7th Street East. The City and Tatham concluded the most appropriate alignment for the looping watermain would be in this utility corridor, and as it is City owned, the undertaking is classified as an exempt activity. Construction of this first phase of the looping watermain was completed in 2023. The location of the looping watermain from 6th Street East to 8th Street East is illustrated in Figure 2.

Superior Street to 6th Street East

The second segment of the looping watermain has only one City owned road allowance or utility corridor, 9th Avenue East. Installing a twin watermain on 9th Avenue East from Superior Street to 6th Street East was not considered in detail for the following reasons:

- does not provide benefit to properties on Superior Street;
- if twin watermains are too close together, one cannot be safely worked on without shutting down/depressurizing the other; and

- existing utilities, sewers and watermain limit the available space to fit a second watermain.

In consideration of the discussion above, the looping watermain from Superior Street to 6th Street East was assumed to be "established, extended or enlarged" outside of a road allowance or utility corridor (as identified in Figure 3), and as such, a Schedule B Class EA was initiated to review and select an appropriate alignment. Five alternative solutions were explored, in addition to a "do nothing" scenario, as detailed in Table 1 and illustrated in Figure 4 through Figure 8.

Table 1: Looping Watermain Alternatives

ALTERNATIVE	DESCRIPTION
Do Nothing	▪ existing watermain system remains in its current arrangement with no looping south of 6th Street East
Alternative 1	▪ watermain installed in easements to be created on the 595 9th Avenue East (Grey County) and 425 9th Avenue East (E.C. King) properties ▪ connects to existing watermains on Superior Street and 6th Street East ▪ outside of existing sanitary sewer easements (shown in green) on 595 9th Avenue East and 1010 Superior Street properties ▪ considerable tree removals required on 425 9th Avenue East (E.C. King) property
Alternative 2	▪ generally parallel to existing sanitary sewer easements (shown in green) on 595 9th Avenue East (Grey County) and 1010 Superior Street properties ▪ existing sanitary sewer easements are not wide enough to accommodate the watermain; existing easements would need to be widened ▪ connects to existing watermains on Superior Street and 6th Street East
Alternative 3	▪ parallel to existing sanitary sewer easements (shown in green) on 595 9th Avenue East (Grey County) and 1010 Superior Street properties ▪ existing sanitary sewer easements are not wide enough to accommodate the watermain; existing easements would need to be widened ▪ connects to existing watermains on Superior Street and 6th Street East ▪ existing building on Grey County property would need to be relocated
Alternative 4	▪ watermain installed in easements to be created on the 595 9th Avenue East (Grey County), 1010 Superior Street, 1000 Superior Street and 1150 Superior Street properties ▪ connects to existing watermains on Superior Street and 6th Street East
Alternative 5	▪ watermain installed in easements to be created on the1305 8th Street East, 1650 Superior Street (Hydro One) and 1150 Superior Street properties ▪ connects to existing watermains on Superior Street and 6th Street East

5 Background Reports & Studies

To inform the evaluation of alternative solutions, several background reports and studies were completed to consider various environments within the project area, the findings of which are summarized below.

5.1 SCOPED ENVIRONMENTAL IMPACT STUDY

Azimuth Environmental was retained to conduct a Scoped Environmental Impact Study (EIS) within the area (provided in Appendix D). The purpose of the EIS is to identify Natural Heritage Features and Functions (NHFFs) and evaluate potential impacts of the proposed alternatives. The Scoped EIS considers any negative environmental impacts from each of the proposed alternatives, and recommendations are provided to assist in determining the optimal alternative.

5.1.1 Study Approach

To develop the Scoped EIS report, Azimuth completed the following:

- collected and reviewed background information through Grey County, Ministry of Natural Resources and Forestry, and Ministry of the Environment, Conservation and Parks records;
- conducted the following field surveys:
  - 2 vascular plant inventories (spring and summer 2022); and
  - 2 dawn breeding bird surveys;
- completed a Species at Risk (SAR) habitat assessment through background information and fieldwork to identify the presence of SAR/SAR habitat in the study area;
- recorded wildlife observations and assessed potential for Significant Wildlife Habitat (SWH) function according to provincial criteria;
- evaluated the alignment alternatives with regard for the identified NHFFs; and
- assessed the potential direct and indirect impacts of the project on NHFFs in the study area.

5.1.2 Habitat for Threatened or Endangered Species

The following Threatened or Endangered species were determined to have the potential to occur in or adjacent to the study area:

- Eastern Meadowlark;
- Little Brown Myotis (potential);

- Northern Myotis (potential); and
- Tri-colored Bat (potential).

Eastern Meadowlark

Eastern Meadowlark activity was detected in the area of Alternative 5, as well as the lands adjacent to this area. It was determined that this alternative would likely disrupt the habitat of the Eastern Meadowlark. However, the works proposed in Alternatives 1 through 4 would not impact the habitat, and it was deemed the Eastern Meadowlark would likely continue to be present post-construction.

Little Brown Myotis, Northern Myotis and Tri-colored Bat

Through field investigations, approximately 20 candidate bat snag trees were found in the woodland corridor between 405 9th Avenue East and 1010 Superior Street. Alternatives 1 through 3 would encroach into potential SAR bat habitat (Alternative 1 would have the greatest impact), and the proposed works would represent removal of a small number of snag trees with potential to provide habitat for SAR bats (if present).

Based on the MECP Bat Survey Standards Note, and provided only a small number of potential bat habitat snags would be removed outside of the active bat season (April 1 to September 30 in Southern Ontario), additional bat surveys or MECP consultation would not be required. It was found that the potential for indirect impacts to SAR bat habitat would be considered mitigable, provided that the mitigation measures outlined in the Scoped EIS report Section 8 are followed.

5.1.3 Other Wetlands

It was identified that Alternatives 4 and 5 would both directly and indirectly impact three small, isolated wetlands, located in the field east of 1025 6th Street East. Alternatives 1 through 3 would not encroach into wetland, and therefore would not represent a direct impact to wetlands.

5.1.4 Candidate Significant Woodlands

One Candidate Significant Woodland feature was identified in the study area, located west and south of 1000 6th Street East. It was determined Alternative 5 would not encroach upon this feature, while Alternatives 1 through 4 would. In Azimuth's opinion however, Alternatives 3 and 4 would not compromise the overall form or ecological function of the feature since construction would be along the eastern-most edge of the Woodland. Alternatives 1 and 2 may have adverse effects as they would fragment part of the Candidate Significant Woodland and possibly increase forest "edge effects", which results in potentially increased risk of predation on bird nests and exposure to nest parasitism.

5.1.5 Candidate Significant Wildlife Habitat

Azimuth identified certain potential Significant Wildlife Habitat features, and noted anticipated impacts due to construction in their report:

Bat Maternity Colonies

Potential bat maternity roosting habitat was identified in the study area of Alternatives 1 through 4, however it was determined that the scale of tree removals would be relatively small, especially with Alternatives 3 and 4. It is expected that the potential habitat for roosting bats will not be impacted post construction.

Special Concern and Rare Wildlife Species

During the study period, Azimuth detected Eastern Wood-pewee (Special Concern species) on adjacent lands, but not within the study area. The conclusion was that this species and its habitat would not be impacted by the proposed works.

Azimuth also identified potential habitat for the Monarch Butterfly but did not observe any Monarch and deemed the habitat quality as low. More suitable habitat locations were located outside of the study area; thus, it was determined that the impact on Monarch habitat within the study area would be negligible.

5.1.6 Recommendations

Based on findings from field surveys and background information, it was determined that Alternative 3 would be the least impactful. This alternative would avoid wetlands areas and have minimal encroachment on Candidate Significant Woodlands, while avoiding the habitat of Eastern Meadowlark and minimizing impacts on habitat of other significant wildlife. Given the similar alignment of Alternative 2 to Alternative 3, Alternative 2 similarly has a low impact.

5.2 GEOTECHNICAL INVESTIGATION

GEI Consultants completed a comprehensive geotechnical investigation of the entire project area (report is provided in Appendix E). Boreholes 17, 19, 20 and 21 are within the Schedule B Class EA study area which generally revealed the following subsurface conditions (drilling completed February 13, 2023):

- native fill comprised of clay;
- a layer of glacial till with cobbles and boulders below the fill layer;
- auger refusal at 2.3 to 3.5 metre depth; and
- groundwater at drilling from 1.2 metres below ground surface to dry.

The watermain will generally be installed with a 2.0 metre depth to invert. Therefore, there may be a need for dewatering due to the groundwater levels, and localized rock excavation.

5.3 HYDROGEOLOGICAL ASSESSMENT

Following the geotechnical investigation, which revealed groundwater levels above the watermain invert, a hydrogeological assessment was completed (refer to Appendix F). This assessment will support future construction dewatering permit applications with the MECP.

5.4 WATER MODELLING

As noted previously, several scenarios were analyzed in the City's water model to determine the appropriate size of the distribution watermain on 9th Avenue East and the looping watermain (results of the modelling are provided in Appendix C). The modelling determined a 200 millimetre watermain was appropriate for both watermains.

6 Evaluation of Alternative Solutions

This section will discuss the evaluation of the alternative solutions as previously described. The evaluation of results at this stage is considered preliminary given the need to solicit agency and public input. The evaluation is descriptive or qualitative in nature allowing for a comparative evaluation of the positives and negatives associated with each alternative solution.

6.1 EVALUATION CRITERIA

In completing the evaluation, a number of criteria were considered as outlined below.

Technical (Water Operations)

- water system needs
- alignment and configuration

Natural Environment

- vegetation impacts
- wildlife/terrestrial impacts
- fisheries/aquatic impacts

Social Environment

- future impacts on adjacent property

Cultural/Heritage Environment

- archaeological impacts
- built heritage impacts

Economic Environment

- construction and operating costs

6.2 ENVIRONMENTAL IMPACTS

The potential impacts associated with each alternative are noted in the following sections.

6.2.1 Do Nothing

Criteria	Comments	Score
Technical (Water Operations)	▪ Operational needs not addressed	0
Social Environment	▪ No easements required ▪ Watermain break results in detrimental impacts to commercial and institutional properties	1
Natural Environment	▪ No adverse impacts	5
Cultural / Heritage Environment	▪ No adverse impacts	5
Economic Environment	▪ No capital cost ▪ Maintenance costs remain (flushing, fixing breaks)	2
	TOTAL:	**13**

6.2.2 Alternative 1

Criteria	Comments	Score
Technical (Water Operations)	▪ Operational needs addressed ▪ Relatively straight alignment	5
Social Environment	▪ New easements required on 2 properties ▪ Significantly reduces impacts of watermain breaks (less customers affected)	3
Natural Environment	▪ Fragments woodland in south half ▪ Encroaches on potential SAR bat habitat	1
Cultural / Heritage Environment	▪ No adverse impacts ▪ Previously disturbed area in north half	5
Economic Environment	▪ Lowest capital cost (shortest length) ▪ Reduces maintenance costs (flushing, fixing breaks)	5
	TOTAL:	**19**

6.2.3 Alternative 2

Criteria	Comments	Score
Technical (Water Operations)	▪ Operational needs addressed ▪ Relatively straight alignment	5
Social Environment	▪ New easement required on 1 property ▪ Widen existing easement on 1 property ▪ Significantly reduces impacts of watermain breaks (less customers affected)	4
Natural Environment	▪ Minimal impacts (limited tree removals)	4
Cultural / Heritage Environment	▪ No adverse impacts ▪ All areas previously disturbed	5
Economic Environment	▪ Lowest capital cost (shortest length) ▪ Reduces maintenance costs (flushing, fixing breaks)	5
	TOTAL:	**23**

6.2.4 Alternative 3

Criteria	Comments	Score
Technical (Water Operations)	▪ Operational needs addressed ▪ Straight alignment	5
Social Environment	▪ Widen existing easements on 2 properties ▪ Significantly reduces impacts of watermain breaks (less customers affected)	4
Natural Environment	▪ Minimal impacts (limited tree removals)	4
Cultural / Heritage Environment	▪ No adverse impacts ▪ All areas previously disturbed	5
Economic Environment	▪ Lowest watermain capital cost (shortest length) but must relocate building on Grey County property ▪ Reduces maintenance costs (flushing, fixing breaks)	1
	TOTAL:	**19**

6.2.5 Alternative 4

Criteria	Comments	Score
Technical (Water Operations)	▪ Operational needs addressed ▪ Several bends in alignment, longer length	4
Social Environment	▪ Widen existing easements on 2 properties ▪ New easements required on 2 properties ▪ Significantly reduces impacts of watermain breaks (less customers affected)	3
Natural Environment	▪ Limited tree removals ▪ Will encroach into wetlands	2
Cultural / Heritage Environment	▪ No adverse impacts ▪ All areas previously disturbed	5
Economic Environment	▪ Largest watermain capital cost (longest length) ▪ Reduces maintenance costs (flushing, fixing breaks)	1
	TOTAL:	**15**

6.2.6 Alternative 5

Criteria	Comments	Score
Technical (Water Operations)	▪ Operational needs addressed ▪ Several bends in alignment, longer length	4
Social Environment	▪ New easements required on 3 properties ▪ Hydro One won't allow infrastructure or easements through high voltage area ▪ Significantly reduces impacts of watermain breaks	0
Natural Environment	▪ Limited tree removals ▪ Will encroach into wetlands	2
Cultural / Heritage Environment	▪ No adverse impacts ▪ All areas previously disturbed	5
Economic Environment	▪ Largest watermain capital cost (longest length) ▪ Reduces maintenance costs (flushing, fixing breaks)	1
	TOTAL:	**12**

6.3 RECOMMENDED SOLUTION

A comparative summary of the evaluation scores is provided in Table 2. In consideration of the advantages and disadvantages of each alternative and their respective scoring, and the overall project objectives, Alternative 2 is recommended.

Table 2: Looping Watermain Alternatives - Evaluation Summary

CRITERIA	ALTERNATIVE					
	Do Nothing	1	2	3	4	5
Technical (Operations)	0	5	5	5	4	4
Social Environment	1	3	4	4	3	0
Natural Environment	5	1	4	4	2	2
Cultural/Heritage Environment	5	5	5	5	5	5
Economic Environment	2	5	5	1	1	1
TOTAL	**13**	**19**	**23**	**19**	**15**	**12**

It noted that the recommended solution is not presented as a decision but as a preliminary preference based on evaluation of information available through the background reports and studies.

6.4 PREFERRED SOLUTION

The recommended solution was presented to the public and stakeholders at a public information centre and subsequently presented to the City of Owen Sound Operations Committee (as discussed further in Section 7.4). Following consideration of the comments and input received, Alternative 2 was identified as the preferred solution.

6.5 CONFIRMATION OF CLASS EA SCHEDULE

In context of the preferred solution, the Schedule B Class EA framework is confirmed as appropriate. As noted previously, the Schedule B undertaking applies to the enlargement of a water distribution system and all works necessary to connect the system to an existing system or water source, where such facilities are not in either an existing road allowance or an existing utility corridor.

7 Stakeholder Engagement & Consultation

To satisfy the requirements of the Schedule B Class EA and to provide further opportunity for stakeholder engagement and consultation, several activities were completed which are detailed in the following sections.

7.1 NOTICE OF STUDY COMMENCEMENT

At the onset of the Class EA, the Notice of Study Commencement was posted on the project webpage on the City's website. The notice was issued on June 23, 2022 and is included in Appendix A for reference.

7.2 PROPERTY OWNER CONSULTATION

City of Owen Sound staff led efforts to consult with specific property owners in the study area. These included property owners where easements would be required to implement the watermain alignments being considered. Letters were sent by mail and email to 13 property owners which are included in Appendix G. The letters also included a copy of the Notice of Study Commencement.

7.3 CITY OPERATIONS COMMITTEE PRESENTATION 1

A project update was presented to the City of Owen Sound Operations Committee on April 20, 2023. While the presentation focused on the first phase of the project (i.e. the looping watermain from 6th Street East to 8th Street East), it also provided an update on the status of the Schedule B Class EA (at the time of the presentation, the Class EA was at the alternative solution identification stage). The presentation slides are provided in Appendix H for reference.

7.4 PUBLIC INFORMATION CENTRE & OPERATIONS COMMITTEE PRESENTATION 2

A Public Information Centre (PIC) was held on November 16, 2023 at Owen Sound City Hall. The purpose of the PIC was to provide information to the public and agencies and seek their input with respect to the following:

- identification of the problem/opportunity;
- development of alternative solutions to address the problem/opportunity;
- general inventory of the affected environments;
- potential impacts of the alternative solutions to the environments considered;

- evaluation of the alternative solutions and the identification of the recommended solution; and
- discussion of remaining tasks to be undertaken in completing the Class EA.

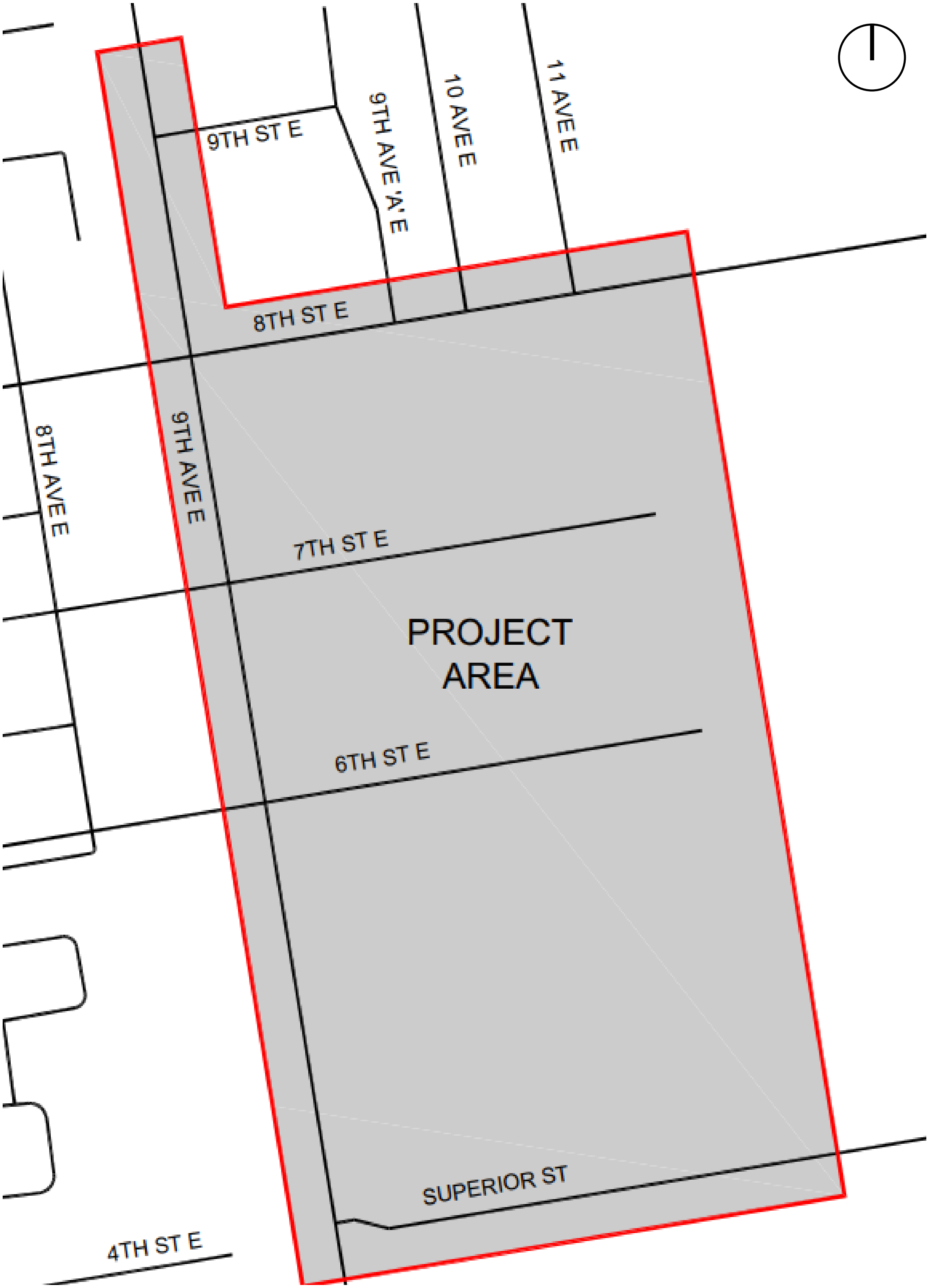
A Notice of PIC was sent to all stakeholders within the study area two weeks in advance. The notice was also posted on the project webpage on the City's website. A copy of the notice is included in Appendix A.

The PIC format was a one-hour open house with City and Tatham staff present. Comment sheets were available for feedback from stakeholders; however, no comments were received.

Following the open house, Tatham gave a further presentation to the City's Operations Committee to summarize the Class EA process and present the alternative solutions and the recommended alternative solution as presented at the PIC. The presentation slide deck is included in Appendix I.

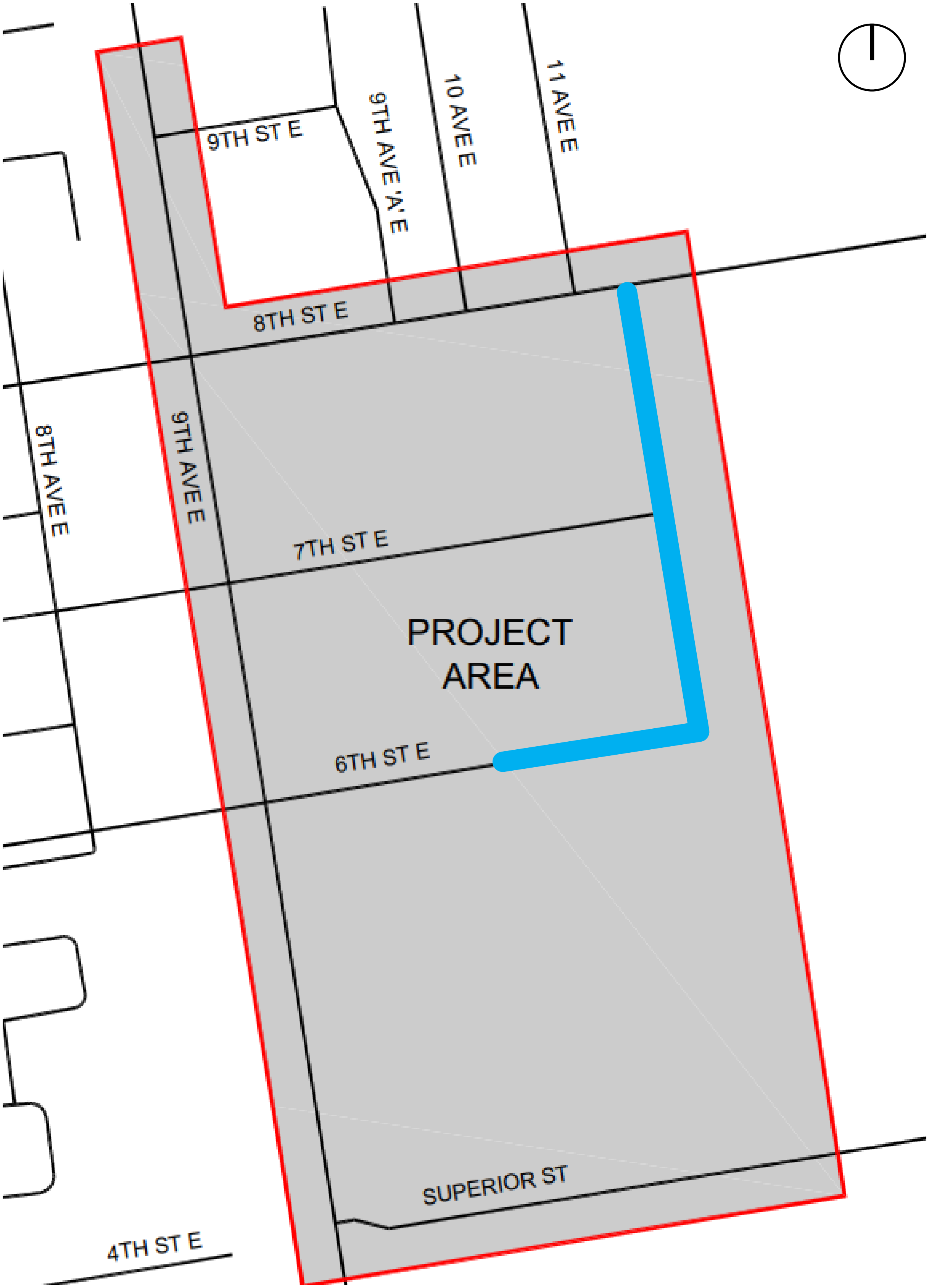
7.5 NOTICE OF STUDY COMPLETION

A Notice of Study Completion will be issued in conjunction with the completion of this report, to be emailed to all stakeholders on the project contact list (including Indigenous Communities) and the MECP Southwest Region office. The notice will also be posted on the project webpage on the City's website. A copy of the notice is included in Appendix A.



9th AVENUE EAST CLASS ENVIRONMENTAL ASSESSMENT

Figure 1: Project Area



9th AVENUE EAST CLASS ENVIRONMENTAL ASSESSMENT

Figure 2: Looping Watermain from 6th Street East to 8th Street East

9th AVENUE EAST CLASS ENVIRONMENTAL ASSESSMENT

Figure 3: Looping Watermain from Superior Street to 6th Street East

🟩 Existing sanitary sewer easement

🟦 Alternative watermain alignment

9th AVENUE EAST CLASS ENVIRONMENTAL ASSESSMENT

Figure 4: Looping Watermain from Superior Street to 6th Street East - Alternative 1

🟩 Existing sanitary sewer easement 🟦 Alternative watermain alignment

Figure 5: Looping Watermain from Superior Street to 6th Street East - Alternative 2

Figure 6: Looping Watermain from Superior Street to 6th Street East - Alternative 3

9th AVENUE EAST CLASS ENVIRONMENTAL ASSESSMENT

Figure 7: Looping Watermain from Superior Street to 6th Street East - Alternative 4

🟩 Existing sanitary sewer easement

🟦 Alternative watermain alignment

9th AVENUE EAST CLASS ENVIRONMENTAL ASSESSMENT

Figure 8: Looping Watermain from Superior Street to 6th Street East - Alternative 5

Appendix A:
Study Notices

Engineering Services Division
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9TH AVENUE EAST CLASS ENVIRONMENTAL ASSESSMENT

Notice of Study Commencement

The Study

The City of Owen Sound has initiated a Municipal Class Environmental Assessment (Class EA) to address infrastructure, road and sidewalk needs and deficiencies within the 9th Avenue East corridor. It is expected that the deficiencies will require repair, replacement and/or improvements to the following (subject to confirmation following engineering investigations and/or condition assessments):

- water distribution system from 100m south of Superior Street to 100m north of 9th Street East;
- storm sewer system between Superior Street and 9th Street East;
- sanitary sewer system between 7th Street East and 8th Street East;
- road system within the above noted limits; and
- sidewalk system within the above noted limits, including provision of new sidewalk on the west side of 9th Avenue East from 6th Street East to 8th Street East.

The Process

To appropriately consider any impacts associated with the proposed work, the City is undertaking a Schedule B Class EA which will address the following:

- the existing operations and conditions of the noted systems;
- alternative solutions to implementing the necessary repair, replacement and/or improvements;
- the location, extent and sensitivity of the existing environments within the area;
- the potential impacts of each alternative to the noted environments and possible mitigating measures;
- public and agency consultation and participation; and
- an assessment and evaluation of the alternative solutions culminating in a preferred solution.

Purpose of Notice

The purpose of this notice is to invite stakeholder input and comments early in the study such that they can be incorporated into the planning and overall study design. Comments should be directed to the City and/or Consultant as noted below. A further opportunity for stakeholder involvement will be provided at a Public Information Centre (PIC) to be held in the upcoming months, during which time additional details will be provided with respect to the system needs and deficiencies, the alternative solutions and assessment of such. Further details with respect to the PIC will be provided closer to the date.

Project Contacts

Owner
City of Owen Sound
808 2nd Avenue East
Owen Sound, ON   N4K 2H4
Chris Webb, P.Eng.
Manager of Engineering Services
cwebb@owensound.ca
(519) 376-1440

Consultant
Tatham Engineering Limited
115 Sandford Fleming Drive, Suite 200
Collingwood, ON   L9Y 5A6
Allan Brownridge, P.Eng.
Project Manager
abrownridge@tathameng.com
(705) 444-2565 x2007

This notice issued June 23, 2022

Engineering Services Division
City of Owen Sound
808 2nd Avenue East
Owen Sound ON   N4K 2H4

owen sound
where you want to live

Telephone: 519-376-1440
Facsimile: (519) 376-3579
Website: www.owensound.ca

9TH AVENUE EAST CLASS ENVIRONMENTAL ASSESSMENT

Problem / Opportunity Statement

The City of Owen Sound has initiated a Municipal Class Environmental Assessment (Class EA) to address infrastructure, road and sidewalk needs and deficiencies within the 9th Avenue East corridor. It is expected that the deficiencies will require repair, replacement and/or improvements to the following (subject to confirmation following engineering investigations and/or condition assessments):

- water distribution system from 100 metres south of Superior Street to 100 metres north of 9th Street East;
- storm sewer system between Superior Street and 9th Street East;
- sanitary sewer system between 7th Street East and 8th Street East;
- road system within the above noted limits; and
- sidewalk system within the above noted limits, including provision of new sidewalk on the west side of 9th Avenue East from 6th Street East to 8th Street East.

In consideration of the above and in context of the City's objective to provide safe and reliable infrastructure, road and sidewalk systems, the following Problem Statement has been defined to set the framework for the completion of the Class EA study.

> *That existing infrastructure, road and sidewalk needs and deficiencies within the subject length of 9th Avenue East (100 metres south of Superior Street to 100 metres north of 9th Street East) be addressed in an environmentally sound manner, in consideration of City standards and policies, infrastructure requirements and active transportation opportunities, with the objective of providing safe and reliable service to the people of Owen Sound.*

This notice issued June 23, 2022

Engineering Services Division
City of Owen Sound
808 2nd Avenue East
Owen Sound ON   N4K 2H4

Telephone: 519-376-1440
Facsimile: (519) 376-3579
Website: www.owensound.ca

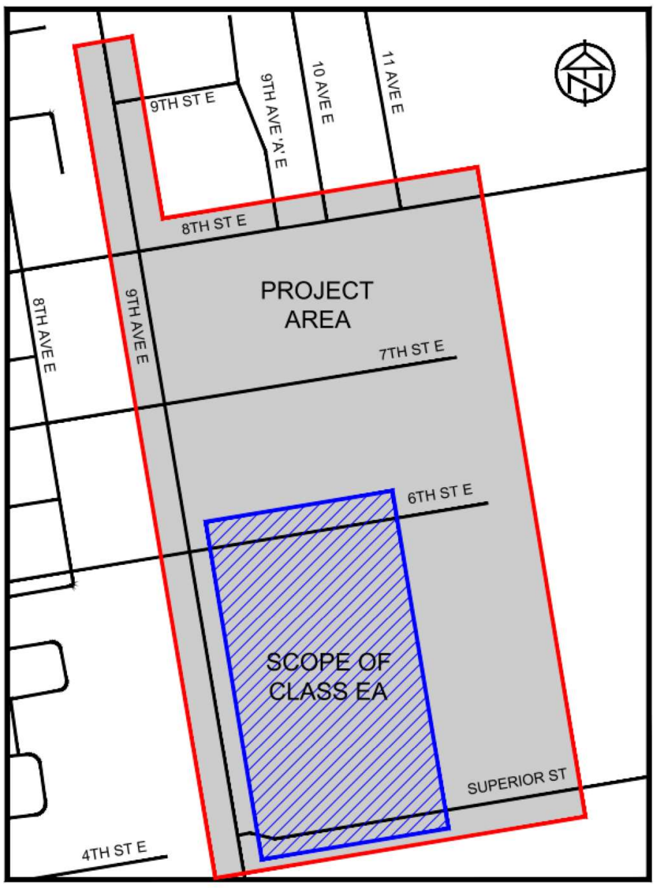
9TH AVENUE EAST CLASS ENVIRONMENTAL ASSESSMENT – WATER DISTRIBUTION ALTERNATIVES FOR THE SUPERIOR STREET TO 6TH STREET EAST AREA

Notice of Public Information Centre

The City of Owen Sound has initiated a Municipal Class Environmental Assessment (Class EA) to address infrastructure, road and sidewalk needs and deficiencies within the 9th Avenue East corridor. Specifically, the City is considering options to improve the reliability of the water distribution system in this area where there are current water supply risks in the event of a watermain break.

Alternatives related to the existing watermain in 9th Avenue East from Superior Street to 6th Street East are being planned through the Schedule B process in the Municipal Class Environmental Assessment (2023). Consultation with the public, technical agencies and other stakeholders will inform the study recommendations.

A Public Information Centre (PIC) is being held to present alternative solutions being considered to improve the reliability of the water distribution system in the project area. The PIC will consist of an informal open house from 4:30 pm to 5:30 pm with materials pertaining to the study on display and members of the project team present to answer questions related to the project. A presentation will follow from the consultant at 5:30 pm at the City's Operations Committee meeting to provide an update on the status of the project and present the alternative solutions.



Date:	November 16, 2023
Time:	4:30 pm – 6:30 pm
Location:	Owen Sound City Hall,
Council Chambers
(808 2nd Avenue East,
Owen Sound, Ontario)

If you have any questions related to the PIC, please contact one of the following members of the Project Team. There will be an opportunity to provide comments at the PIC.

More information is also available on the City's project webpage:
https://www.owensound.ca/en/city-hall/9th-avenue-east.aspx

Project Team

Owner
City of Owen Sound
808 2nd Avenue East
Owen Sound, ON   N4K 2H4
Chris Webb, P.Eng.
Manager of Engineering Services
cwebb@owensound.ca
(519) 376-1440 x3300

Consultant
Tatham Engineering Limited
115 Sandford Fleming Drive, Suite 200
Collingwood, ON   L9Y 5A6
Mark Figueroa, P.Eng.
Project Manager
mfigueroa@tathameng.com
(705) 444-2565 x2142

This notice issued November 2, 2023

Engineering Services Division
City of Owen Sound
808 2nd Avenue East
Owen Sound ON   N4K 2H4

Telephone: 519-376-1440
Facsimile: (519) 376-3579
Website: www.owensound.ca

9TH AVENUE EAST CLASS ENVIRONMENTAL ASSESSMENT – WATER DISTRIBUTION ALTERNATIVES FOR THE SUPERIOR STREET TO 6TH STREET EAST AREA

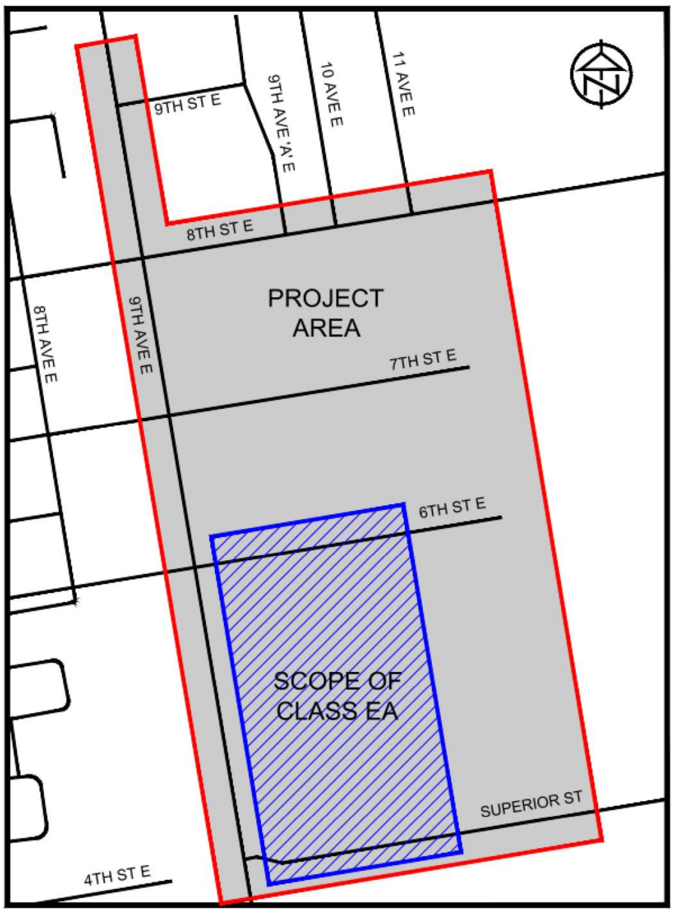
Notice of Study Completion

The City of Owen Sound has undertaken a Municipal Class Environmental Assessment (Class EA) to address infrastructure, road and sidewalk needs and deficiencies within the 9th Avenue East corridor. Specifically, the City has considered options to improve the reliability of the water distribution system in this area where there are current water supply risks in the event of a watermain break. The recommended solution is to install a watermain from Superior Street to 6th Street East in easements on two private properties to complete a watermain loop parallel to 9th Avenue East from Superior Street to 8th Street East (watermain loop from 6th Street East to 8th Street East is already in place).

The watermain system improvements are being planned through the Schedule B process in the Municipal Class Environmental Assessment (2023). Consultation with the public, technical agencies, property owners and other stakeholders have informed the study recommendations.

A Project File Report documenting the planning process undertaken, details of the study recommendations and potential impacts and mitigation measures, has been completed and is being made available for public review. Subject to comments received following this Notice and the receipt of approvals, the City intends to proceed with construction of the recommended project, as outlined in the Project File Report.

The Project File Report is available for review on the City's website (https://www.owensound.ca/en/city-hall/9th-avenue-east.aspx) and at Owen Sound City Hall (808 2nd Avenue East). Further information may be obtained from one of the following members of the project team:



Owner
City of Owen Sound
808 2nd Avenue East
Owen Sound, ON   N4K 2H4
Chris Webb, P.Eng.
Manager of Engineering Services
cwebb@owensound.ca
(519) 376-1440 x3300

Consultant
Tatham Engineering Limited
115 Sandford Fleming Drive, Suite 200
Collingwood, ON   L9Y 5A6
Mark Figueroa, P.Eng.
Project Manager
mfigueroa@tathameng.com
(705) 444-2565 x2142

Interested persons may provide written comments to our project team by February 8, 2024. All comments and concerns should be sent directly to the City of Owen Sound by mail or email to the contact above.

Additionally, a request to the Minister of the Environment, Conservation and Parks for an order imposing additional conditions or requiring an individual environmental assessment may be made on the grounds that the requested order may prevent, mitigate or remedy adverse impacts on constitutionally protected Aboriginal and treaty rights. Requests should include your full name and contact information.

Requests should specify what kind of order is being requested (additional conditions or an individual environmental assessment), explain how an order may prevent, mitigate or remedy potential adverse impacts, and can include any supporting information.

The request should be sent to:

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

and

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

Requests should also be sent to the City of Owen Sound by mail or email. Please visit the ministry's website for more information on requests for orders under Section 16 of the Environmental Assessment Act at: https://www.ontario.ca/page/classenvironmental-assessments-part-ii-order

All personal information included in your request such as name, address, telephone number and property location, is collected under the authority of Section 30 of the Environmental Assessment Act and is collected and maintained for the purpose of creating a record that is available to the general public. As this information is collected for the purpose of a public record, the protection of personal information provided in the Freedom of Information and Protection of Privacy Act (FIPPA) does not apply (s.37). Personal information you submit will become part of a public record that is available to the general public unless you request that your personal information remain confidential.

Personal information is collected under the authority of the Environmental Assessment Act, s.30. The information collected will be used to complete the environmental assessment process, and will form part of the public record. Questions about this collection should be addressed to Briana Bloomfield, City Clerk at bbloomfield@owensound.ca or 519-376-4440 ext. 1247.

This notice issued January 9, 2024

Appendix B:
Class EA Guidelines

[illegible]
[illegible]

[illegible]

[illegible]

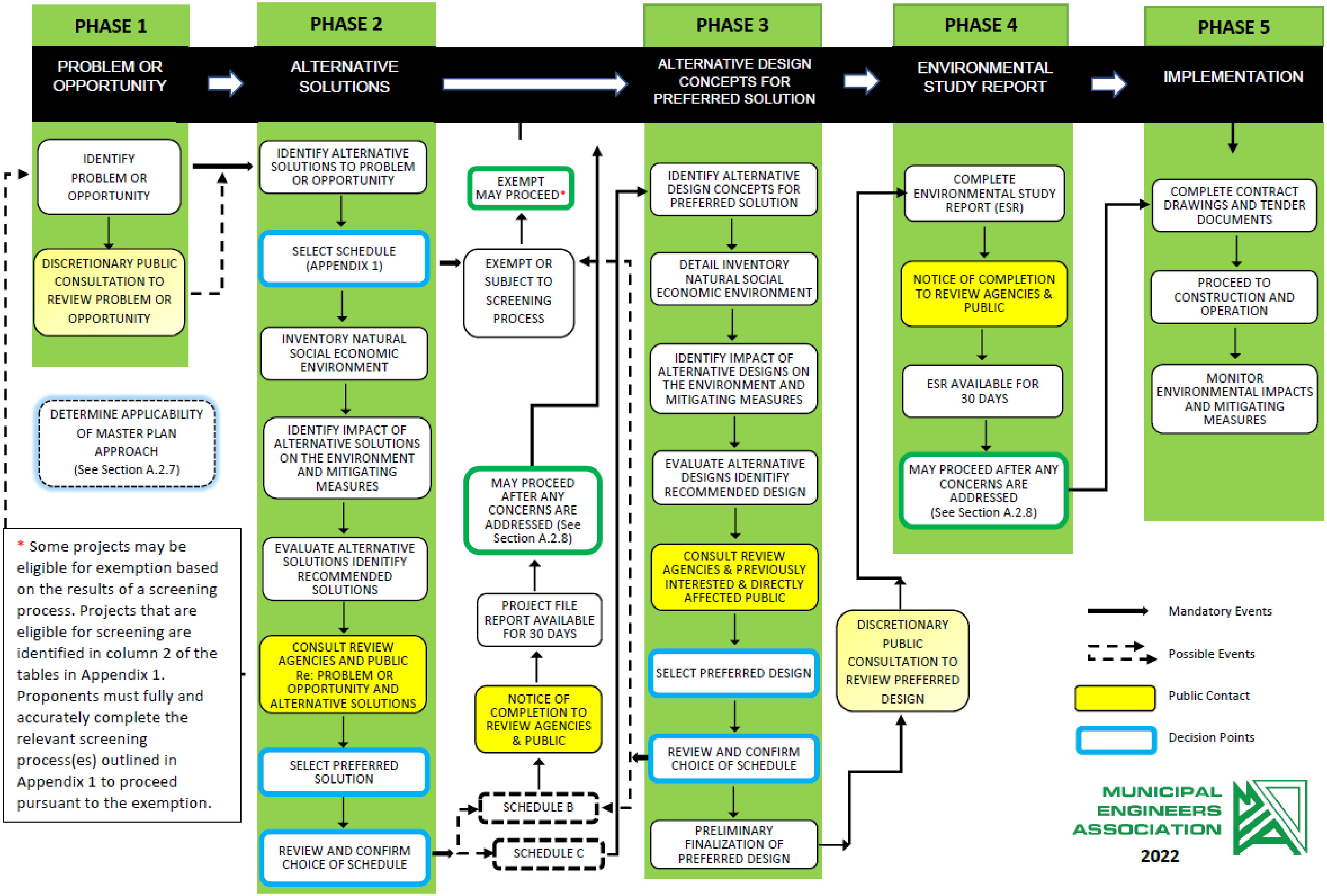
	PHASE 1	**PHASE 2**	**PHASE 3**	**PHASE 4**	**PHASE 5**
BASIC PROCESS (See Exhibit A.2 for detailed flow chart)	*PROBLEM OR OPPORTUNITY*	*ALTERNATIVE SOLUTIONS*	*ALTERNATIVE DESIGN CONCEPTS FOR PREFERRED SOLUTION*	*ENVIRONMENTAL STUDY REPORT*	*IMPLEMENTATION*
Consultation Requirements	*Optional*	*Mandatory*	*Mandatory*	*Mandatory*	*Optional*
EXEMPT	✓				✓
SCHEDULE B PROJECTS	✓	✓			✓
SCHEDULE C PROJECTS	✓	✓	✓	✓	✓
MASTER PLANS	✓	✓	✓	✓	✓

Notes:

- At a minimum, master plans the same steps of the first two phases of the MCEA process.

EXHIBIT A.2. MUNICIPAL CLASS EA PLANNING AND DESIGN PROCESS

NOTE: This flow chart is to be read in conjunction with Part A of the MCEA



* Some projects may be eligible for exemption based on the results of a screening process. Projects that are eligible for screening are identified in column 2 of the tables in Appendix 1. Proponents must fully and accurately complete the relevant screening process(es) outlined in Appendix 1 to proceed pursuant to the exemption.

MUNICIPAL ENGINEERS ASSOCIATION
2022

Appendix C:
Water Modelling Results Summary

TATHAM
ENGINEERING

115 Sandford Fleming Drive, Suite 200
Collingwood, Ontario L9Y 5A6

T 705-444-2565
E info@tathameng.com
tathameng.com

File 121387

Aug 26, 2022

Chris Webb
City of Owen Sound
808 2nd Avenue East
Owen Sound, Ontario N4K 2H4
cwebb@owensound.ca

Re: 9th Avenue East Watermain Replacement and Road Rehabilitation
Water Model Analysis

Dear Chris:

Tatham Engineering Limited (Tatham) has completed a hydraulic analysis using the City of Owen Sound's WaterCAD water distribution system model in support of the preliminary design for the 9th Avenue East watermain replacement and road rehabilitation project. The purpose of the analysis was to evaluate the hydraulic performance of the replacement watermain on 9th Avenue East and the 150 mm and 200 mm diameter pipe options for the new looping watermain from 8th Street East to Superior Street. The hydraulic analysis included consideration of future water demands for the proposed residential development at 1409 8th Street East.

DESIGN CRITERIA

The water distribution analysis was completed using the design criteria listed below, based on the Owen Sound Engineering Standards (City of Owen Sound, 2013) and the Design Guidelines for Drinking Water Systems (MECP, 2008).

Residential Population Density	2.3 persons per unit (ppu)
Average Day Demand – residential	400 L/person/day
Maximum Day Factor (MDF)	1.9

New or replacement PVC pipes created in the model were assigned a Hazen-Williams friction factor (C-factor) of 120.

WATER DEMANDS

Water demands were calculated for the proposed 721 residential units at the 1409 8th Street East future development site. The total Average Day Demand (ADD) and Maximum Day Demand (MDD) were calculated to be 7.68 L/s and 14.6 L/s, respectively.

The water demand calculations are appended in Attachment 1.

MODEL SETUP

The following changes were made to the City's WaterCAD water distribution model (last updated March 2022) to simulate the replacement of the 9th Avenue East watermain, the construction of the looping watermain, and the future development at 1409 8th Street East.

1409 8th Street East Future Development

New junction J-888 was created in the model on the 300 mm diameter PVC watermain on 8th Street East. The calculated ADD and MDD for the proposed residential development were assigned to junction J-888.

9th Avenue East Reconstruction

The existing 150 mm and 200 mm diameter cast iron watermain on 9th Avenue East from 8th Street to Superior Street was changed to 200 mm diameter PVC watermain.

The 150 mm diameter watermain connecting Superior Street to 9th Avenue East and located on private property, was deactivated in the model. A new 200 mm diameter watermain was added on 9th Avenue East to directly connect the watermain sections north and south of Superior Street.

Looping Watermain

New PVC watermain from 8th Street East to Superior Street was added based on Watermain Alignment Option #5 shown on Attachment 2.

The existing 150 mm diameter cast iron watermain on Superior Street from 9th Avenue East to the looping watermain connection was changed to a PVC pipe.

Physical scenarios were created in the model to simulate 150 mm and 200 mm diameter PVC pipe options for the looping watermain and the replacement of watermain on Superior Street. The lengths for the new PVC watermain were calculated using the scaled-length function in WaterCAD.

Connections from the looping watermain to the existing watermain on 6th Street East and 7th Street East were added to the model, eliminating the dead ends.

Initial Model Settings

The model results were simulated using the initial settings as found in the model. The initial model settings were the same for all demand scenarios and are summarized in Table 1. Pump 2 at the East Hill Booster Pump Station (BPS) was on, all pressure reducing valves (PRVs) across the boundary of the East Hill pressure zone were active, and the initial hydraulic grade line at the Norm Robertson Reservoir was 248.2 m.

Table 1: Initial Model Settings

ELEMENT	INITIAL STATUS	INITIAL WATER ELEVATION (m)	INITITAL PRESSURE SETTING (kPa)
East Hill BPS	Active. One pump ON (EH. P-2)	-	-
Norm Robertson Reservoir	Active	248.2	-
PRV-5 #108	Active	-	310.3
PRV-4 #112	Active	-	303.4
PRV-3 #111	Active	-	310.4
PRV-2 #110	Active	-	262

MODEL RESULTS

The model was used to analyze flows, pressures, and pipe velocities for the proposed new and replacement watermains under the following steady state scenarios: ADD, MDD, MDD + Fire Flow (FF), and simulated fire at 9th Avenue East and Superior Street (J-811).

Each scenario was analyzed for both 150 mm and 200 mm diameter PVC pipe options for the looping watermain and Superior Street.

A summary of the model set up and results for pipes and junctions located throughout the East Hill pressure zone (8th Street East, 9th Avenue East, Superior Street, and looping watermain), along with figures showing the model results for each scenario, are appended in Attachment 3.

Model Results for 200 mm Diameter PVC Watermain

Table 2 summarizes the range of pressures, flows, and pipe velocities under each scenario, for the 200 mm diameter watermain option.

The model results indicate the following:

- Pressure ranging between 336 kPa (49 psi), at node J-811 on 9th Avenue south of Superior Street, and 635 kPa (92 psi), at node J-22 on 9th Avenue at 6th Street East, under ADD and MDD scenarios. The pressures are within the City of Owen Sound's Engineering Standards allowable range for normal operating conditions of 275 kPa (40 psi) to 700 kPa (102 psi).
- Available fire flows ranging from 54 L/s, south of the intersection of 9th Avenue and Superior Street, to 233 L/s on 8th Street East with a minimum pressure of 20 psi.

- A maximum pipe velocity of 1.63 m/s in pipe P-1393 on 9th Avenue south of Superior Street. This is below the maximum velocity of 3.0 m/s recommended by the Design Guidelines for Drinking Water Systems (MECP, 2008).

Table 2: 200 mm Diameter PVC Pipe Scenario

SCENARIO	PRESSURE (kPa)		AFF (L/s)		PIPE VELOCITY (m/s)	
	MIN	MAX	MIN	MAX	MIN	MAX
ADD	337	635	-	-	-	-
MDD	336	634	-	-	-	-
MDD + FF	138	405	54	233	-	-
MDD + Fire at J-811	-	-	-	-	0.03	1.63

Model Results for 150 mm Diameter PVC Watermain

Table 3 summarizes the range of pressures, flows, and pipe velocities under each scenario, for the 150 mm diameter watermain option.

Table 3: 150 mm Diameter PVC Pipe Scenario

SCENARIO	PRESSURE (kPa)		AFF (L/s)		PIPE VELOCITY (m/s)	
	MIN	MAX	MIN	MAX	MIN	MAX
ADD	337	635	-	-	-	-
MDD	336	633	-	-	-	-
MDD + FF	138	424	43	244	-	-
MDD + Fire at J-811	-	-	-	-	0.03	1.63

The model results indicate the following:

- Pressure ranging between 336 kPa (49 psi) on 9th Avenue south of Superior Street, and 635 kPa (92 psi) at 9th Avenue and 6th Street under ADD and MDD scenarios, which are within the City of Owen Sound's Engineering Standards.

- Available fire flows ranging from 43 L/s, south of 9th Avenue and Superior Street, to 244 L/s on 8th Street East with a minimum pressure of 20 psi.
- A maximum pipe velocity of 1.63 m/s in pipe P-1393 on 9th Avenue south of Superior Street, which is below the maximum velocity of 3.0 m/s recommended by the MECP.

ANALYSIS

Analysis of the 150 mm and 200 mm diameter watermain options modelled is as follows:

- There is no significant difference in operating pressures between the two options.
- For the 200 mm option, available fire flow is improved by 11 L/s to 43 L/s along 9th Avenue, Superior Street, and the looping watermain.
- In the case of a fire in the vicinity of the intersection of 9th Avenue and Superior Street, the pipe velocities experienced in the 9th Avenue and looping watermains are slightly higher for the 150 mm option than for the 200 mm option. Pipe velocities are within MECP recommendations for both diameters.
- The 200 mm option provides full redundancy for the 9th Avenue watermain between 8th Street East and Superior Street.

RECOMMENDATIONS

The WaterCAD model results predict that either of the proposed watermain sizes will provide an adequate supply of water for domestic use and fire protection. However, the 200 mm option would provide a moderate improvement in fire flow and full redundancy for the 9th Avenue watermain. Therefore, construction of the 200 mm diameter watermain option is recommended.

We trust this report is sufficient to support the evaluation of watermain sizes with regard to hydraulic performance. Should you have any questions or require any further analysis, please do not hesitate to contact us.

Yours truly,
Tatham Engineering Limited

LICENSED PROFESSIONAL ENGINEER
Aug.26/22
J.R. COVEY
100051289
Jason Covey
PROVINCE OF ONTARIO

Emily Park, B. Eng.
Engineering Intern

Jason R. Covey, B.Sc.(Eng.), P.Eng.
Senior Engineer

EP/JRC:pt
Encl. – WaterCAD Demand Calculations, Watermain Layout Figure, WaterCAD Results and Figures

copy: Spencer Hammill, EIT City of Owen Sound shammill@owensound.ca

I:\2021 Projects\121387 - 9th Avenue East Reconstruction, Owen Sound\Documents\Reports\Water Model Analysis\L - Webb - 9th Avenue Water Model Analysis.docx

TATHAM ENGINEERING

PROJECT	9th Ave E Watermain Replacement and Road Rehabilitation	FILE	121387
		DATE	June 30, 2022
SUBJECT	Water Demand Calculation	NAME	EP
		PAGE	1 OF 1

Number of Units

Residential

Single Detached	117	units	
Townhouse	444	units	
Apartment	160	units	
Total	**721**	**units**	*(Bousfields Inc., April 2021)*

Population Density	2.3	persons/unit	*(Owen Sound Engineering Standards, 2013)*
Residential Population	1,659	persons	

Design Criteria

Average Day Demand	400	L/person/day	*(Owen Sound Engineering Standards, 2013)*
Maximum Day Factor	1.9		*(MECP Design Guidelines, for systems serving a population between 10,000 and 25,000 persons)*

Design Flows

Average Day Flow	7.68	L/s
Maximum Day Flow	14.59	L/s

TATHAM ENGINEERING

PROJECT	9th Ave E Watermain Replacement and Road Rehabilitation	FILE	121387
		DATE	June 29, 2022
SUBJECT	WaterCAD Demands	NAME	EP
		PAGE	1 OF 1

Design Criteria

Average Day Demand	400	L/person/day	*(Owen Sound Engineering Standards, 2013)*
Maximum Day Factor	1.9		*(MECP Design Guidelines, for systems serving a population between 10,000 and 25,000 persons)*

WaterCad Flows

Development	Description	Node ID	No. of Units	ppu	Pop.	Water Demands ADD (L/s)	ADD (m^3/day)	MDD (L/s)	MDD (m^3/day)
1409 8th Street East	Residential	J-888	721	2.3	1658	7.68	663.32	14.59	1260.31


N
10th St E
9th St A E
9th St E
8th St E
7th St A E
7th St E
6th St A E
6th St E
5th St E
4th St E
3rd St A E
Superior St
8th Ave E
8th Ave A E
8th Ave B E
9th Ave E
9th Ave A E
10th Ave E
11th Ave E
Lila Rd
Lamson Cres
Laurie Cres
Watermain alignment Option #1
Watermain alignment Option #2
Watermain alignment Option #3
Watermain alignment Option #4
Watermain alignment Option #5
Valve
Normally Closed
Open
Curbstop
Hydrant
Flush Hydrant Block
Valve Chamber
Meter Pit
Hydrant Lead
Watermain
Redundant Watermain
Watermain Replacement

Watermain Diameter Scenarios

Scenario A: All watermains in reconstruction of 9th Ave E and looping watermain from 8th St to Superior St to be constructed of 200 mm diameter PVC pipes.

Scenario B: All watermains in reconstruction of 9th Ave E to be constructed of 200 mm diameter PVC pipes and looping watermain from 8th St to Superior St to be constructed of 150 mm diameter PVC pipes.

Scenario A

Average Day Demand

Node ID	Elev. (m)	Demand (L/s)	HGL (m)	Pressure	
				psi	kPa
J-25	258.2	0.6	299.4	59	404
J-22	234.6	0.8	299.4	92	635
J-19	234.8	0.3	299.5	92	633
J-17	243	0.0	299.5	80	553
J-6	238.3	0.2	299.6	87	600
J-5	242.2	0.4	299.6	81	562
J-3	245.7	0.2	299.6	76	527
J-600	244.5	1.1	299.5	78	539
J-827	260.46	0.0	299.4	55	382
J-828	246	0.0	299.4	76	523
J-829	239.49	0.0	299.6	85	588
J-879	248.39	0.0	299.6	73	501
J-881	245.28	0.0	299.5	77	531
J-884	242	0.0	299.5	82	562
J-886	242	0.0	299.5	82	562
J-887	258.2	0.0	299.4	59	404
J-888	251.6	7.7	299.5	68	469
J-811	265	0.0	299.4	49	337
	Total	**11.2**			

Maximum Day Demand

Node ID	Elev. (m)	Demand (L/s)	HGL (m)	Pressure	
				psi	kPa
J-25	258.2	0.6	299.4	58	403
J-22	234.6	0.9	299.4	92	634
J-19	234.8	0.3	299.5	92	633
J-17	243	0.0	299.4	80	552
J-6	238.3	0.2	299.6	87	600
J-5	242.2	0.4	299.6	81	561
J-3	245.7	0.2	299.5	76	527
J-600	244.5	1.1	299.4	78	538
J-827	260.46	0.0	299.4	55	381
J-828	246	0.0	299.4	76	522
J-829	239.49	0.0	299.5	85	587
J-879	248.39	0.0	299.5	73	500
J-881	245.28	0.0	299.4	77	530
J-884	242	0.0	299.4	81	562
J-886	242	0.0	299.4	81	562
J-887	258.2	0.0	299.4	58	403
J-888	251.6	14.6	299.4	68	468
J-811	265	0.0	299.4	49	336
	Total	**18.2**			

TATHAM
ENGINEERING

PROJECT	9th Ave E Watermain Replacement and Road Rehabilitation	FILE	121387
		DATE	June 30, 2022
SUBJECT	WaterCAD Results - Pressure	NAME	EP
		PAGE	2 OF 4

Available Fire Flow

Node ID	Elev. (m)	AFF (L/s)	HGL (m)	Pressure	
				psi	kPa
J-25	258.2	103	299.03	27	189
J-22	234.6	143	299.03	59	405
J-19	234.8	173	299.24	57	393
J-17	243	190	299.28	20	138
J-6	238.3	206	299.46	31	212
J-5	242.2	203	299.48	51	351
J-3	245.7	206	299.45	46	318
J-600	244.5	233	299.29	33	225
J-827	260.46	105	299.05	21	146
J-828	246	114	299.03	43	298
J-829	239.49	109	299.38	20	138
J-879	248.39	201	299.34	41	282
J-881	245.28	178	299.22	39	266
J-884	242	139	299.11	41	280
J-886	242	120	299.08	41	283
J-887	258.2	110	299.06	21	146
J-888	251.6	217	299.29	32	218
J-811	265	54	299.02	34	232

PROJECT 9th Ave E Watermain Replacement and Road Rehabilitation
FILE 121387
DATE June 30, 2022
SUBJECT WaterCAD Results - Pressure
NAME EP
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Scenario B

Average Day Demand

Node ID	Elev. (m)	Demand (L/s)	HGL (m)	Pressure	
				psi	kPa
J-25	258.2	0.6	299.4	59	404
J-22	234.6	0.8	299.4	92	635
J-19	234.8	0.3	299.5	92	633
J-17	243	0.0	299.5	80	553
J-6	238.3	0.2	299.6	87	600
J-5	242.2	0.4	299.6	81	562
J-3	245.7	0.2	299.6	76	527
J-600	244.5	1.1	299.5	78	539
J-827	260.46	0.0	299.4	55	382
J-828	246	0.0	299.4	76	523
J-829	239.49	0.0	299.6	85	588
J-879	248.39	0.0	299.6	73	501
J-881	245.28	0.0	299.5	77	531
J-884	242	0.0	299.4	82	562
J-886	242	0.0	299.4	82	562
J-887	258.2	0.0	299.4	59	404
J-888	251.6	7.7	299.5	68	469
J-811	265	0.0	299.4	49	337
	Total	**11.2**			

Maximum Day Demand

Node ID	Elev. (m)	Demand (L/s)	HGL (m)	Pressure	
				psi	kPa
J-25	258.2	0.6	299.3	58	402
J-22	234.6	0.9	299.3	92	633
J-19	234.8	0.3	299.4	92	633
J-17	243	0.0	299.5	80	553
J-6	238.3	0.2	299.6	87	600
J-5	242.2	0.4	299.6	81	561
J-3	245.7	0.2	299.6	76	527
J-600	244.5	1.1	299.5	78	538
J-827	260.46	0.0	299.3	55	380
J-828	246	0.0	299.3	76	522
J-829	239.49	0.0	299.5	85	587
J-879	248.39	0.0	299.5	73	500
J-881	245.28	0.0	299.4	77	530
J-884	242	0.0	299.3	81	561
J-886	242	0.0	299.3	81	561
J-887	258.2	0.0	299.3	58	402
J-888	251.6	14.6	299.5	68	468
J-811	265	0.0	299.3	49	336
	Total	**18.2**			

TATHAM
ENGINEERING

PROJECT	9th Ave E Watermain Replacement and Road Rehabilitation	FILE	121387
		DATE	June 30, 2022
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Available Fire Flow

Node ID	Elev. (m)	AFF (L/s)	HGL (m)	Pressure	
				psi	kPa
J-25	258.2	79	298.82	28	190
J-22	234.6	109	298.84	61	424
J-19	234.8	151	299.13	61	420
J-17	243	190	299.31	20	138
J-6	238.3	205	299.46	31	217
J-5	242.2	201	299.47	51	355
J-3	245.7	206	299.45	46	316
J-600	244.5	244	299.31	30	209
J-827	260.46	67	298.83	20	138
J-828	246	87	298.82	45	309
J-829	239.49	109	299.4	20	138
J-879	248.39	203	299.37	39	270
J-881	245.28	150	299.1	22	152
J-884	242	99	298.89	25	174
J-886	242	77	298.86	33	226
J-887	258.2	67	298.85	20	138
J-888	251.6	230	299.32	30	206
J-811	265	43	298.81	34	232

TATHAM ENGINEERING

PROJECT 9th Ave E Watermain Replacement and Road Rehabilitation
FILE 121387
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Watermain Diameter Scenarios

Scenario A:	All watermains in reconstruction of 9th Ave E and looping watermain from 8th St to Superior St to be constructed of 200 mm diameter PVC pipes.
Scenario B:	All watermains in reconstruction of 9th Ave E to be constructed of 200 mm diameter PVC pipes and looping watermain from 8th St to Superior St to be constructed of 150 mm diameter PVC pipes.

Scenario A

MDD + Fire at J-811 (50 L/s)

Pipe	Diameter (mm)	Length (m)	Roughness	Velocity (m/s)	Friction Loss (m/m)
Redudant Watermain + Superior Street (200 mm dia.)					
P-1385(1)	200	198	120	0.93	0.006
P-1385(2)	200	214	120	0.87	0.005
P-1390	200	188	120	0.64	0.003
P-1391	200	118	120	0.64	0.003
P-1392	200	234	120	0.64	0.003
P-1305	200	170	120	0.64	0.003
9th Avenue East Reconstruction					
P-25	200	198	120	1.06	0.007
P-28	200	212	120	1.07	0.007
P-1306	200	247	120	1.03	0.007
P-1393	200	155	120	1.63	0.016
7th Street E					
P-1209	150	281	72	0.08	0
6th Street E					
P-30	200	380	60	0.2	0.001
8th Street E					
P-3	300	101	140	0.65	0.001
P-820(2)(1)(1)	300	160	140	0.23	0
P-822	300	233	140	0.03	0

TATHAM ENGINEERING

PROJECT	9th Ave E Watermain Replacement and Road Rehabilitation	FILE	121387
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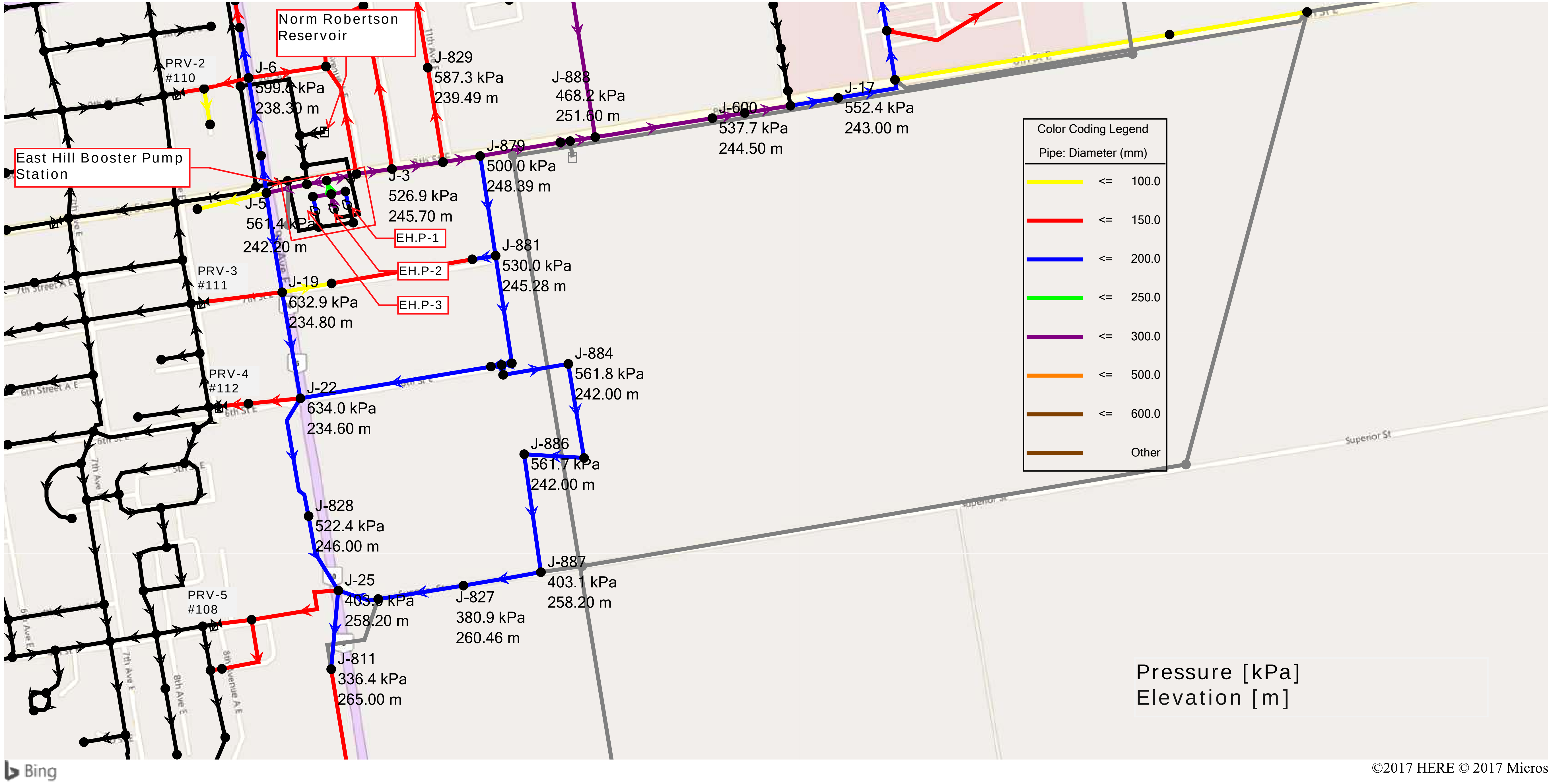
Scenario B

MDD + Fire at J-811 (50 L/s)

Pipe	Diameter (mm)	Length (m)	Roughness	Velocity (m/s)	Friction Loss (m/m)
Redudant Watermain + Superior Street (150 mm dia.)					
P-1385(1)	150	198	120	1.12	0.011
P-1385(2)	150	214	120	1.01	0.009
P-1390	150	188	120	0.65	0.004
P-1391	150	118	120	0.65	0.004
P-1392	150	234	120	0.65	0.004
P-1305	150	170	120	0.65	0.004
9th Avenue East Reconstruction					
P-25	200	198	120	1.36	0.011
P-28	200	212	120	1.38	0.011
P-1306	200	247	120	1.3	0.01
P-1393	200	155	120	1.63	0.016
7th Street E					
P-1209	150	281	72	0.08	0
6th Street E					
P-30	200	380	60	0.17	0.001
8th Street E					
P-3	300	101	140	0.54	0.001
P-820(2)(1)(1)	300	160	140	0.25	0
P-822	300	233	140	0.03	0

Scenario: 2022 MDD 9th Ave E Recon. 200 mm



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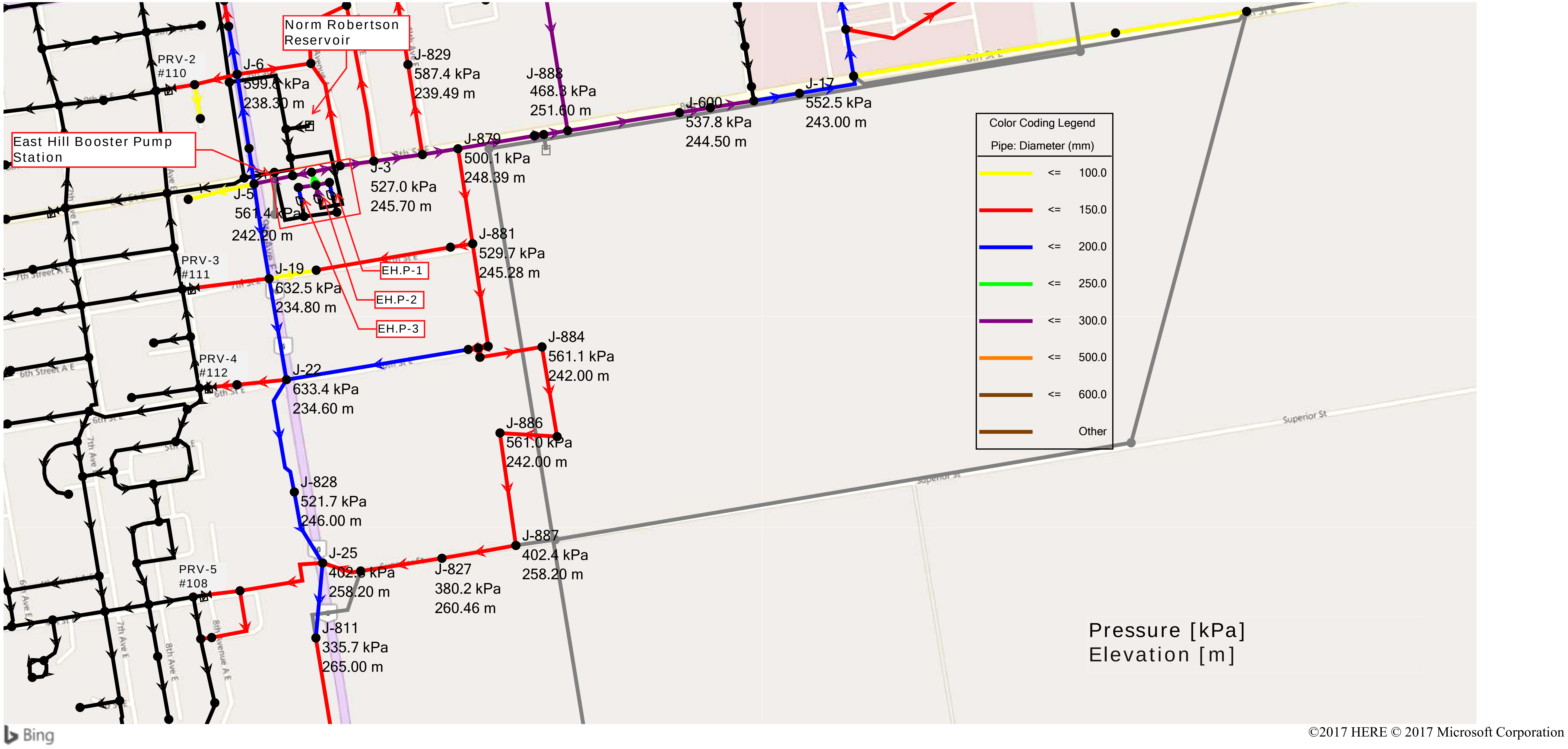
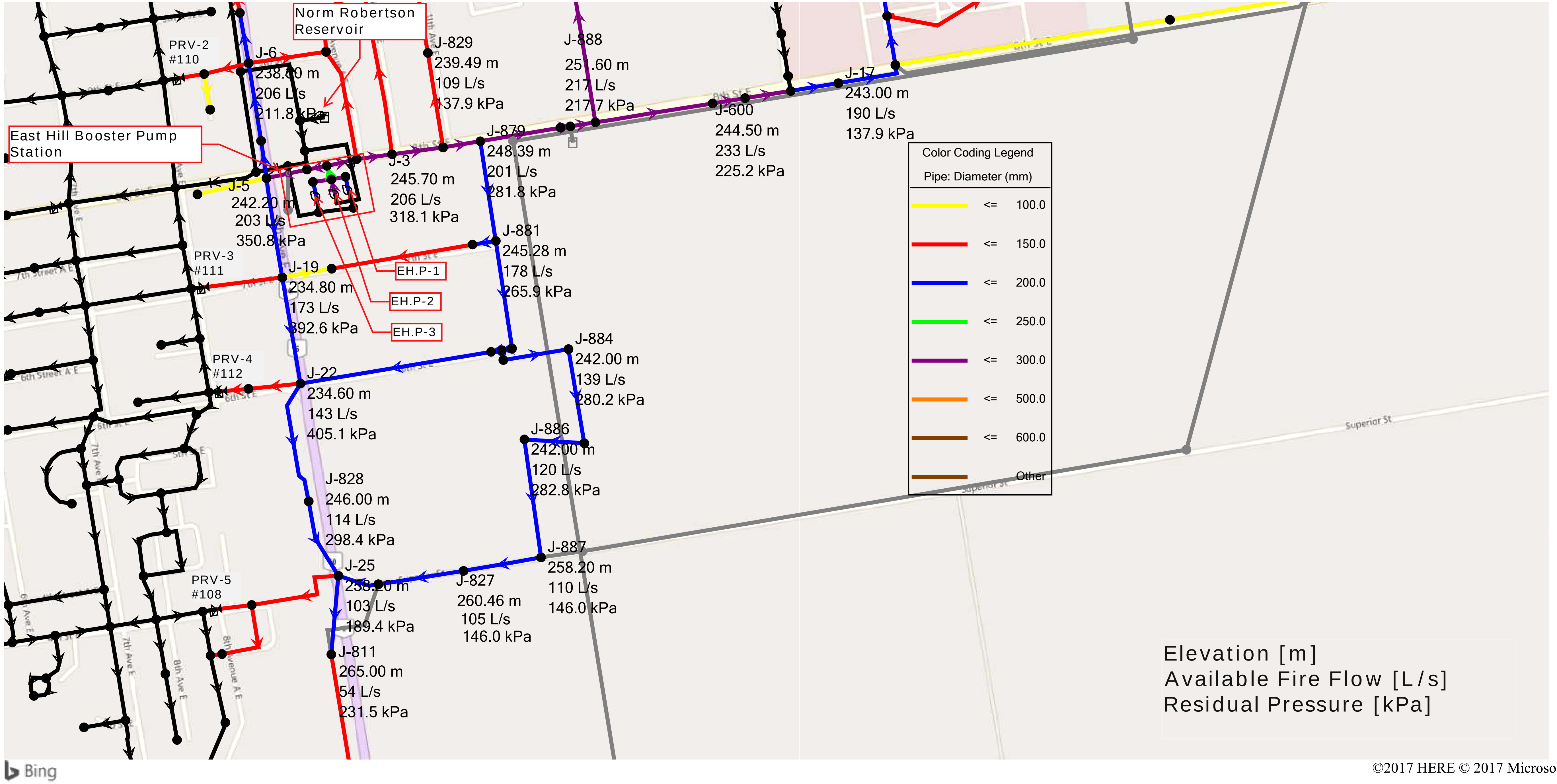
Scenario: 2022 MDD 9th Ave E Recon. 150 mm



Scenario: 2022 MDD 9th Ave E Recon. 200 mm + Fire Flow



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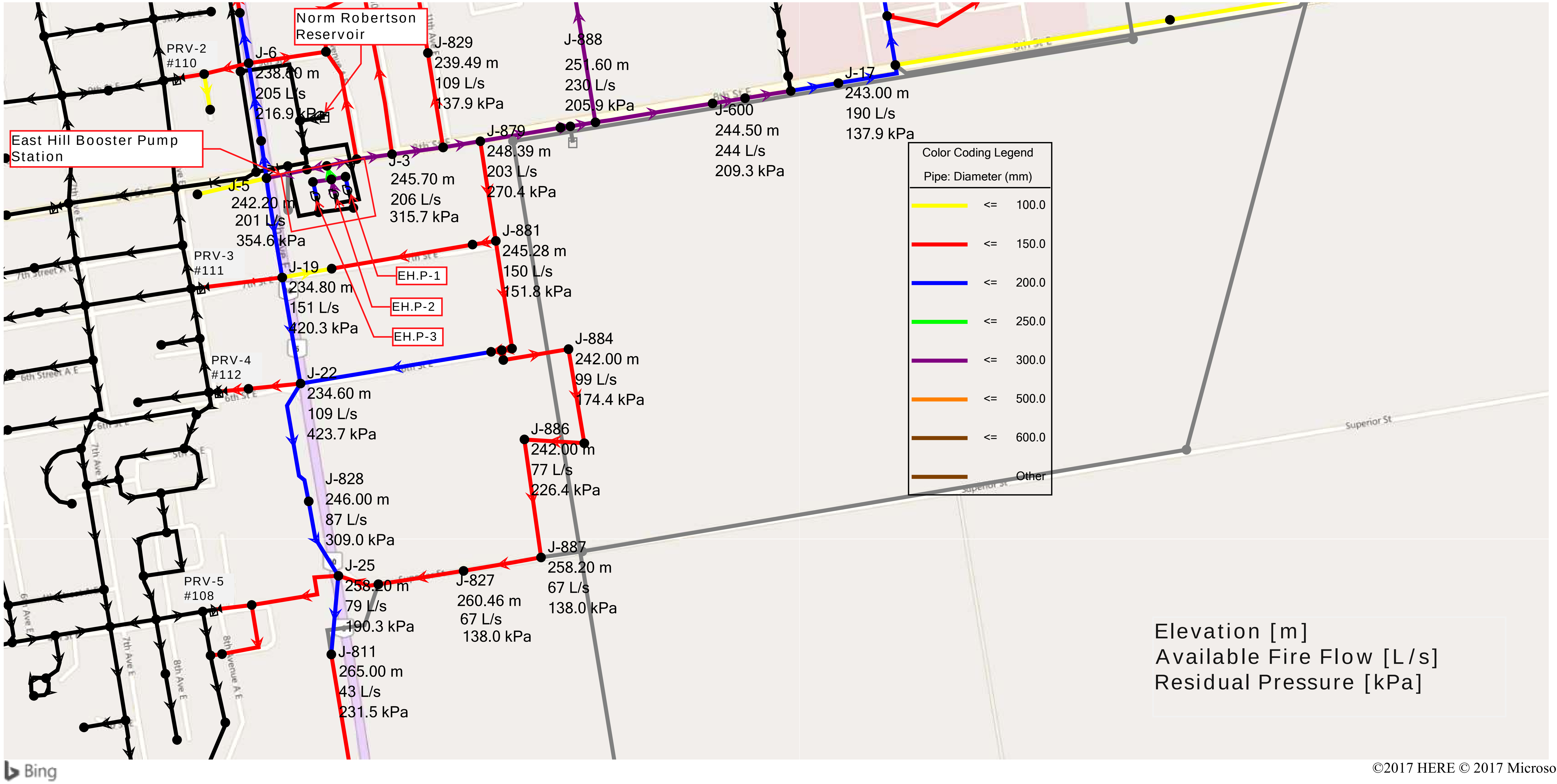
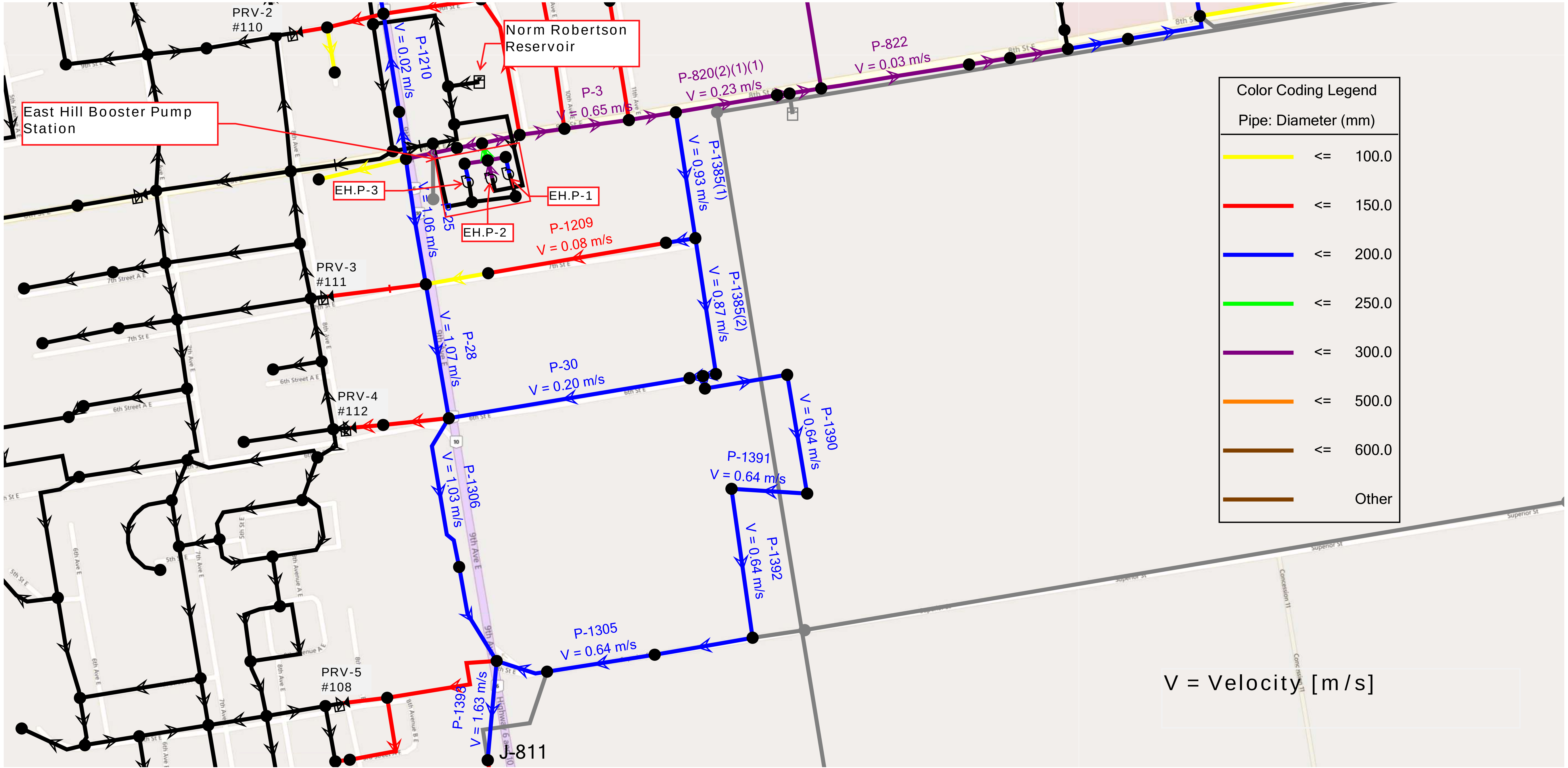
Scenario: 2022 MDD 9th Ave E Recon. 150 mm + Fire Flow



Scenario: 2022 MDD 9th Ave E Recon. 200 mm + Fire @ J-811



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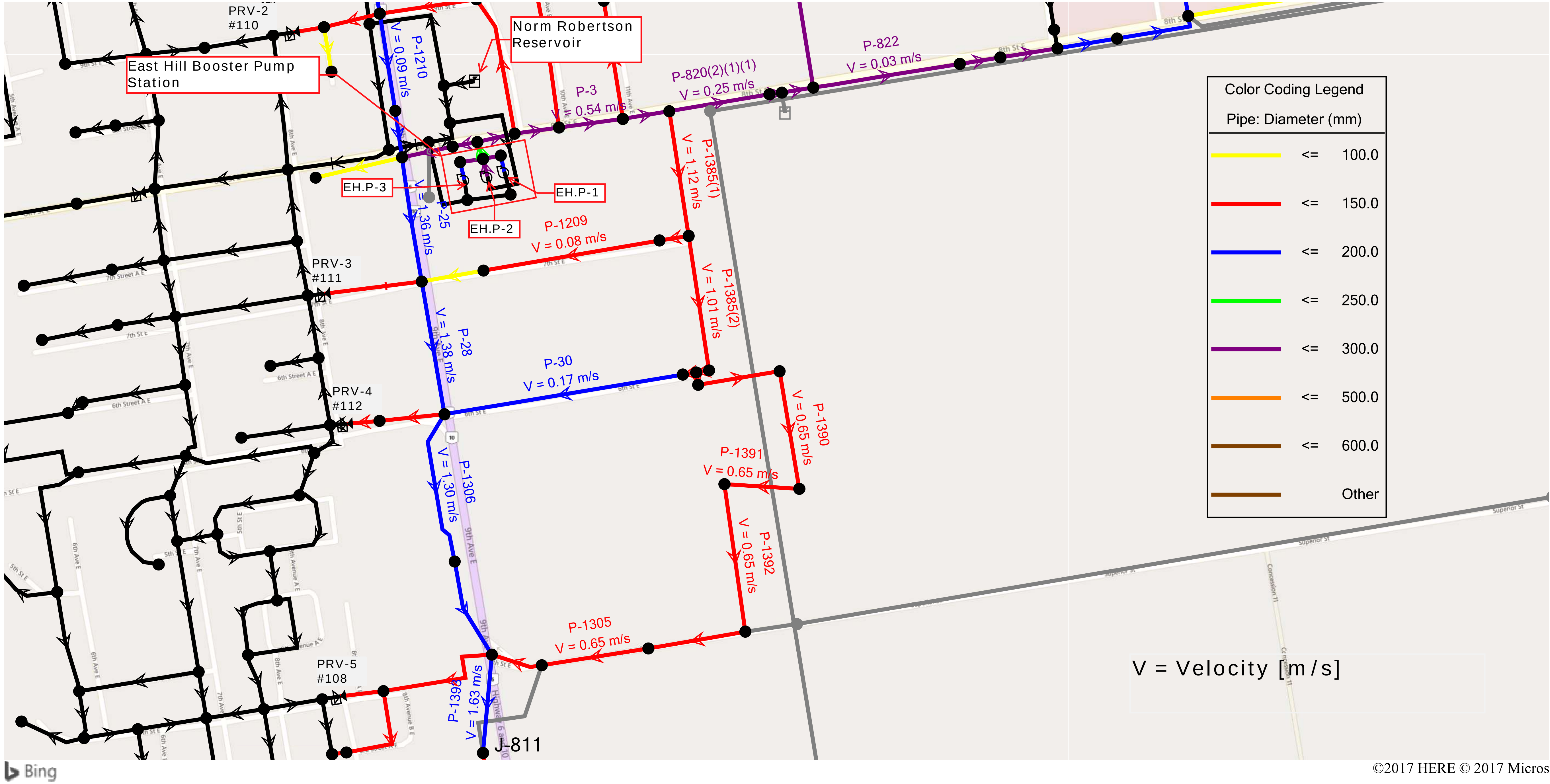
Scenario: 2022 MDD 9th Ave E Recon. 150 mm + Fire @ J-811



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Appendix D:
Environmental Impact Study

Scoped Environmental Impact Study

Owen Sound Watermain Improvements – Early Design Stage

City of Owen Sound

Prepared for:
Tatham Engineering Ltd.

Prepared by:
Azimuth Environmental
Consulting, Inc.

February 2023

AEC 21-453

AZIMUTH ENVIRONMENTAL
CONSULTING, INC.
Environmental Assessments & Approvals

February 3, 2023 AEC 21-453

Tatham Engineering Ltd.
Mark Figueroa
115 Sandford Fleming Drive, Suite #200
Collingwood, Ontario L9Y 5A6

Re: **Scoped Environmental Impact Study – 9th Avenue East to 10th Street East, City of Owen Sound**

Dear Mr. Figueroa:

Azimuth Environmental Consulting, Inc. was retained to provide a Scoped Environmental Impact Study in support of a Municipal Class Environmental Assessment pertaining to municipal watermain improvements between 9th Avenue and 10th Avenue in the City of Owen Sound. The purpose of this report is to provide the City with an understanding of natural environmental conditions and potential impacts related to the proposed design alternatives on natural heritage features and functions in the study area, including Species at Risk and their habitat.

The assessment concludes that the recommended Preferred Option #3 can be achieved with the least impact to natural heritage features and functions, including Species at Risk, relative to the other design alternatives. Confirmatory planning consultation may be advised regarding the Niagara Escarpment Plan.

Should you have any questions please do not hesitate to contact the undersigned.

Yours truly,
AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Dr. Scott Tarof, Ph.D. (Biology)
Terrestrial Ecologist

642 Welham Road, Barrie, Ontario L4N 9A1
telephone: (705) 721-8451 • fax: (705) 721-8926 • info@azimuthenvironmental.com • www.azimuthenvironmental.com

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1.0 INTRODUCTION

Azimuth Environmental Consulting, Inc. (Azimuth) was retained by Tatham Engineering Ltd. (Tatham) to prepare a Scoped Environmental Impact Study (EIS) supporting a Municipal Class Environmental Assessment (Class EA) involving watermain improvements in the City of Owen Sound (City), Grey County (County) (Figure 1). The project is in the early design stages. It is our understanding that a Scoped EIS has been requested in support of the Class EA. The study area is in the jurisdiction of the Grey Sauble Conservation Authority (GSCA), but is not within the GSCA Regulation Limit, therefore it is expected a permit under Ontario Regulation (O. Reg.) 151/06 will not be required.

The purpose of this Scoped EIS is to identify candidate Natural Heritage Features and Functions (NHFFs) in the study area associated with five watermain alignment alternative solutions (Alternative Options #1-5) and evaluate potential impacts of the proposed alternatives on those NHFFs to recommend a preferred solution from a natural heritage perspective. The Scoped EIS satisfies the natural heritage obligations of the Class EA and will assist the project team in identification of a preferred alignment solution. A review of background information, combined with field surveys, was undertaken in spring/summer 2022 to identify existing NHFFs in the study area. The report also examines potential for Species at Risk (SAR) and SAR habitat protected under Ontario's *Endangered Species Act*, 2007 (ESA). The potential for negative impacts to identified NHFFs is considered and recommendations for avoidance and mitigation are provided.

For the purposes of this Scoped EIS, the study area comprises lands containing the watermain alignment alternatives, as shown on Figures 1-3, plus adjacent lands within approximately 120 metres (m) of the alignment alternatives. Natural heritage features and functions in the overall planning area beyond study area limits are discussed where applicable throughout the report.

2.0 PLANNING CONTEXT

2.1 Provincial Planning Policy (2020)

The Provincial Policy Statement (PPS) (MMAH, 2020) outlines policies related to natural heritage features (Section 2.1) and water resources (Section 2.2). Ontario's *Planning Act*, (1990) requires that planning decisions shall be consistent with the PPS. The study area for this assessment is located entirely in Ecoregion 6E. According to the PPS, development and site alteration shall not be permitted in:

- *Significant wetlands* in Ecoregions 5E, 6E and 7E; and,
- *Significant coastal wetlands*.

Similarly, Section 2.1.5 of the PPS states that, unless it has been demonstrated that there will be no negative impacts on the natural features or their ecological functions, development and site alteration shall not be permitted within:

a) *significant wetlands* in the Canadian Shield north of Ecoregions 5E, 6E; and 7E;
b) *significant woodlands* in Ecoregions 6E; and 7E;
c) *significant valleylands* in Ecoregions 6E; and 7E;
d) *significant wildlife habitat*;
e) *significant areas of natural and scientific interest*; and,
f) *coastal wetlands* in Ecoregions 5E, 6E; and 7E that are not subject to policy 2.1.4(b)

It is ultimately the responsibility of the Province and/or the Municipality to designate areas identified within Section 2.1.4 and 2.1.5 of the PPS as "significant".

Section 2.1.6 of the PPS states that development and site alteration is not permitted in fish habitat except in accordance with federal and provincial requirements.

Section 2.1.7 of the PPS states that development and site alteration shall not be permitted in habitat of Threatened and Endangered species, except in accordance with provincial and federal requirements.

Furthermore, under Section 2.1.8 of the PPS, no development and site alteration will be permitted on lands adjacent to natural heritage features and areas identified in policies 2.1.4, 2.1.5 and 2.1.6 unless the ecological function of the adjacent lands has been evaluated and it has been demonstrated there will be no negative impacts on the natural features and ecological functions.

2.2 Endangered Species Act (2007)

Ontario's ESA provides regulatory protection to Endangered and Threatened species prohibiting harassment, harm and/or killing of individuals and destruction of their habitats. Habitat is broadly characterized within the ESA as the area prescribed by a regulation as the habitat of the species or an area on which the species depends, directly or indirectly, to carry on its life processes including reproduction, rearing of young, hibernation, migration or feeding.

The various schedules of the ESA included under O. Reg. 230/08 identify SAR in Ontario. These include species listed as Extirpated, Endangered, Threatened and Special Concern. As noted above, only species listed as Endangered and Threatened receive protection from harm and destruction to habitat on which they depend.

2.3 County of Grey

According to Schedule A - Map 1 of the County Official Plan (OP; 2019), the study area is designated as within a Primary Settlement Area (Appendix A).

The study area does not occur in mapped Provincially Significant Wetlands (PSWs), Significant Coastal Lands or Hazard Lands (Schedule A - Map 1; Appendix A), nor is it in a mapped Core Area or Linkage Area (Schedule C; Appendix A). Grey County mapping (2022) shows no woodlands, County Forests, unevaluated wetlands or watercourses associated with the study area (County Map #1; Appendix A).

The southern portion of the study area is mapped as part of the Niagara Escarpment Plan Area [Urban Area and Escarpment Protection Area (County Map #2), see also OP Schedule A - Map 1; Appendix A)] (see Section 2.5 below).

2.4 City of Owen Sound

The study area is designated in the City OP (2022) as Employment, Arterial Commercial, Institutional and Niagara Escarpment Plan Area (Schedule A; Appendix A).

Section 6.1.4.3 states that municipal public works projects are exempt from development constraints associated with Significant Woodlands.

2.5 Niagara Escarpment Plan (2017)

As per the Niagara Escarpment Plan (NEP; NEC, 2017), part of the study area is in the Niagara Escarpment Plan Area - Urban Area and Escarpment Protection Area (Map #7 and County Map 2; Appendix A). Section 1.3.3 of the Niagara Escarpment Plan (2017) lists “Infrastructure” as a permitted land use in the Niagara Escarpment Plan Area. Although a development permit through the Niagara Escarpment Commission (NEC) would not be anticipated, the client may wish to confirm with the Niagara Escarpment Commission.

2.6 Grey Sauble Conservation Authority

The study area is outside the GSCA Regulation Limit (Schedule A - Map 1, GSCA Regulation Limit Map; Appendix A). Consequently, it is anticipated a GSCA permit under O. Reg. 151/06 would not be required.

3.0 STUDY APPROACH

A combination of background information and field data were used to fulfill the objectives of this Scoped EIS. Unless indicated otherwise, the scope of the field program focused on the defined study area. Azimuth undertook the following activities for this study:

- Searched the County, GSCA, Ministry of Natural Resources and Forestry (MNRF) and Ministry of the Environment, Conservation and Parks (MECP) records to obtain available background information, including current information related to natural heritage conditions including SAR;
- Conducted the following field surveys:
    - Defined and mapped vegetation community types in the area of watermain alignment alternatives based on Ecological Land Classification (ELC) methods;
    - Completed two (2) vascular plant inventories (spring and summer, 2022);
    - Completed two (2) dawn breeding bird surveys with emphasis on determining if habitat for Bobolink and/or Eastern Meadowlark were present (SAR birds);
    - Characterized the vegetated area designated as "woodland" to determine potential habitat for SAR bats;
- Completed a SAR habitat assessment based on background information and fieldwork to identify SAR/SAR habitat that could be present in the study area;
- Recorded wildlife observations and assessed potential for Significant Wildlife Habitat (SWH) function according to provincial criteria;
- Assisted the client with evaluation of alignment alternatives for proposed watermain improvements with regard for NHFFs identified; and,
- Assessed the potential direct and indirect impacts of the project on NHFFs in the study area.

The early design stage of the project involves an evaluation of alternative solutions to help identify a preferred solution for future detailed design, and the study area is not regulated by the GSCA. Consequently, confirmation of a Terms of Reference with the GSCA for the field program and impact assessment was not part of the scope.

3.1 Background Data

A review of background documents provided information on property characteristics, habitat, wildlife, rare species and communities, and general cultural/historic aspects of the study area. Background documentation included a review of the following:

- Natural Heritage Information Center (NHIC) data from the Ministry of Natural Resources and Forestry (MNRF, 2022);
    - Make-A-Map: Natural Heritage Areas application
- Ontario Ministry of Natural Resources (OMNR) Natural Heritage Reference Manual (NHRM; OMNR, 2010);
- Atlas of the Breeding Birds of Ontario (OBBA; Cadman *et al*., 2007);
- Ontario Reptile and Amphibian Atlas (2020);
- iNaturalist (2022);
- MECP SAR Ontario list (2022);
- Bat Survey Standards Note (MECP, 2021);
- Government of Canada's Species at Risk Public Registry (2022);
- Aerial photographs available for the study area (Google Earth Pro, VuMap);
- Atlas of the Mammals of Ontario (Dobbyn, 1994);
- County interactive mapping (2022);
- County OP (2019); and,
- City OP (2022).

3.2 Vegetation Community Mapping and Surveys

Prior to undertaking detailed field studies, an initial classification of habitats was undertaken using recent air photo imagery for an area encompassing the study area. Vegetation community types and boundaries in association with the study area were confirmed and characterized in the field using ELC methods (Lee 2008, Lee *et al*. 1998) based on field surveys undertaken on June 10 (temperature: 19ºC, cloud cover: 0%, Beaufort wind: B2, precipitation: none) and August 12, 2022 (temperature: 22ºC, cloud cover: 5%, Beaufort wind: B1-2, precipitation: none) during spring and summer growing seasons, respectively (Figure 2).

To describe vascular plant species composition, a two-season plant inventory was conducted to compile a list of species by ELC vegetation community. Property visits were undertaken by a qualified ecologist with existing knowledge related to rare, Threatened and Endangered vascular plant species with potential to occur in the area. The assessment was focused during ELC work to ensure that appropriate effort was made to detect any federally or provincially designated plant species, notably SAR as identified by the provincial ESA or provincially rare plants. The inventories included consideration for SAR plants, such as Butternut (*Juglans cinerea*) (Endangered) and Black Ash (*Fraxinus nigra*) (Endangered) which are protected under the ESA.

To estimate the amount of woodland cover (ha) in the study area and on adjacent lands (*i.e.* landscape scale), the polygon tracing tool was used in Google Earth Pro. Woodland cover east of the terminus of 6th Street East and west of 9th Avenue East was excluded because gaps between woodland edges were approximately 70-165m wide, exceeding the maximum 20m gap that constitutes a single woodland feature, as defined in the NHRM (OMNR, 2010).

3.3 Wildlife Surveys

Wildlife species utilizing the study area were identified from direct observation, auditory signs and through interpretation of other signs (tracks, scats, vocalizations, *etc*.) as a matter of course while conducting field surveys.

3.3.1 Species at Risk

The SAR screening undertaken for this assignment included an assessment of SAR with potential to occur at the County scale. The County list was modified based on habitat features in the area and species' ranges. Where potentially suitable habitat was present, the assessment included SAR occurrence records from the NHIC database (Appendix B). Habitat requirements and appropriate designations (Endangered, Threatened or Special Concern) are outlined in Table 1. The SAR assessment followed the MECP Guidance Document - Client's Guide to Preliminary Screening for SAR (MECP, 2019).

3.3.2 Breeding Birds

Two dawn breeding bird surveys were conducted at six point count stations on June 2 and June 15, 2022 (Figure 2), guided by point count methodology in the OBBA Guide for Participants (OBBA, 2001). Surveys were conducted no earlier than one half hour before sunrise and were completed prior to 10:00am. Surveys were completed under suitable weather conditions [*i.e.* light winds (Beaufort wind scale ≤3)]. Point counts were five minutes (min) in duration and otherwise followed the protocol of the Ontario Breeding Bird Atlas Guide for Participants (OBBA, 2001). Survey station locations were distributed throughout the study area to confer reasonable coverage of vegetation communities relative to the alternative solutions. Breeding evidence was assessed using OBBA (2001) criteria. All birds seen or heard were identified to species and counted.

3.3.3 Bats and Bat Habitat

Several bat species including (but not limited to) SAR Little Brown Myotis, Northern Myotis and Tri-colored Bat may utilize trees in early stages of decay ("snag" trees) for the purposes of maternity colony roosting and/or day roosting during the late spring and summer seasons. Larger trees [*e.g.* at least 25 centimetres (cm) diameter at breast height (DBH)] are often preferred by bats as roost trees; however, trees of any size have the potential to be used (MECP, 2021; MNRF, 2015a). Trees described as "snag" trees are those having cracks, splits, holes, *etc*. that could feasibly provide access for roosting bats.

Given the woodland cover in portions of the study area, on June 14, 2022 Azimuth conducted a *high level* screening for SAR bat habitat in the study area. The objective of the screening was to evaluate whether or not there was potential for SAR bat habitat to be present in the vicinity of any of the proposed watermain alignment alternatives. Since the objective was not to generate a detailed map of each candidate bat snag tree, the screening was completed during leaf-out. The survey involved a roving search of woodland areas; the presence of leaves on the trees did not limit survey effectiveness. Given the characteristics of the woodland areas screened (*e.g.* relatively narrow treed areas, access throughout), results of the bat habitat screening would not be expected to be different had the survey been completed during leaf-off conditions. The general areas in the study area where potential SAR bat habitat was observed were mapped in relation to the ELC vegetation communities (Figure 2).

4.0 EXISTING CONDITIONS

4.1 Land Use

The estimated 15.8 hectare (ha) defined study area is located on the southeastern perimeter of Owen Sound, and is bound by 9th Avenue East to the west, 8th Street East to the north and Superior Street to the south. The eastern-most extent of the study area is approximately 730m east of 9th Avenue East. The study area consists of a combination of industrial (*e.g.* Hydro One, Miller aggregate site) and residential land uses interspersed with woodland and open field habitat areas (Figure 2). A hydroelectric corridor passes through the central region of the study area in a generally north-south direction.

Adjacent land use includes rural residential lots along Superior Street separated by open fields, hedgerows and agricultural lands.

4.2 Terrestrial Resources

4.2.1 Vegetation

Limits of the 11 unique ELC communities identified in the study area are illustrated on Figure 2. Some of the communities occur multiple times in the study area, but they differ in species composition. The patch of White-Ash Deciduous Woodland Thicket (WODM4-2) is adjacent to Maintained Lawn that extends south to the Dry-Fresh White Ash-Hardwood Deciduous Forest (FODM4-2) (Figure 2). A complete list of vascular plant species identified is presented in Tables 2a and 2b, and summary descriptions of ELC vegetation communities are provided in Table 3. Appendix C provides a photographic record of the study area associated with the alternative options.

A total of 151 vascular plant species were identified in the study area, 83 (55%) of which are considered native to Ontario (Tables 2a and 2b). No SAR plant species were observed, including no Butternut or Black Ash. None of the vegetation communities or plant species documented are of federal or provincial conservation concern, and no plant species are considered rare provincially (*i.e.* S1-S3) (NHIC, 2022).

4.2.2 Wildlife

4.2.2.1 Mammals and Other Incidental Wildlife Observations

Evidence of three mammalian species [Eastern Chipmunk (*Tamias striatus*). Gray Squirrel (*Sciurus carolinensis*), White-tailed Deer (*Odocoileus virginianus*)] were observed in the study area. Given study area proximity to large natural wooded and field areas at the landscape scale, it is expected that the following mammals could also conceivably be encountered in the study area: small mammal species (various mice, voles and shrews); Red Squirrel (*Tamiasciurus hudsonicus*); Eastern Cottontail (*Sylvilagus floridanus*); Ermine (*Mustela erminea*); Long-tailed Weasel (*Neogale frenata*); Least Weasel (*Mustela nivalis*); Groundhog (*Marmota monax*); Striped Skunk (*Mephitis mephitis*); Porcupine (*Erethizon dorsatum*); Eastern Coyote (*Canis latrans*); Red Fox (*Vulpes vulpes*); and Raccoon (*Procyon lotor*).

No salamanders, newts or reptiles were observed over the course of the field program.

4.2.2.2 Breeding Birds

A total of 35 bird species were detected in the study area during the dawn breeding bird surveys (Table 4). Eastern Meadowlark (Threatened), including at least one female, was confirmed in the study area in association with the Dry-Fresh Mixed Meadow (MEMM3) ELC polygon proximal to Point Count Stations #2-3 (Figure 2). The species was also detected on adjacent lands approximately 150-200m east of 1150 Superior Street on the north side of the road (Figure 2). Eastern Meadowlark were detected during both dawn breeding bird surveys, and evidence of breeding was treated as evident based on observations of at least one female.

Eastern Wood-pewee (Special Concern) was heard singing near Point Count Station #6 and on adjacent lands on the south side of Superior Street (Figure 2).

4.2.3 Bats and Bat Habitat

Woodland screening for presence of potential candidate bat snags in the study area identified a small number of trees that may potentially be used by roosting bats. Approximately two hedgerow trees immediately west of 1025 6th Street East were observed in the hedgerow/fencerow (TAGM5) ELC community to have low quality bat snag features (Figure 2); however, in Azimuth's experience, hedgerow habitat is not typically considered to be habitat for SAR bats. Immediately south of this hedgerow, in the FODM4-2 corridor west of 1000 Superior Street, an estimated 20 trees were observed to have bat snag features (cavities, hollows, peeling bark, dead limbs) that could be used by SAR bats (if present) (Figure 2). Approximately 50% of the candidate bat snag trees observed in this FODM4-2 corridor would likely be considered "high quality" bat snag trees because of the combination of snag features present, feature height (3-10m, >10m up the trunk of the trees) and tree location (on edge of corridor – bats often travel along woodland edges when searching for insects). No other trees were observed in the study area that had candidate bat snag features.

4.3 Species at Risk

The SAR assessment (Table 1) considers SAR and SAR habitat with potential to occur in the study area in accordance with field data, known SAR for Grey County (Endangered, Threatened or Special Concern) and NHIC records (see Appendix B), scoped to consider potential habitat opportunities in the study area limits. Based on this assessment, in combination with vegetation communities and other environmental features observed during the investigation, the following species are considered below in this report:

- **Threatened or Endangered**;
    - Eastern Meadowlark;
    - Little Brown Myotis (Potential);
    - Northern Myotis (Potential);
    - Tri-colored Bat (Potential);
- **Special Concern;**
    - Eastern Wood-pewee; and,
    - Monarch (Potential).

Only species designated as Threatened or Endangered receive individual and habitat protection under Section 9 and Section 10 of the ESA. Special Concern species are discussed in the context of Significant Wildlife Habitat (SWH) (Special Concern and Rare Wildlife Species).

4.4 Wetlands

Background NHIC and VuMap mapping indicate no wetlands in the study area or on adjacent lands, including no PSWs on municipal or provincial resources for the area (Appendix B). Three small marsh communities (MAMM1-2, MAMM1-16 and MAMM3) were observed in the field (Figure 2). For the purposes of this assessment, these features are considered as "Other Wetlands".

4.5 Significant Woodlands

Woodlands in the study area and on adjacent lands were estimated to be 4.1ha in size. The City OP defines woodlands as Significant Woodlands if the feature is 4ha or greater in size. Consequently, woodlands in the study area are considered Candidate Significant Woodlands for the purposes of this assessment.

4.6 Significant Valleylands

No portion of the study area is identified as Significant Valleyland nor assigned a similar designation on City, County (Appendix A) or provincial mapping resources (NHIC, 2022; Appendix B). There are no valleyland features in the study area according to standards presented in the NHRM, principally due to the lack of permanent or intermittent watercourses that constitute a defining component of a valleyland feature. Furthermore, no portion of the study area fulfills the well-defined valley morphology and landform prominence required to be considered Candidate Significant Valleyland.

4.7 Significant Wildlife Habitat

An assessment of the potential for SWH in the study area was conducted using criteria outlined in MNRF's Significant Wildlife Habitat Technical Guide (2000) and the accompanying the Ecoregion 6E Criteria Schedules (MNRF, 2015). The following SWH types were considered to be present, or have potential to occur, based on results of the field program, organized by habitat type below:

- Bat Maternity Colonies (Potential);
- Special Concern and Rare Wildlife Species;
    - Eastern Wood-pewee; and,
    - Monarch Butterfly (Potential).

These candidate SWH types are discussed below (Impact Assessment) in the context of SWH function.

4.8 Areas of Natural and Scientific Interest

No portion of the study area is identified as ANSI on City, County (Appendix A) or provincial mapping resources (NHIC, 2022; Appendix B).

4.9 Fish and Fish Habitat

No mapped watercourses are indicated in the study area, as per City, County or regional mapping resources (Appendix A), nor were watercourses observed in the field in the study area. No features with potential to provide fish habitat were documented in study area limits.

5.0 NATURAL HERITAGE FEATURES AND FUNCTIONS

The results of Azimuth's field studies combined with review of background information indicate the potential for the following candidate NHFFs in the study area:

- Habitat for Threatened or Endangered Species;
  - Eastern Meadowlark;
  - Little Brown Myotis (Potential);
  - Northern Myotis (Potential);
  - Tri-colored Bat (Potential);
- Other Wetlands;
- Candidate Significant Woodlands;
- Candidate Significant Wildlife Habitat;
  - Bat Maternity Colonies (Potential);
  - Special Concern and Rare Wildlife Species;
    - Eastern Wood-pewee; and,
    - Monarch Butterfly (Potential).

6.0 PRELIMINARY PROPOSED ALTERNATIVE SOLUTIONS

The project is in the early design stage. The proposed development is a municipal works project involving five watermain alignment alternatives (Figure 3). The looping watermain will be constructed east of 9th Avenue East and extend between 8th Street East and Superior Street. The two main portions of the watermain will be between 8th Street East to 6th Street East, and then continue south from 6th Street East to Superior Street. The 8th Street East to 6th Street East section will consist of a single line approximately 430m in length, installed in a City-owned block currently lined with hydro poles.

The City is considering five alignment alternatives between 6th Street East and Superior Street. The preferred solution will be installed with open-cut construction methods and a minimum cover of 1.8m. Below we summarize the watermain alignment alternatives under consideration between 6th Street East and Superior Street. Detailed design drawings will be part of a future design stage once the preferred solution has been identified. As such, specific details regarding the work limits associated with each watermain alignment alternative are not currently known.

6.1 Alternative Option #1

Alternative Option #1 would involve installing the watermain from the City-owned block in the 6th Street East road allowance to the 6th Street East frontage at the 595 9th Avenue East property. The watermain would continue south underneath the existing parking lot within easements on the 595 9th Avenue East and the 425 9th Avenue East properties.

The existing watermain on Superior Street would be replaced to connect to the 9th Avenue East watermain. Alternative Option #1 involves the watermain running south at the left-most position in that portion of the study area in easements on the 595 9th Avenue East and the 425 9th Avenue East (Figure 3).

6.2 Alternative Option #2

In Alternative Option #2, watermain construction would entail installing the watermain from the City-owned block in the 6th Street East road allowance to the 6th Street East frontage at the 595 9th Avenue East property. The watermain would continue south in easements on the 595 9th Avenue East property in front of the building at the northeast corner of the property and the property at 1010 Superior Street. The existing watermain on Superior Street would be replaced to connect to the 9th Avenue East watermain. Alternative Option #2 involves the watermain running south in a central alignment within easements on the 595 9th Avenue East and the 425 9th Avenue East (Figure 3).

6.3 Alternative Option #3

In Alternative Option #3, watermain construction would entail installing the watermain from the City-owned block in the 6th Street East road allowance to the 6th Street East frontage at the 595 9th Avenue East property. The watermain would continue south in easements on the 595 9th Avenue East property behind the building at the northeast corner of the property and the 1010 Superior Street property. The existing watermain on Superior Street would be replaced to connect to the 9th Avenue East watermain. Between 6th Street East and Superior Street, Alternative Option #3 involves the watermain running south along the eastern edge of the easements on the 595 9th Avenue East and the 425 9th Avenue East (Figure 3).

6.4 Alternative Option #4

Alternative Option #4 would involve installing the watermain from the City-owned block in the 6th Street East road allowance to the 6th Street East frontage at the 595 9th Avenue East property. The watermain would continue south in easements on the 595 9th Avenue East property behind the building at the northeast corner of the property, turn east through the 1000 Superior Street property and then turn south along the west side of 1150 Superior Street. The existing watermain on Superior Street would be replaced to connect to the 9th Avenue East watermain (Figure 3).

6.5 Alternative Option #5

Alternative Option #5 would originate southward from 8th Street East in the City-owned block (the same as Alternative Options #1-4) to 6th Street East, then turn east and then south in easements along the central portions of 1650 Superior Street. The watermain would then continue west toward 1000 Superior Street and south in easements on the 1150 Superior Street property (Figure 3). The existing watermain on Superior Street would be replaced to connect to the 9th Avenue East watermain.

7.0 PRELIMINARY IMPACT ASSESSMENT OF ALTERNATIVE SOLUTIONS

This impact assessment is prepared with regard for the proposed watermain alignment alternatives. Background information and results of the field program were used to evaluate possible preliminary impacts to NHFFs pertaining to the alternative solutions. The assessment summarizes potential constraints that may be associated with each solution. The primary intent is to identify possible environmental sensitivities for client consideration as the project progresses to detailed design. A more detailed impact assessment may be needed during detailed design once more information is available for the preferred solution. Constraints deemed worthy of further consideration are discussed below in relation to each alternative solution, followed by a summary.

7.1 Habitat for Threatened or Endangered Species

Impacts with regards to the ESA and Habitat of Threatened or Endangered species are covered under Section 9 and 10 of the ESA. Section 9 deals directly with killing, harming or harassing living members of a species. Section 10 covers destruction or damage to habitat of Threatened or Endangered species. According to the PPS, development and site alteration shall not be permitted in habitat of Threatened or Endangered species, except in accordance with provincial and federal requirements. The following Threatened or Endangered species have the potential to occur in or adjacent to the study area:

- Eastern Meadowlark;
- Little Brown Myotis (Potential);
- Northern Myotis (Potential); and,
- Tri-colored Bat (Potential).

7.1.1 Eastern Meadowlark

Eastern Meadowlark were detected calling in one portion of the study area, specifically in association with Alternative Option #5 and on adjacent lands approximately 150m east of 1150 Superior Street (Figure 2). Nest locations were not identified. Under Section 10 of the ESA in regards to habitat protection, damage or destruction of habitat is considered a contravention. Habitat for Eastern Meadowlark in MEMM3 would be impacted by encroachment if Alternative Option #5 were to be selected. Under this scenario, consultation with MECP would be required to outline a mitigation approach to help minimize impacting the species. Due to the nature of the proposed watermain improvements (*i.e.* a temporary open-cut trench), mitigation might take the form of habitat restoration (*e.g.* site preparation and reseeding post-construction); however, MECP consultation would be recommended. The MECP might also require an Information Gathering Form for Eastern Meadowlark with Alternative Option #5.

The anticipated work limits associated with Alternative Options #1 to #4 would not encroach into habitat for Eastern Meadowlark. Consequently, proposed infrastructure works in these other four regions of the study area would not pose an impact to Eastern Meadowlark. The study area is proximal to a highly urbanized landscape to the north, south and west, with Eastern Meadowlark present to the east. The species will most likely continue to be present post-construction. Providing the mitigation measures recommended in Section 8.0 below are followed, the potential for indirect impacts to SAR grassland bird habitat would be considered mitigable.

7.1.2 Little Brown Myotis, Northern Myotis and Tri-colored Bat

The screening for potential bat snag trees found approximately 20 candidate bat snag trees in the FODM4-2 woodland corridor between 405 9th Avenue East and 1010 Superior Street (Figure 2). Work limits associated with Alternative Options #1, #2 or #3 would be considered an encroachment into potential SAR bat habitat in this region of the study area. Consequently, the proposed infrastructure works in Alternative Options #1, #2 or #3 would represent removal of a small number of candidate snag trees with potential to provide habitat for SAR bats (if present). The anticipated work limits associated with Alternative Options #4 or #5 would not encroach into suitable habitat for SAR bats.

In regards to treed habitat for maternity or day roosting by SAR bats, the Bat Survey Standards Note (MECP, 2021) states “If a proposed activity will avoid impairing or eliminating the function of habitat for supporting bat life processes (*e.g.* remove, stub, *etc.* a small number of potential maternity or day roost trees in treed habitats) but the timing of tree removal will avoid the bat active season (April 1-September 30 in Southern Ontario), then there is no need to conduct species at risk bat surveys of treed habitats.” Based on this direction from the MECP, and given only a small number of potential bat habitat snags would be removed, the potential for impact to SAR bat habitat would be considered acceptable and would not trigger the need for additional bat surveys or MECP consultation. This assessment is based on tree removals occurring outside the active bat season (*i.e.* removals between October 1 and March 31 of a given year).

Providing the mitigation measures recommended in Section 8.0 below are followed, the potential for indirect impacts to SAR bat habitat in relation to Alternative Options #1 to #5 would be considered mitigable.

7.2 Other Wetlands

Three small isolated MAMM (Mineral Meadow Marsh) wetlands were identified in the field east of 1025 6th Street East (Figure 2). Alternative Option #5 would encroach into Other Wetlands in the form of an open-cut trench. Consequently, Alternative Option #5 would pose a direct impact to Other Wetlands. The anticipated open-cut trench work limit for Alternative Option #4 would be adjacent (within approximately 5m) to Other Wetlands. Alternative Options #1 to #3 would not encroach into wetland, and therefore, would not represent a direct impact to wetlands. In some development situations, encroachment into wetlands may be approved (*e.g.* for infrastructure); however, GSCA consultation, mitigation and possible restoration of indirect wetland impact would likely be required for works in or immediately adjacent to wetlands.

Another consideration pertaining to Alternative Options #4 or #5 is the possibility of alteration of wetland hydrology. Soils in the vicinity of the wetlands were observed to be moist in the field. Engineering input regarding the potential need for dewatering of the open-cut trench during construction would be advised in relation to Alternative Options #4 or #5. Dewatering, if required, may affect wetland hydroperiod. In addition, pipe bedding might function as a wetland "drain", slowly removing water from the wetlands post-construction.

Provided the mitigation measures recommended below in Section 8.0 are followed, the potential for indirect impact to Other Wetlands in relation to Alternative Options #1 to #5 are considered mitigable.

7.3 Candidate Significant Woodlands

According to the PPS, development and site alteration are not permitted in Significant Woodlands in Ecoregion 6E, unless it can be demonstrated there will be no negative impacts to the feature and its ecological function. One (1) Candidate Significant Woodland feature was identified in the study area in association with the FODM4-2 ELC vegetation community west and south of 1000 6th Street East (Figure 2, see also Appendix B). Since the project will require tree removals to accommodate Alternative Options #1 to #4, watermain alignment work in this part of the study area would result in tree removals within Candidate Significant Woodlands. The anticipated work limits associated with Alternative Option #5 would not encroach into Candidate Significant Woodlands. Consequently, this alignment alternative would not result in tree removals in Candidate Significant Woodlands.

Section 6.1.4.3 in the City OP indicates that municipal public works projects are permitted in Significant Woodlands. Consequently, impacts to Candidate Significant Woodlands associated with Alternatives Options #1 to #4 would likely be deemed acceptable to the City, as per municipal policies. Regardless, it is Azimuth's opinion that Alternative Options #3 or #4, in particular, would not compromise the overall form or ecological function of the feature since construction would be along the eastern-most edge of the Candidate Significant Woodland as opposed to approximately 10-20m west of the feature edge (*i.e.* within the Candidate Significant Woodland - as the case would be for Alternative Options #1 or #2). Alternative Options #1 or #2 would fragment part of the Candidate Significant Woodland and possibly increase forest "edge effects" (*e.g.* increased risk of predation on bird nests and exposure to nest parasitism). Despite the urban setting, these impacts could affect breeding success of local birds. Providing mitigation recommendations in Section 8.0 below are implemented, the potential for indirect impacts to Candidate Significant Woodlands would, for the most part, be treated as mitigable.

7.4 Candidate Significant Wildlife Habitat

According to the PPS, development and site alteration are not permitted in SWH in Ecoregion 6E, unless it can be demonstrated there will be no negative impacts upon the feature and its ecological function.

7.4.1 Bat Maternity Colonies

Potential bat maternity roosting habitat was identified in the study area within the FODM4-2 ELC vegetation community (Figure 2). Although limited tree removals to accommodate Alternative Options #1 to #4 would be anticipated, the scale of tree removals will likely be relatively small (especially with Alternative Options #3 or #4) and the likelihood of loss of SWH form or function would be considered minimal and mitigable (especially with Alternative Options #3 or #4). Overall, the feature will remain post-development, and, at the landscape scale, potential habitat for roosting bats will not be impacted.

7.4.2 Special Concern and Rare Wildlife Species

Eastern Wood-pewee (Special Concern) was detected on adjacent lands only - approximately 60m east of the study area near Point Count Station #6 during the first dawn breeding bird survey but not during the second survey. A breeding evidence status of "Possible" would apply to the species. Since the species was not detected in the study area during the field program, neither the species nor its habitat will be impacted by the proposed watermain improvements. As such, SWH feature and function for Eastern Wood-pewee will not be impacted.

Potential habitat for Monarch Butterfly [*i.e.* Common Milkweed plants (*Asclepias syriaca*)] was observed in THDM3, MEMM3 and WODM4-2 ELC vegetation communities in the study area (Figure 2), indicating the potential for Monarch Butterfly to be present. Individual Monarch were not observed. Habitat quality for Monarch Butterflies in these ELC polygons was low. Trees and thickets limited milkweed to a very sparse distribution. Areas in the surrounding landscape to the northeast and east would be considered to represent higher quality habitat more suitable for the species. Consequently, the likelihood for impact to Monarch habitat would be negligible.

Provided that the mitigation measures recommended in Section 8.0 are followed, the potential for indirect impacts to SWH function is considered mitigable.

7.5 Preliminary Impact Assessment Summary

The identification of a Preferred Option from a natural heritage perspective has been based on the relative degree to which each Alternative Option would encroach into NHFFs, or have the potential for direct or indirect impacts on NHFFs. Encroachment into a feature was considered a larger impact compared with no encroachment or works adjacent to a feature.

Based on the assessment, the Preferred Option recommended by Azimuth from a natural heritage perspective would be a watermain alignment footprint that extends south from 8th Street East to 6th Street East, west along 6th Street East to west of 1025 6th Street East, and then continues as Preferred Option #3 west of 1025 6th Street East and 1000/1010 Superior Street to the existing watermain along Superior Street. Preferred Option #3 would avoid impacts to Eastern Meadowlark habitat, wetlands (within or adjacent) and maintain the majority of SWH form and function for potential roosting bats. As per MECP (2021), Preferred Option #3 would not be considered a significant impact to habitat of SAR bats in the region. Preferred Option #3 would minimize impacts to the Candidate Significant Woodland. In addition, this option would avoid fragmentation of the FODM4-2 vegetation community (part of the Candidate Significant Woodland) and increasing possible edge effects for birds and local wildlife (Figure 3).

While Alternative Options #1 or #2 would be similarly mitigable as Preferred Option #3 in regards to possible impacts to SAR bats, these two options would most likely create some fragmentation effects of the Candidate Significant Woodland. In the case of Alternative Option #4, while the potential for impacts to the Candidate Significant Woodland, SAR bat habitat and SWH habitat for non-SAR bats would be minimal/avoidable/mitigable, this option would involve construction immediately adjacent to wetlands (Figure 3). Construction immediately adjacent to wetlands may increase the possibility of chemicals entering into the wetlands in the event of a spill or leak. Alternative Option #5 would be mitigable (*e.g.* timing windows) in terms of species impacts to Eastern Meadowlark; however, it would be associated with impacts to habitat for Eastern Meadowlark (Figure 3). It follows that Alternative Option #5 would require consultation with the MECP and possible habitat restoration/compensation. Other Wetlands would also be impacted under Alternative Option #5, likely triggering GSCA consultation and possible wetland restoration/compensation post-construction. Consequently, overall, Preferred Option #3 would be considered the solution that minimizes natural heritage impacts to the extent possible.

8.0 RECOMMENDATIONS

8.1 Species at Risk

It should be noted that absence of a protected species in the study area does not indicate that they will never occur in the area. Given the dynamic character of the natural environment, there is a constant variation in habitat use. Care should be taken in the interpretation of presence of species of concern, including those listed under the ESA. Changes to policy or the natural environment could result in shifts, removal or addition of new areas to the list of areas currently considered candidate NHFFs. This report is intended as a point in time assessment of the potential to impact SAR; not to provide long term “clearance” for SAR. While there is no expectation that the assessment should change significantly, it is the responsibility of the proponent to ensure that they are not in contravention of the ESA at the time property works are undertaken.

8.2 Migratory Breeding Birds and Bat Habitat

Activities involving removal of vegetation/trees should be restricted from occurring during the migratory bird breeding season. Migratory birds, nests and eggs are protected by the *Migratory Birds Convention Act*, 1994 (MBCA) and the *Fish and Wildlife Conservation Act,* 1997 (FWCA). Environment Canada outlines dates when activities in any region have potential to impact nests at the Environment Canada Website (https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/general-nesting-periods.html). In Zones C1 and C2, vegetation/tree clearing should be avoided between **April 1 and August 31** of a given year to avoid impacts to migratory birds.

According to MECP guidelines, the window during which tree removals should not occur to avoid potential impacts to SAR bats and/or SAR bat habitat protected under the ESA is April 1 to September 30. To ensure protection measures for *both* birds and bats, vegetation/tree removals should be avoided between **April 1 and September 30** of a given year.

8.3 Sediment and Erosion Controls

Diligent application of sediment and erosion controls based on Best Management Practices (BMPs) is recommended for future construction activities to minimize accidental or unavoidable impacts to adjacent vegetation communities (including Candidate Significant Woodlands, wetlands), bird, bat and wildlife habitat. Prior to commencement of site works, silt fencing should be applied along the length of the proposed work limits that are directly adjacent to natural or naturalized features. Routine inspection/maintenance of silt fencing is recommended (*e.g.* weekly or monthly) throughout future construction to help avoid the potential for impact to NHFFs. Soil stockpiles should be suitably isolated using sediment controls.

8.4 Operations

All maintenance activities required during future construction should be at least 30m away from woodlands, wetlands, habitat of SAR and SWH habitat, and follow BMPs at the time to prevent accidental spillage of deleterious substances that may harm natural environments. Snow fencing or equivalent should be installed around the perimeter of future work limits to prevent accidental intrusion of machinery operations into adjacent undisturbed natural areas.

9.0 CONCLUSIONS

Based on our analysis of NHFFs, it is concluded that Preferred Option #3 represents the least potential impact to environmental conditions in the study area through incorporation of the environmental protection measures described in Section 8.0. Given the NHFFs described resulting from the field program, Preferred Option #3 is Azimuth's recommendation as the most appropriate alignment for the City's watermain improvements in terms of minimizing impacts to NHFFs to the extent possible. While Alternative Options #1, #2 and #4 would be similar to the preferred option in some respects, they would have somewhat elevated natural heritage constraints related to either the Candidate Significant Woodland or wetlands. Due to Eastern Meadowlark habitat and wetlands, Alternative Option #5 would be associated with more substantial constraints relative to the other four options.

At this time, our findings are summarized as follows in regards to Preferred Option #3:

- Preferred Option #3 is consistent with policies/legislation of the ESA. Our impact assessment has given full consideration to habitat requirements of all SAR assumed and documented to occur in the area, and results indicate the Preferred

Option #3 will not result in unacceptable impacts to habitat of SAR, as identified in this study, providing conformance is demonstrated to mitigation measures described in Section 8.0;

- Preferred Option #3 is not expected to impact negatively the form or ecological function of Candidate Significant Woodland or Candidate SWH outlined in Section 5.0 if the appropriate mitigation measures outlined in Section 8.0 are followed; and,

- Proposed earth works or construction to implement watermain improvements at a future design stage may require additional assessment to confirm the potential for impacts to NHFFs.

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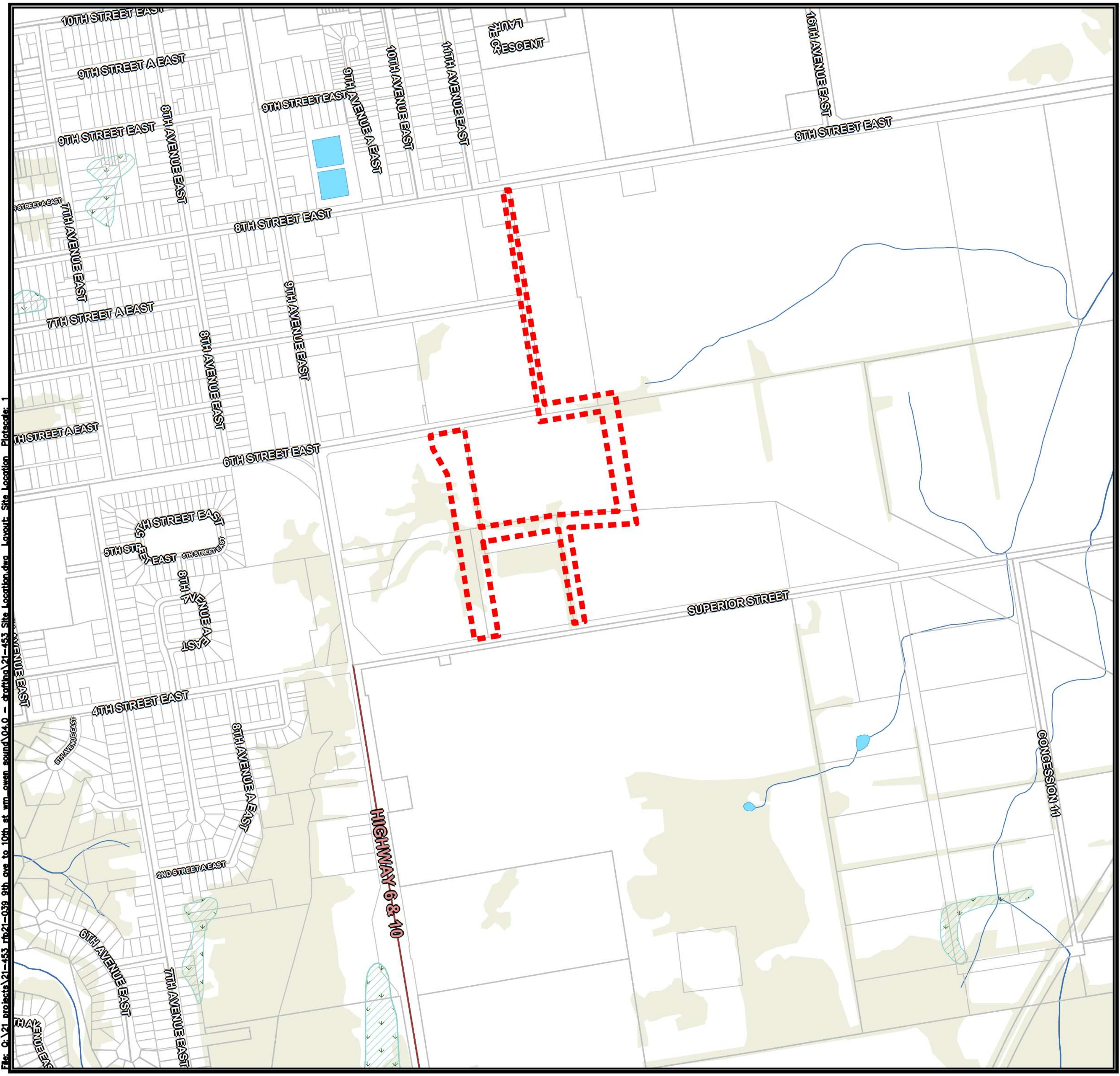
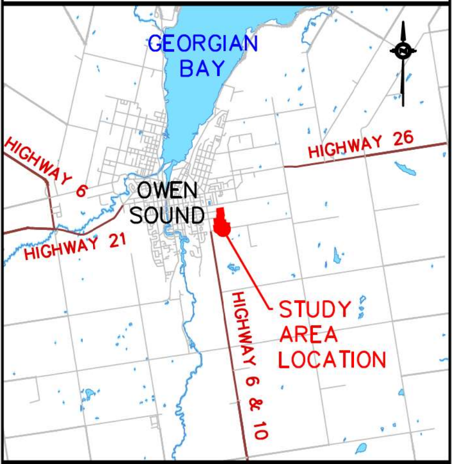


LEGEND:

- STUDY AREA BOUNDARY



REGIONAL MAP

SCALE 1:250000

0 250.0 500.0

HORIZONTAL SCALE 1:10000

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

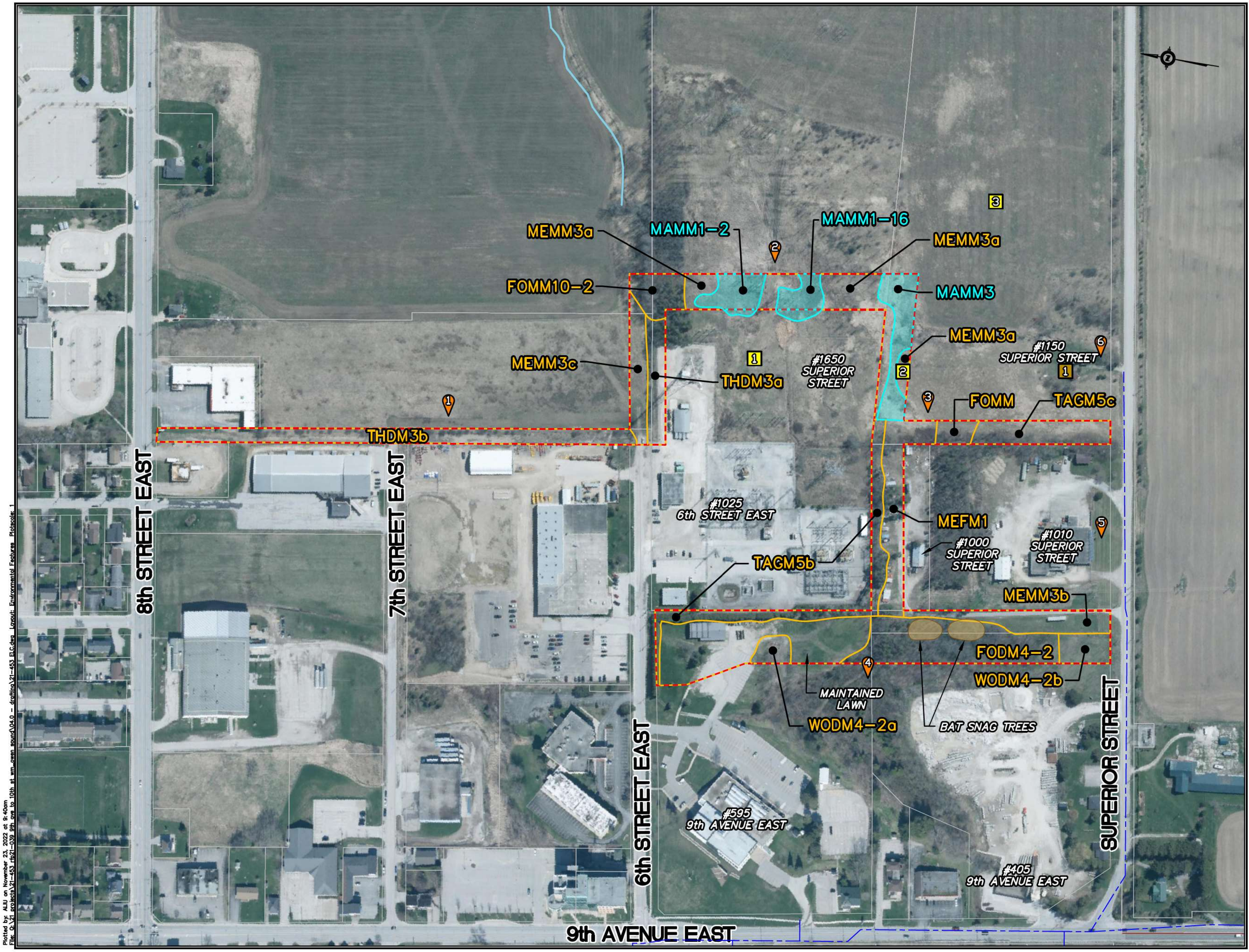
ENVIRONMENTAL ASSESSMENTS & APPROVALS

SITE LOCATION

RFP#21039 9th AVENUE TO 10th STREET E.
OWEN SOUND, ON

DATE ISSUED: *NOVEMBER 2022*	Figure No.
CREATED BY: *A.L.*	1
PROJECT NO.: *21-453*	
REFERENCE: *GREY COUNTY*	

Plotted by: AJIU on November 14, 2022 at 2:34pm
File: G:\21 projects\21-453 rfp21-039 9th ave to 10th st wm owen sound\04.0 – drafting\21-453 Site Location.dwg Layout: Site Location Plotscale: 1



Plotted by: ALIU on November 23, 2022 at 9:40am
File: Q:\21 projects\21-453 rfp21-039 9th ave to 10th st wm_owen sound\04.0 - drafting\21-453 ELC.dwg Layout: Environmental Features Plotscale: 1

LEGEND:

- APPROX. STUDY AREA
- WATERCOURSE (NDMNRF, 2021)

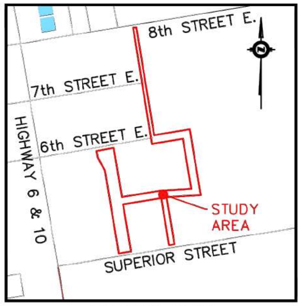
ELC UPLAND COMMUNITIES:

FODM4–2	DRY–FRESH WHITE ASH–HARDWOOD DECIDUOUS FOREST
FOMM	MIXED FOREST
FOMM10–2	FRESH–MOIST WHITE SPRUCE –HARDWOOD MIXED FOREST
MEFM1	DRY–FRESH FORB MEADOW
MEMM3	DRY–FRESH MIXED MEADOW
TAGM5	FENCEROW
THDM3	DRY–FRESH DECIDUOUS HEDGEROW
WODM4–2	WHITE–ASH DECIDUOUS WOODLAND THICKET

ELC WETLAND COMMUNITIES:

MAMM1–2	CATTAIL GRAMINOID MINERAL MEADOW MARSH
MAMM1–16	MIXED GRAMINOID MINERAL MEADOW MARSH
MAMM3	MIXED MINERAL MEADOW MARSH

●	DAWN BREEDING BIRD POINT COUNT STATION
■	EASTERN MEADOWLARK
■	EASTERN WOOD–PEWEE
●	BAT SNAG TREE AREA



LOCATION PLAN

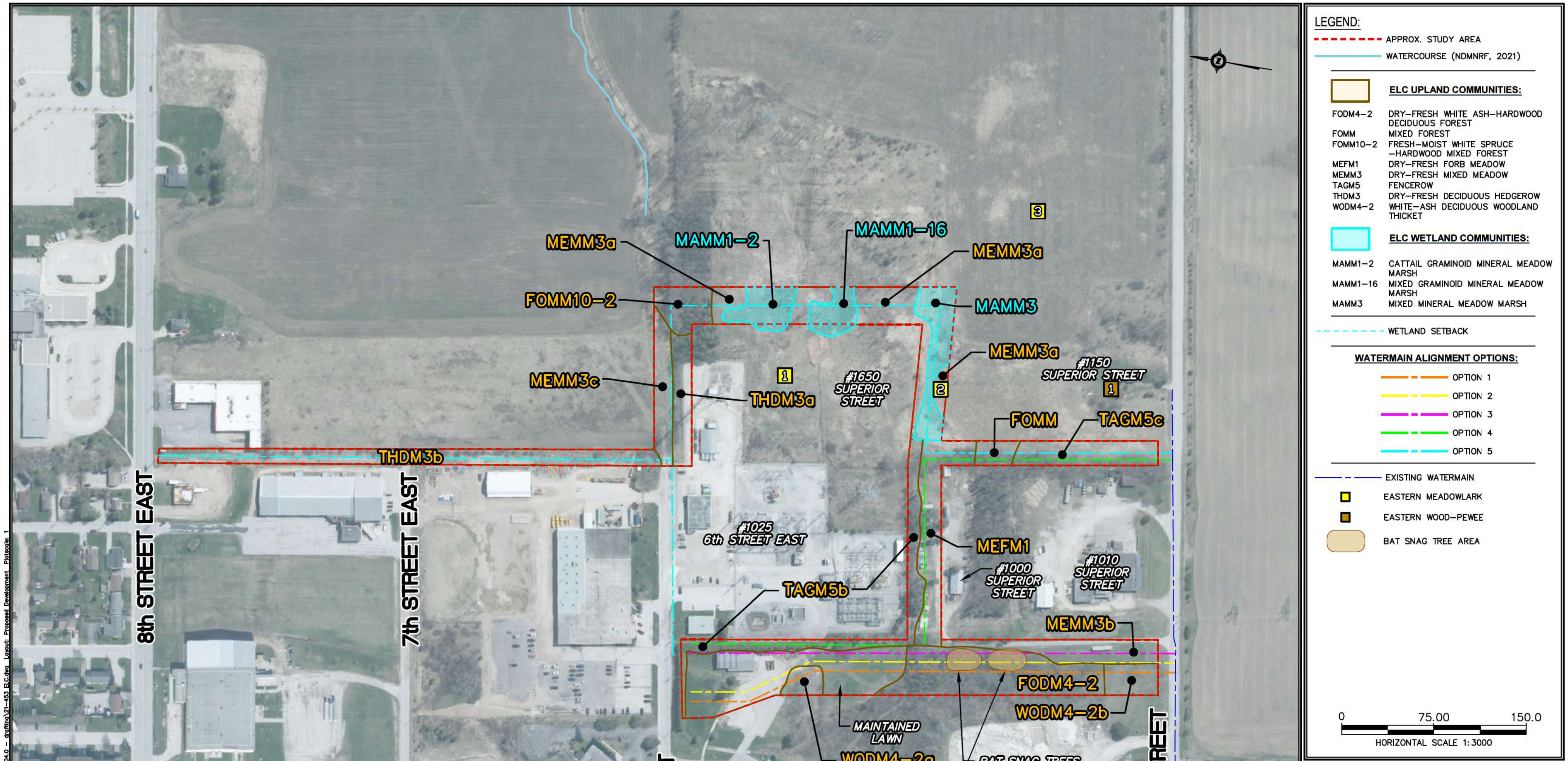
0 75.00 150.0
HORIZONTAL SCALE 1:3000

AZIMUTH ENVIRONMENTAL CONSULTING, INC.
ENVIRONMENTAL ASSESSMENTS & APPROVALS

ENVIRONMENTAL FEATURES

RFP#21039 9th AVENUE TO 10th STREET E.
OWEN SOUND, ON

DATE ISSUED:	NOVEMBER 2022	Figure No.
CREATED BY:	A.L.	2
PROJECT NO.:	21-453	
REFERENCE:	GREY COUNTY	



AZIMUTH ENVIRONMENTAL CONSULTING, INC.
ENVIRONMENTAL ASSESSMENTS & APPROVALS

PROPOSED DEVELOPMENT

RFP#21039 9th AVENUE TO 10th STREET E.
OWEN SOUND, ON

DATE ISSUED:	NOVEMBER 2022	Figure No.
CREATED BY:	A.L.	3
PROJECT NO.:	21-453	
REFERENCE:	GREY COUNTY	

Plotted by: ALIU on November 23, 2022 at 9:40am
File: Q:\21 projects\21-453 rfp21-039 9th ave to 10th st wm_owen sound\04.0 - drafting\21-453 ELC.dwg Layout: Proposed Development Plotscale: 1

Table 1: Species at Risk Habitat Summary

Common Name	Species Name	ESA	SARA	Key Habitats Used By Species[1]	Initial Assessment
Bald Eagle	*Haliaeetus leucocephalus*	SC	No status	Nests are typically found near the shoreline of lakes or large rivers, often on forested islands (Cadman *et al* ., 2007). ESA Protection: N/A	Study area not near shorelines of lakes or large rivers, or forested islands. Species not observed during surveys.
Barn Swallow	*Hirundo rustica*	THR	THR	Ledges and walls of man-made structures such as buildings, barns, boathouses, garages, culverts and bridges. Also nest in caves, holes, crevices and cliff ledges (COSEWIC, 2011a). ESA Protection: Species and general habitat protection	No suitable old buildings, barns, box culverts, bridges *etc* .in the study area or on adjacent lands. Species not observed.
Black Ash	*Fraxinus nigra*	END	No status	Facultative wetland tree species frequently found in floodplain forests, swamps, seepage areas, shoreline margins and fens. Occupied sites are generally seasonally-flooded (COSEWIC, 2018). ESA Protection: Species and general habitat protection (ESA protections take effect January 27, 2024)	Key habitat requirements not found in the study area. Species not observed.
Black Tern	*Chlidonias niger*	SC	No status	Colonial nesters typically found within marshes. Its preferred nesting habitat is a hemi-marsh (*i.e.* a wetland with 50:50 open water and emergent vegetation). Nests are usually built on an upturned cattail root, floating vegetation mat or patch of mud (Cadman *et al* , 2007). ESA Protection: N/A	Small isolated patches of marsh habitat present in MAMM3 ELC ploygon, but not considered suitable for species (e.g. not hemi-marsh habitat). Species not found during surveys.
Bobolink	*Dolichonyx oryzivorus*	THR	THR	Nests primarily in forage crops (*e.g.* hayfields and pastures) dominated by a variety of species such as clover, Timothy, Kentucky Bluegrass, tall grass, and broadleaved plants. Also occurs in wet prairie, graminoid peatlands, and abandoned fields dominated by tall grasses. Does not generally occupy fields of row crops (*e.g* . corn, soybeans, wheat) or short-grass prairie. Sensitive to habitat size and has lower reproductive success in small habitat fragments (COSEWIC, 2010a). ESA Protection: Species and general habitat protection	NHIC records exist in 1km grid squares 17NK0634 and 17NK0635 (Appendix B). Potentially Ssuitable habitat for species present in study area in MEMM3 ELC polygon, but species was not observed in study area or on adjacent lands. Not considered further in our assessment.
Butternut	*Juglans cinerea*	END	END	Commonly found in riparian habitats, but is also found in rich, moist, well-drained loams, and well-drained gravels. Butternut is intolerant of shade (COSEWIC, 2003a). ESA Protection: Species and general habitat protection	Species not observed.
Chimney Swift	*Chaetura pelagica*	THR	THR	Nests primarily in chimneys though some populations (*i.e* . in rural northern areas) may nest in cavity trees (COSEWIC, 2007a). Recent changes in chimney design may be a significant factor in recent declines in numbers (Cadman *et al* ., 2007). ESA Protection: Species and general habitat protection	NHIC records exist in 1km grid squares 17NK0535 (Appendix B) but species was not observed in study area or on adjacent lands during field program. Not considered further in our assessment.

Table 1: Species at Risk Habitat Summary

Common Name	Species Name	ESA	SARA	Key Habitats Used By Species[1]	Initial Assessment
Eastern Meadowlark	*Sturnella magna*	THR	THR	Most common in grassland, pastures, savannahs, as well as anthropogenic grassland habitats, including hayfields, weedy meadows, young orchards, golf courses, restored surface mines, *etc* . Occasionally nest in row crop fields such as corn and soybean, but there are considered low-quality habitat. Large tracts of grassland are preferred over smaller fragments and the minimum area required is estimated at 5ha (COSEWIC, 2011b). ESA Protection: Species and general habitat protection	**NHIC records exist in 1km grid squares 17NK0533, 17NK0534, 17NK0535, 17NK0635 and 17NK0635 (Appendix B). Suitable habitat present in study area and species was observed. Considered further in main text.**
Eastern Prairie Fringed-orchid	*Platanthera leucophaea*	END	END	It is a species primarily of mesic prairies, fens and old fields (COSEWIC, 2003b). ESA Protection: Species and regulated habitat protection	Species not observed.
Eastern Small-footed Myotis	*Myotis leibii*	END	END	Generally occurs in mountainous or rocky regions as well as in buildings, on the face of rock bluffs and beneath slabs of rock and stones. Hibernation is typically confined to caves and old mines (Best and Jennings, 1997). ESA Protection: Species and general habitat protection	Key roosting habitat requirements not found. Hibernation habitat not present.
Eastern Ribbonsnake	*Thamnophis sauritus*	SC	SC	Found in wetland habitats with both flowing and standing water such as marshes, bogs, fens, ponds, lake shorelines and wet meadows. Most sightings occur near the water's edge (COSEWIC, 2012a). ESA Protection: N/A	Habitat requirements not met in study area. Wetland areas present are small and do not have flowing and standing water.
Eastern Wood-pewee	*Contopus virens*	SC	SC	Mostly in mature and intermediate-age deciduous and mixed forests having an open understory. It is often associated with forests dominated by Sugar Maple and oak. Usually associated with forest clearings and edges within the vicinity of its nest (COSEWIC, 2012d). ESA Protection: N/A	**Habitat generally not present in study area, but species detected at one location adjacent. Considered further in main text.**
Hart's-tongue Fern	*Asplenium scolopendrium* var. *americanum*	SC	SC	Grows on calcareous rocks in deep shade on slopes in deciduous forest. Most occurrences are in maple-beech forest (MECP, 2022). ESA Protection: N/A	Suitable habitat for species not present and species not observed.
Henslow's Sparrow	*Ammodramus henslowii*	END	END	Requires grassland habitat and occurs more frequently and at higher densities in large patches of suitable habitat. Nests in tallgrass prairie, wet meadow, and marsh habitats as well as agricultural grasslands, lightly grazed pasture and grasslands on reclaimed surface mines (COSEWIC, 2011c). ESA Protection: Species and general habitat protection	Grassland habitat of suitable size for species not present in study area. Species not observed.
King Rail	*Rallus elegans*	END	END	Wide variety of freshwater marsh habitat types with cattails. Large marshes, especially those that contain a range of water level conditions and a mosaic of habitats, are preferred (COSEWIC, 2011d). ESA Protection: Species and general habitat protection	Suitable habitat for species not present and species not observed.

Table 1: Species at Risk Habitat Summary

Common Name	Species Name	ESA	SARA	Key Habitats Used By Species[1]	Initial Assessment
Least Bittern	*Ixobrychus exilis*	THR	THR	Breed strictly in marshes of emergents (usually cattails) that have relatively stable water levels and interspersed areas of open water (COSEWIC, 2009a). ESA Protection: Species and general habitat protection	Suitable habitat for species not present and species not observed.
Little Brown Myotis	*Myotis lucifugus*	END	END	Forests and regularly aging human structures as maternity roost sites. Regularly associated with attics of older buildings and barns for summer maternity roost colonies. Overwintering sites are characteristically mines or caves (MNRF, 2014) (COSEWIC, 2013a). ESA Protection: Species and general habitat protection	**Key habitat requirements for the species, including potential candidate trees with suitable bat snag features, occur in FODM4-2 ELC polygon in the study area. Species has potential to occur. Considered further in main text.**
Loggerhead Shrike	*Lanius ludovicianus*	END	END (*mirgrans* subspecies)	Breeding habitat characterized by open areas dominated by grasses and/or forbs, interspersed with scattered shrubs or small trees and bare ground. Suitable habitat includes pasture, old fields, prairie, savannah, pinyon-juniper woodland, shrub-steppe and alvar (COSEWIC, 2014). ESA Protection: Species and general habitat protection	Some open habitat present in study area and on adjacent lands, but scattered shrubs/small trees generally absent. Species not observed.
Louisiana Waterthrush	*Parkesia motacilla*	THR	SC	Occupies specialized habitat, showing a strong preferences for nesting and wintering along relatively pristine headwater streams and wetlands situated in large tracts of mature forest. Prefers running water, but also inhabits heavily wooded swamps and vernal or semi-permanent pools (COSEWIC, 2015).	Suitable habitat for species not present and species not observed.
Massasauga (Great Lakes - St. Lawrence population)	*Sistrurus catenatus*	THR	THR	In Georgian Bay, Massasaugas use bedrock barrens, conifer swamps, beaver meadows, fens, bogs, and shoreline habitats. On the upper Bruce Peninsula, forested habitats are used during hibernation and open, wetland, and edge habitat with canopy closure <50% in mid-late summer (COSEWIC, 2012b). ESA Protection: Species and general habitat protection	Study area over 2km from Georgian Bay. Suitable habitat not present in study area.
Monarch	*Danaus plexippus*	SC	SC	Breeding habitat is confined to sites where milkweeds, the sole food of caterpillars, grow. Milkweeds grow in a variety of environments, including meadows in farmlands, along roadsides and in ditches, open wetlands, dry sandy areas, short and tall grass prairie, river banks, irrigation ditches, arid valleys, and south-facing hills (COSEWIC, 2010b). ESA Protection: N/A	**Common Milkweed present in the study area but species not observed. Considered further in main text.**
Northern Brook Lamprey	*Ichthyomyzon fossor*	SC	SC	Inhabits clear, coolwater streams. Adults are found in fast flowing riffles comprised of rock or gravel (MECP, 2022). ESA Protection: N/A	NHIC records exist in 1km grid squares 17NK0533, 17NK0534, 17NK0535, 17NK0635 and 17NK0635 (Appendix B). Watercourses not present in study area. Not considered further in our assessment.
Northern Myotis	*Myotis septentrionalis*	END	END	Maternity roost sites are generally located within deciduous and mixed forests and focused in snags including loose bark and cavities of trees. Overwintering sites are characteristically mines or caves (COSEWIC, 2013a). ESA Protection: Species and general habitat protection	**Key habitat requirements for the species, including potential candidate trees with suitable bat snag features, occur in FODM4-2 ELC polygon in the study area. Species has potential to occur. Considered further in main text.**

Table 1: Species at Risk Habitat Summary

Common Name	Species Name	ESA	SARA	Key Habitats Used By Species[1]	Initial Assessment
Peregrine Falcon	*Falco peregrinus*	SC	SC (*anatum/tundrius*)	Most nest on cliff ledges or crevices, but some will use tall buildings or bridges near good foraging areas. Nests are typically close to bodies of water (COSEWIC, 2007b). ESA Protection: N/A	No suitable habitat present in study area or on adjacent lands. Species not observed.
Redside Dace	*Clinostomus elongatus*	END	END	Found in pools and slow-flowing sections of relatively small, clear headwater streams with both pool and riffle habitats and a moderate to high gradient. These streams typically flow through meadows, pasture or shrub overstory, and have abundant overhanging riparian vegetation (COSEWIC, 2007c). ESA Protection: Species and regulated habitat protection.	No watercourses in study area.
Snapping Turtle	*Chelydra serpentina*	SC	SC	Habitat is characterized by slow-moving water with a soft mud bottom and dense aquatic vegetation. Often located in ponds, sloughs, shallow bays or river edges and slow streams, or areas combining several of these wetland habitats (COSEWIC, 2008a). ESA Protection: N/A	NHIC records exist in 1km grid squares 17NK0533 and 17NK0633 (Appendix B), but habitat not present in study area. MAMM wetlands unsuitable due to lack of standing water, basking/foraging function. Not considered further in our assessment.
Tri-colored Bat	*Perimyotis subflavus*	END	END	Maternity roost sites include forests and modified landscapes (barns or human-made structures). Overwintering sites include mines and caves (COSEWIC, 2013a). ESA Protection: Species and general habitat protection	**Key habitat requirements for the species, including potential candidate trees with suitable bat snag features, occur in FODM4-2 ELC polygon in the study area. Species has potential to occur. Considered further in main text.**
Tuberous Indian-plantain	*Arnoglossum plantagineum*	SC	SC	Prefer open sunny areas in wet, calcareous meadows or shoreline fens (COSEWIC, 2002a). ESA Protection: N/A	Species not observed.

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[1] Habitat as outlined within the MNRF's Species at Risk in Ontario website files (https://www.ontario.ca/environment-and-energy/species-risk-ontario-list), or Species Specific COSEWIC Reports referenced in this document.

Species at Risk in Ontario List (June 13, 2017)

Best, T., and J. Jennings. 1997. Mammalian Species, *Myotis leibii* . The American Society of Mammalogists. No. 547, pp. 1-6, 5 figs.

Cadman, M., D. Sutherland, G. Beck, D. Lepage and A. Couturier. 2007. Atlas of the Breeding Birds of Ontario 2001-2005. Bird Studies

COSEWIC. 2002a. COSEWIC assessment and update status report on the Tuberous Indian-plantain *Arnoglossum plantagineum* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 11 pp.

COSEWIC 2003a. COSEWIC assessment and status report on the Butternut *Juglans cinerea* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 32 pp.

COSEWIC. 2003b. COSEWIC assessment and update status report on the Eastern Prairie Fringed-orchid *Platanthera leucophaea* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 27 pp.

COSEWIC. 2007a. COSEWIC assessment and update status report on the Chimney Swift *Chaetura pelagic* a in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 49 pp.

COSEWIC. 2007b. COSEWIC assessment and status report on the Peregrine Falcon *Falco peregrinus* (*pealei* subspecies - *Falco peregrinus* and *pealei anatum/tundrius* - *Falco peregrinus anatum/tundrius*) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 45 pp.

COSEWIC. 2007c. COSEWIC assessment and update status report on the Redside Dace *Clinostomus elongates* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 59 pp.

COSEWIC. 2008a. COSEWIC assessment and status report on the Snapping Turtle *Chelydra serpentina* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 47 pp.

COSEWIC. 2009a. COSEWIC assessment and update status report on the Least Bittern *Ixobrychus exilis* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 36 pp.

COSEWIC. 2010a. COSEWIC assessment and update status report on the Bobolink *Dolichonyx oryzivorus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 42 pp.

COSEWIC. 2010b. COSEWIC assessment and status report on the Monarch *Danaus plexippus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 43 pp.

COSEWIC. 2011a. COSEWIC assessment and update status report on the Barn Swallow *Hirundo rustica* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. ix + 37 pp.

COSEWIC. 2011b. COSEWIC assessment and update status report on the Eastern Meadowlark *Sturnella magna* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 40 pp.

COSEWIC. 2011c. COSEWIC assessment and update status report on the Henslow's Sparrow *Ammodramus henslowii* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 37 pp.

COSEWIC. 2011d. COSEWIC assessment and update status report on the King Rail *Rallus elegan* s in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 32 pp.

COSEWIC. 2012a COSEWIC assessment and status report on the Eastern Ribbonsnake *Thamnophis sauritus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xii + 39 pp.

COSEWIC. 2012b. COSEWIC assessment and update status report on the Massasauga *Sistrurus catenatus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xiii + 84 pp.

COSEWIC. 2013a. COSEWIC assessment and update status report on the Little Brown Myotis *Myotis lucifugus* , Northern Myotis *Myotis septentrionalis* and Tri-colored Bat *Perimyotis subfalvus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xxiv + 93 pp.

COSEWIC. 2014. COSEWIC assessment and update status report on the Loggerhead Shrike *Lanius ludovicianus* ssp. and the Prairie subspecies *Lanius ludovicianus excubitorides* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xiii + 51 pp.

Table 1: Species at Risk Habitat Summary

Common Name	Species Name	ESA	SARA	Key Habitats Used By Species[1]	Initial Assessment

COSEWIC. 2015. COSEWIC assessment and status report on the Louisiana Waterthrush *Parkesia motacilla* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xi + 58 pp.
COSEWIC. 2018. COSEWIC assessment and status report on the Black Ash *Fraxinus nigra* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xii + 95 pp.
Ministry of the Environment, Conservation and Parks (MECP). 2022. Species at Risk in Ontario (https://www.ontario.ca/page/species-risk-ontario)
Ministry of Natural Resources and Forestry (MNRF). 2014. Eastern Small-footed Bat. Queen's Printer for Ontario. https://www.ontario.ca/environment-and-energy/eastern-small-footed-bat

Table 2a: Vascular Plant Species List, Owen Sound Class EA

Surveyor: Adam McClelland

			Vegetation Communities[2]															Conservation Rankings[3]		
FAMILY[1]	SCIENTIFIC NAME[1]	COMMON NAME[1]	MEMM3a	MAMM1-2	MAMM3	TAGM5a	FOMM10-2	THDM3a	THDM3b	FODM4-2	WODM4-2a	TAGM5b	WODM4-2b	MEMM3b	MEFM1	FOMM	TAGM5c	GRANK	SRANK	TRACK
Aceraceae	*Acer negundo*	Manitoba Maple	X			X		X		X		X			X	X		G5	S5	N
Aceraceae	*Acer platanoides*	Norway Maple				X				X					X			GNR	SE5	N
Aceraceae	*Acer saccharum*	Sugar Maple				X				X	X			X			X	G5	S5	N
Anacardiaceae	*Rhus typhina*	Staghorn Sumac	X							X				X				G5	S5	N
Anacardiaceae	*Toxicodendron radicans var. radicans*	Eastern Poison Ivy	X			X												G5T5	S5	N
Apiaceae	*Anthriscus sylvestris*	Wild Chervil	X							X				X	X			GNR	SE4?	N
Apiaceae	*Daucus carota*	Wild Carrot	X				X	X	X	X	X	X	X	X	X	X	X	GNR	SE5	N
Apocynaceae	*Asclepias syriaca*	Common Milkweed	X					X			X							G5	S5	N
Apocynaceae	*Vinca minor*	Lesser Periwinkle					X	X		X							X	GNR	SE5	N
Asteraceae	*Achillea millefolium*	Common Yarrow	X							X								G5	SE5?	N
Asteraceae	*Ambrosia artemisiifolia*	Common Ragweed										X		X	X		X	G5	S5	N
Asteraceae	*Arctium minus*	Common Burdock				X	X						X				X	GNR	SE5	N
Asteraceae	*Centaurea jacea*	Brown Knapweed	X	X		X		X	X	X	X	X	X	X	X		X	GNR	SE5	N
Asteraceae	*Cichorium intybus*	Wild Chicory				X		X	X			X		X	X		X	GNR	SE5	N
Asteraceae	*Cirsium arvense*	Canada Thistle											X	X				G5	SE5	N
Asteraceae	*Cirsium vulgare*	Bull Thistle					X					X				X	X	GNR	SE5	N
Asteraceae	*Erigeron annuus*	Annual Fleabane								X	X			X	X		X	G5	S5	N
Asteraceae	*Erigeron canadensis*	Canada Horseweed	X						X						X		X	G5	S5	N
Asteraceae	*Erigeron philadelphicus*	Philadelphia Fleabane	X															G5	S5	P
Asteraceae	*Euthamia graminifolia*	Grass-leaved Goldenrod			X													G5	S5	N
Asteraceae	*Eutrochium maculatum var. maculatum*	Spotted Joe Pye Weed		X														G5T5	S5	N
Asteraceae	*Lapsana communis*	Common Nipplewort				X	X			X								GNR	SE5	N
Asteraceae	*Leucanthemum vulgare*	Oxeye Daisy	X						X		X	X			X			GNR	SE5	N
Asteraceae	*Solidago canadensis var. canadensis*	Canada Goldenrod	X		X	X		X	X	X	X	X	X	X	X		X	G5T5	S5	N
Asteraceae	*Solidago gigantea var. gigantea*	Giant Goldenrod	X					X	X	X	X	X	X	X				G5T5	S5	N
Asteraceae	*Sonchus arvensis ssp. arvensis*	Glandular Sow-thistle	X						X		X	X			X			GNRTNR	SE5	N
Asteraceae	*Symphyotrichum cordifolium*	Heart-leaved Aster								X		X				X	X	G5	S5	N
Asteraceae	*Symphyotrichum lanceolatum ssp. lanceola*	Eastern Panicled Aster	X		X	X	X		X	X		X	X			X	X	G5T5	S5	P
Asteraceae	*Symphyotrichum lateriflorum*	Calico Aster					X											G5	S5	P
Asteraceae	*Symphyotrichum novae-angliae*	New England Aster			X	X		X	X			X	X					G5	S5	N
Asteraceae	*Symphyotrichum sp.*	an Aster												X				N/A	N/A	N/A
Asteraceae	*Tanacetum vulgare*	Common Tansy												X				GNR	SE5	N
Asteraceae	*Tragopogon pratensis*	Meadow Goatsbeard	X										X	X				GNR	SE5	N
Asteraceae	*Tussilago farfara*	Coltsfoot		X	X	X				X	X	X		X	X	X		GNR	SE5	N
Brassicaceae	*Alliaria petiolata*	Garlic Mustard				X									X		X	GNR	SE5	N
Brassicaceae	*Erysimum cheiranthoides*	Wormseed Wallflower										X						G5	S5?	N
Brassicaceae	*Hesperis matronalis*	Dame's Rocket							X			X		X	X			G4G5	SE5	N
Brassicaceae	*Lepidium campestre*	Field Peppergrass													X			GNR	SE5	N
Brassicaceae	*Thlaspi arvense*	Field Pennycress										X						GNR	SE5	N
Caprifoliaceae	*Lonicera sp.*	a Honeysuckle														X		N/A	N/A	N/A
Caprifoliaceae	*Lonicera tatarica*	Tatarian Honeysuckle					X			X	X	X	X			X	X	GNR	SE5	N
Caprifoliaceae	*Viburnum lentago*	Nannyberry	X															G5	S5	N
Caprifoliaceae	*Viburnum opulus*	Cranberry Viburnum	X			X	X		X	X				X		X		G5	S5	N
Caprifoliaceae	*Viburnum rafinesqueanum*	Downy Arrowwood				X												G5	S5	N
Caryophyllaceae	*Saponaria officinalis*	Bouncing-bet												X				GNR	SE5	N

Table 2a: Vascular Plant Species List, Owen Sound Class EA Surveyor: Adam McClelland 1

			Vegetation Communities[2]															Conservation Rankings[3]		
FAMILY[1]	**SCIENTIFIC NAME[1]**	**COMMON NAME[1]**	**MEMM3a**	**MAMM1-2**	**MAMM3**	**TAGM5a**	**FOMM10-2**	**THDM3a**	**THDM3b**	**FODM4-2**	**WODM4-2a**	**TAGM5b**	**WODM4-2b**	**MEMM3b**	**MEFM1**	**FOMM**	**TAGM5c**	**GRANK**	**SRANK**	**TRACK**
Caryophyllaceae	*Silene vulgaris*	Bladder Campion											X	X	X			GNR	SE5	N
Chenopodiaceae	*Chenopodium album*	Common Lamb's-quarters										X						G5	SE5	N
Convolvulaceae	*Convolvulus arvensis*	Field Bindweed												X				GNR	SE5	N
Cornaceae	*Cornus alternifolia*	Alternate-leaved Dogwood								X		X				X		G5	S5	N
Cornaceae	*Cornus racemosa*	Grey Dogwood	X															G5	S5	N
Cornaceae	*Cornus sericea*	Red-osier Dogwood	X	X	X	X	X	X	X		X	X			X	X		G5	S5	N
Cupressaceae	*Thuja occidentalis*	Eastern White Cedar	X				X	X		X		X						G5	S5	N
Cyperaceae	*Carex lasiocarpa*	Woolly-fruit Sedge									X							G5	S5	N
Cyperaceae	*Carex retrorsa*	Retrorse Sedge		X														G5	S5	N
Cyperaceae	*Carex stipata*	Awl-fruited Sedge		X														G5	S5	N
Cyperaceae	*Carex viridula*	Greenish Sedge		X														G5	S5	N
Cyperaceae	*Carex vulpinoidea*	Fox Sedge	X	X					X									G5	S5	N
Cyperaceae	*Scirpus atrovirens*	Dark-green Bulrush	X	X							X							G5	S5	N
Cyperaceae	*Scirpus microcarpus*	Red-tinged Bulrush		X														G5	S5	N
Equisetaceae	*Equisetum arvense*	Field Horsetail	X	X	X	X	X			X	X	X			X	X		G5	S5	N
Euphorbiaceae	*Euphorbia esula*	Leafy Spurge										X						GNRTNR	SE	
Fabaceae	*Lathyrus latifolius*	Everlasting Pea	X					X										GNR	SE4	N
Fabaceae	*Lotus corniculatus*	Garden Bird's-foot Trefoil	X					X	X		X	X		X	X		X	GNR	SE5	N
Fabaceae	*Medicago lupulina*	Black Medick	X									X			X			GNR	SE5	N
Fabaceae	*Melilotus albus*	White Sweet-clover	X					X	X					X	X		X	G5	SE5	N
Fabaceae	*Robinia pseudoacacia*	Black Locust															X	G5	SE5	N
Fabaceae	*Trifolium pratense*	Red Clover	X											X	X			GNR	SE5	N
Fabaceae	*Trifolium repens*	White Clover													X			GNR	SE5	N
Fabaceae	*Vicia cracca*	Tufted Vetch	X	X				X	X	X			X	X				GNR	SE5	N
Fagaceae	*Quercus rubra*	Northern Red Oak										X						G5	S5	N
Geraniaceae	*Geranium robertianum*	Herb-Robert								X						X	X	G5	S5	N
Grossulariaceae	*Ribes cynosbati*	Eastern Prickly Gooseberry								X						X		G5	S5	N
Iridaceae	*Iris versicolor*	Harlequin Blue Flag	X															G5	S5	N
Juglandaceae	*Juglans nigra*	Black Walnut	X			X				X				X				G5	S4?	N
Juncaceae	*Juncus brevicaudatus*	Short-tailed Rush		X	X													G5	S5	N
Juncaceae	*Juncus canadensis*	Canada Rush		X														G5	S5	N
Juncaceae	*Juncus effusus*	Soft Rush		X														G5	S5	N
Juncaceae	*Juncus tenuis*	Path Rush	X	X														GNR	S5	N
Lamiaceae	*Clinopodium vulgare ssp. vulgare*	Wild Basil					X			X			X					G5T5	S5	N
Lamiaceae	*Prunella vulgaris ssp. vulgaris*	Common Self-heal		X					X	X	X					X		G5TU	SE3	N
Liliaceae	*Asparagus officinalis*	Garden Asparagus	X															G5?	SE5	N
Liliaceae	*Convallaria majalis*	European Lily-of-the-valley					X			X				X				G5	SE5	N
Liliaceae	*Hemerocallis fulva*	Orange Daylily															X	GNA	SE5	N
Liliaceae	*Maianthemum stellatum*	Star-flowered False Solomon's Seal															X	G5	S5	N
Lythraceae	*Lythrum salicaria*	Purple Loosestrife	X	X														G5	SE5	N
Malvaceae	*Malva moschata*	Musk Mallow					X											GNR	SE5	N
Oleaceae	*Fraxinus americana*	White Ash	X		X	X	X	X	X	X	X	X	X	X	X	X	X	G4	S4	N
Oleaceae	*Fraxinus pennsylvanica*	Red Ash	X		X													G4	S4	N
Oleaceae	*Syringa vulgaris*	Common Lilac								X		X						GNR	SE5	N
Onagraceae	*Circaea canadensis*	Broad-leaved Enchanter's Nightshade	X															G5	S5	N

Table 2a: Vascular Plant Species List, Owen Sound Class EA Surveyor: Adam McClelland 1

			Vegetation Communities[2]															Conservation Rankings[3]		
FAMILY[1]	**SCIENTIFIC NAME[1]**	**COMMON NAME[1]**	**MEMM3a**	**MAMM1-2**	**MAMM3**	**TAGM5a**	**FOMM10-2**	**THDM3a**	**THDM3b**	**FODM4-2**	**WODM4-2a**	**TAGM5b**	**WODM4-2b**	**MEMM3b**	**MEFM1**	**FOMM**	**TAGM5c**	**GRANK**	**SRANK**	**TRACK**
Onagraceae	*Epilobium parviflorum*	Small-flowered Hairy Willowherb		X	X													GNR	SE4	N
Onagraceae	*Oenothera biennis*	Common Evening-primrose						X			X	X			X		X	G5	S5	N
Pinaceae	*Abies balsamea*	Balsam Fir					X	X									X	G5	S5	N
Pinaceae	*Picea glauca*	White Spruce				X	X	X				X						G5	S5	N
Pinaceae	*Pinus resinosa*	Red Pine					X	X										G5	S5	N
Pinaceae	*Pinus sylvestris var. sylvestris*	Scots Pine	X		X	X				X		X		X	X	X		GNRTNR	SE5	N
Plantaginaceae	*Plantago lanceolata*	English Plantain									X	X		X	X			G5	SE5	N
Plantaginaceae	*Plantago major*	Common Plantain									X	X		X	X			G5	SE5	N
Poaceae	*Agrostis stolonifera*	Creeping Bentgrass												X				G5	SE5	N
Poaceae	*Andropogon gerardi*	Big Bluestem		X														G5	S4	N
Poaceae	*Bromus inermis*	Smooth Brome	X			X		X	X		X	X	X	X		X		G5T5	SE5	N
Poaceae	*Dactylis glomerata*	Orchard Grass	X				X	X	X		X	X	X	X	X	X	X	GNR	SE5	N
Poaceae	*Elymus repens*	Quackgrass	X									X						GNR	SE5	N
Poaceae	*Leersia oryzoides*	Rice Cutgrass														X		G5	S5	N
Poaceae	*Lolium arundinaceum*	Tall Ryegrass	X					X	X					X	X		X	GNR	SE5	N
Poaceae	*Panicum capillare*	Common Panicgrass													X			G5	S5	N
Poaceae	*Phalaris arundinacea*	Reed Canarygrass	X	X	X	X		X	X			X		X		X		G5	S5	N
Poaceae	*Phleum pratense*	Common Timothy	X		X				X				X	X				GNR	SE5	N
Poaceae	*Phragmites australis ssp. australis*	European Reed	X		X													G5T5	SE5	N
Poaceae	*Setaria pumila*	Yellow Foxtail										X						GNR	SE5	N
Polygonaceae	*Reynoutria japonica*	Japanese Knotweed				X											X	GNR	SE5	N
Polygonaceae	*Rumex crispus*	Curled Dock	X						X			X		X	X		X	GNR	SE5	N
Polygonaceae	*Rumex obtusifolius*	Bitter Dock														X		GNR	SE5	N
Ranunculaceae	*Anemonastrum canadense*	Canada Anemone															X	G5	S5	N
Ranunculaceae	*Ranunculus acris*	Common Buttercup	X	X	X	X	X			X	X	X		X	X	X		G5	SE5	N
Rhamnaceae	*Frangula alnus*	Glossy Buckthorn																GNR	SE5	N
Rhamnaceae	*Rhamnus cathartica*	European Buckthorn	X			X	X	X	X	X	X		X			X	X	GNR	SE5	N
Rosaceae	*Crataegus coccinea var. coccinea*	Scarlet Hawthorn					X	X	X							X		G5	S4	N
Rosaceae	*Fragaria virginiana*	Wild Strawberry	X			X				X	X	X	X			X		G5	S5	N
Rosaceae	*Geum aleppicum*	Yellow Avens				X				X						X		G5	S5	N
Rosaceae	*Malus pumila*	Common Apple							X									G5	SE4	N
Rosaceae	*Potentilla anserina ssp. anserina*	Common Silverweed										X		X				G5T5	S5	N
Rosaceae	*Potentilla norvegica*	Rough Cinquefoil													X			G5	S5	N
Rosaceae	*Potentilla recta*	Sulphur Cinquefoil	X														X	GNR	SE5	N
Rosaceae	*Prunus avium*	Sweet Cherry												X				GNR	SE4	N
Rosaceae	*Prunus pensylvanica*	Pin Cherry				X		X		X					X			G5	S5	N
Rosaceae	*Prunus serotina*	Black Cherry								X								G5	S5	N
Rosaceae	*Prunus virginiana*	Chokecherry				X	X			X		X				X		G5	S5	N
Rosaceae	*Rosa acicularis*	Prickly Rose										X						G5	S5	N
Rosaceae	*Rosa multiflora*	Multiflora Rose						X				X						GNR	SE5	N
Rosaceae	*Rubus idaeus ssp. idaeus*	European Red Raspberry	X			X				X				X				G5T5	SE1	N
Rosaceae	*Rubus occidentalis*	Black Raspberry								X				X			X	G5	S5	N
Rosaceae	*Sorbus aucuparia*	European Mountain-ash				X												G5	SE4	N
Rubiaceae	*Galium mollugo*	Smooth Bedstraw						X										GNR	SE5	N
Rubiaceae	*Galium palustre*	Common Marsh Bedstraw	X		X				X									G5	S5	N

Table 2a: Vascular Plant Species List, Owen Sound Class EA Surveyor: Adam McClelland **1**

			Vegetation Communities[2]															Conservation Rankings[3]		
FAMILY[1]	**SCIENTIFIC NAME[1]**	**COMMON NAME[1]**	**MEMM3a**	**MAMM1-2**	**MAMM3**	**TAGM5a**	**FOMM10-2**	**THDM3a**	**THDM3b**	**FODM4-2**	**WODM4-2a**	**TAGM5b**	**WODM4-2b**	**MEMM3b**	**MEFM1**	**FOMM**	**TAGM5c**	**GRANK**	**SRANK**	**TRACK**
Salicaceae	*Populus balsamifera*	Balsam Poplar				X			X									G5	S5	N
Salicaceae	*Populus tremuloides*	Trembling Aspen	X									X			X			G5	S5	N
Salicaceae	*Salix bebbiana*	Bebb's Willow									X							G5	S5	N
Salicaceae	*Salix discolor*	Pussy Willow		X		X												G5	S5	N
Salicaceae	*Salix interior*	Sandbar Willow										X						G5	S5	N
Scrophulariaceae	*Verbascum thapsus*	Common Mullein													X			GNR	SE5	N
Solanaceae	*Solanum dulcamara*	Bittersweet Nightshade				X										X		GNR	SE5	N
Tiliaceae	*Tilia americana*	Basswood				X						X			X	X		G5	S5	N
Typhaceae	*Typha angustifolia*	Narrow-leaved Cattail	X	X	X	X			X									G5	SE5	N
Typhaceae	*Typha latifolia*	Broad-leaved Cattail				X												G5	S5	N
Ulmaceae	*Ulmus americana*	White Elm	X		X	X	X		X	X	X		X		X	X	X	G4	S5	N
Vitaceae	*Parthenocissus quinquefolia*	Virginia Creeper									X	X				X	X	G5	S4?	N
Vitaceae	*Parthenocissus vitacea*	Thicket Creeper							X	X								G5	S5	N
Vitaceae	*Vitis riparia*	Riverbank Grape	X	X			X	X	X	X	X	X	X	X	X	X	X	G5	S5	N

[1] Nomenclature based on Ministry of Natural Resources and Forestry (MNRF) Natural Heritage Information Centre (NHIC, 2022)

[2] ELC Codes based on Ecological Land Classification for Southern Ontario manual (Lee et al., 1998, 2008)

[3] Conservation Rankings: From Ontario Ministry of Natural Resources and Forestry, Natural Heritage Information Centre (https://www.ontario.ca/page/natural-heritage-information-centre)

Table 2b: Vascular Plant Species List, Owen Sound Class EA Surveyor: Adam McClelland **AEC21-453**

			Vegetation Communities[2]		Conservation Rankings[3]		
FAMILY[1]	**SCIENTIFIC NAME[1]**	**COMMON NAME[1]**	**MAMM1-16**	**MEMM3c**	**GRANK**	**SRANK**	**TRACK**
Apiaceae	*Daucus carota*	Wild Carrot		X	GNR	SE5	N
Asteraceae	*Ambrosia artemisiifolia*	Common Ragweed		X	G5	S5	N
Asteraceae	*Centaurea jacea*	Brown Knapweed		X	GNR	SE5	N
Asteraceae	*Euthamia graminifolia*	Grass-leaved Goldenrod	X		G5	S5	N
Asteraceae	*Solidago canadensis var. canadensis*	Canada Goldenrod		X	G5T5	S5	N
Cornaceae	*Cornus sericea*	Red-osier Dogwood	X		G5	S5	N
Cyperaceae	*Carex vulpinoidea*	Fox Sedge	X		G5	S5	N
Cyperaceae	*Scirpus atrovirens*	Dark-green Bulrush	X		G5	S5	N
Fabaceae	*Vicia cracca*	Tufted Vetch	X		GNR	SE5	N
Juncaceae	*Juncus canadensis*	Canada Rush	X		G5	S5	N
Juncaceae	*Juncus tenuis*	Path Rush	X		GNR	S5	N
Lamiaceae	*Mentha canadensis*	Canada Mint	X		G5	S5	N
Lamiaceae	*Prunella vulgaris ssp. vulgaris*	Common Self-heal	X		G5TU	SE3	N
Oleaceae	*Fraxinus pennsylvanica*	Red Ash	X		G4	S4	N
Onagraceae	*Epilobium parviflorum*	Small-flowered Hairy Willowherb	X		GNR	SE4	N
Plantaginaceae	*Plantago major*	Common Plantain		X	G5	SE5	N
Poaceae	*Glyceria striata var. striata*	Fowl Mannagrass	X		G5T5	S5	N
Poaceae	*Lolium arundinaceum*	Tall Ryegrass	X		GNR	SE5	N
Poaceae	*Phalaris arundinacea*	Reed Canarygrass	X	X	G5	S5	N
Poaceae	*Phleum pratense*	Common Timothy	X	X	GNR	SE5	N
Polygonaceae	*Rumex crispus*	Curled Dock	X		GNR	SE5	N
Typhaceae	*Typha angustifolia*	Narrow-leaved Cattail	X		G5	SE5	N

[1] Nomenclature based on Ministry of Natural Resources and Forestry (MNRF) Natural Heritage Information Centre (NHIC, 2022)

[2] ELC Codes based on Ecological Land Classification for Southern Ontario manual (Lee et al., 1998, 2008)

[3] Conservation Rankings: From Ministry of Natural Resources and Forestry, Natural Heritage Information Centre (https://www.ontario.ca/page/natural-heritage-information-centre)

Table 3: Ecological Land Classification, Owen Sound Class EA, 2022

Ecological Land Classification					
System	Community Class	Community Series	Ecosite/Vegetation Type	Canopy/Shrub Layer	Ground Cover
Terrestrial	Meadow	MEM, Mixed Meadow	MEMM3a, Dry-Fresh Mixed Meadow	Tree cover was sparse, and included White Elm, Green Ash, and Scots Pine. Scattered shrub cover included Dogwood species and Common Buckthorn.	Vegetation was dominated by grass and forb species, including Reed Canary Grass, Brown Knapweed and Wild Carrot.
Wetland	Marsh	MAM, Meadow Marsh	MAMM1-2, Cattail Graminoid Mineral Meadow Marsh	Shrub cover was sparse, and consisted of Red Osier Dogwood and Pussy Willow.	The community was dominated by cattails. Graminoid and forb species observed included sedges, rushes, Dark Green Bulrush, and Purple Loosestrife.
Wetland	Marsh	MAM, Meadow Marsh	MAMM3, Mixed Meadow Marsh	Shrub cover consisted of Red Osier Dogwood. Sparse tree cover included Green Ash and Scots Pine.	Abundant graminoid and forb cover included Reed Canary Grass, Asters, Grass-leaved Goldenrod, Narrow-leaved Cattail and Common Reed.
Terrestrial	Cultural	TAG, Treed Agriculture	TAGM5a, Fencerow	Tree species observed included White Ash, Green Ash, Pin Cherry and Scots Pine. Shrub cover included Common Buckthorn, Red Osier Dogwood and Pussy Willow.	The ground cover consisted of grass and forb species, including Reed Canary Grass, Yellow Avens, Asters, Canada Goldenrod and Coltsfoot.
Terrestrial	Forest	FOM, Mixed Forest	FOMM10-2, Fresh-Moist White Spruce-Hardwood Mixed Forest	Tree species observed included White Ash, White Elm, White Cedar, and White Spruce. Shrub species observed included Red Osier Dogwood, Cranberry Viburnum and Common Buckthorn.	The ground cover was dominated by forb species, including Eastern Panicled Aster, Calico Aster and Wild Basil. A large patch of Lesser Periwinkle and European Lily-of-the-valley was observed.
Terrestrial	Cultural	THD, Deciduous Thicket	THDM3a, Dry-Fresh Deciduous Hedgerow Thicket	Tree and shrub cover was dominated by Commno Buckthorn, Hawthorn, Red Osier Dogwood and White Ash.	The ground cover consisted of grass and forb species. Common species observed included Brown Knapweed, Timothy, Orchard Grass, Goldenrod, and Wild Madder.
Terrestrial	Cultural	THD, Deciduous Thicket	THDM3b, Dry-Fresh Deciduous Hedgerow Thicket	Shrub cover was dominated by Common Buckthorn; Hawthorn and Red Osier Dogwood were also present. Scattered White Ash and White Elm were observed.	The ground cover consisted of grass and forb species Common species observed included Brown Knapweed, Reed Canary Grass, Orchard Grass, Goldenrod, and New England Aster.
Terrestrial	Forest	FOD, DeciduousForest	FODM4-2, Dry-Fresh White Ash-Hardwood Deciduous Forest	The canopy was dominated by White Ash; Sugar Maple, Scots Pine, White Elm, Norway Maple and Black Cherry were also observed. Shrub cover was sparse in some areas and consisted of Lilac, Alternate-leaved Dogwood, Thicket Creeper Riverbank Grape and Common Buckthorn.	The ground cover consisted primarily of forb species, including Goldenrods, Asters, Periwinkle, Herb-robert and Coltsfoot.
Terrestrial	Woodland	WOD, Deciduous Woodland	WODM4-2a, White Ash Deciduous Woodland	The canopy was open and consisted of White Ash. Shrub species observed included Red Osier Dogwood, Riverbank Grape, Thicket Creeper, Common Buckthorn and Bebb's Willow.	The ground cover consisted of graminoid and forb species, including Goldenrod, Brown Knapweed, Smooth Brome, Dark-green Bulrush and Wild Carrot.
Terrestrial	Cultural	TAG, Treed Agriculture	TAGM5b, Fencerow	The fencerow was dominated by White Cedar; other species present included Trembling Aspen, Red Oak, White Spruce and White Ash. Shrub cover was sparse in some areas and included Red Osier Dogwood, Thicket Creeper and Rose species.	The ground cover consisted of forb and grass species, including Goldenrods, Asters, Bird's-foot Trefoil, Brown Knapweed, Quackgrass, Reed Canary Grass and Smoth Brome.
Terrestrial	Woodland	WOD, Deciduous Woodland	WODM4-2b, White Ash Deciduous Woodland	The canopy was dominated by White Ash; scattered White Elm was also observed. Shrub cover was sparse in some areas and included Common Buckthorn, Tatarian Honeysuckle and Riverbank Grape	The ground cover consisted of grass and forb species. Common species observed included Reed Canary Grass, Smooth Brome, Timothy, Tufted Vetch, Goldenrods, Asters, and Wild Carrot.

Terrestrial	Meadow	MEM, Mixed Meadow	MEMM3b, Dry-Fresh Mixed Meadow	Tree cover consisted of a treerow along the laneway; White Ash, Scots Pine, Sweet Cherry and Black Walnut were observed. Shrub cover consisted of several patches of Raspberry and Riverbank Grape.	The community was dominated by a variety of grass and forb species, including Smooth Brome, Tall Ryegrass, Timothy, Reed Canary Grass, Brown Knapweed, Goldenrod, and Bird's-foot Trefoil.
Terrestrial	Meadow	MEF, Forb Meadow	MEFM1, Dry-Fresh Forb Meadow	Tree species observed included White Ash, Scots Pine, Norway Maple, White Elm and American Basswood. Sparse shrub cover included Riverbank Grape and Red Osier Dogwood.	The community was dominated by a variety of forb species, including Brown Knapweed, Wild Carrot, Annual Fleabane, Bird's-foot Trefoil, Chicory and White Sweet-clover
Terrestrial	Forest	FOM, Mixed Forest	FOMM, Mixed Forest	The canopy was dominated by Scots Pine and White Ash. Shrub cover consisted of Common Buckthorn, Red Osier Dogwood, Tatarian Honeysuckle and Glossy Buckthorn.	The ground cover consisted of a variety of grass and forb species, including Orchard Grass, Smooth Brome, Field Horsetail, Asters, Yellow Avens, Buttercup, Reed Canary Grass and Coltsfoot.
Terrestrial	Cultural	TAG, Treed Agriculture	TAGM5c, Fencerow	Tree species observed included Sugar Maple, White Ash, White Elm, and Black Locust. Shrub cover consisted of Riverbank Grape,Thicket Creeper, Common Buckthorn, Tatarian Honeysuckle and a patch of Japanese Knotweed.	The ground cover consisted of a variety of grass and forb species, including Orchard Grass, Tall Ryegrass, Goldenrod, Asters, Chicory, Wild Carrot, White Sweet-clover and Periwinkle.
Wetland	Marsh	MAM, Meadow Marsh	MAMM1-16, Mixed Graminoid Mineral Meadow Marsh	Tree and shrub cover was very sparse and included Red Osier Dogwood and young Green Ash.	The community was dominated by graminoid species, including Dark-green Bulrush, Narrow-leaved Cattail, sedges, rushes, and Tall Ryegrass. Forb species observed included Grass-leaved Goldenrod, Canada Mint and Willowherb.
Terrestrial	Meadow	MEM, Mixed Meadow	MEMM3c, Dry-Fresh Mixed Meadow	No trees or shrubs were observed.	The ground cover was dense and dominated by forb and grass species, including Brown Knapweed, Reed Canary Grass, Canada Goldenrod and Wild Carrot.

Table 4: Dawn Breeding Birds Survey, Owen Sound Class EA, 2022

			Location[1,2]														Conservation Rankings[3]				
FAMILY	**SCIENTIFIC NAME**	**COMMON NAME**	**1**		**2**		**3**		**4**		**5**		**6**		**Adjacent Lands**	**Incidental**	**GRANK**	**SRANK**	**ESA**	**SARA**	**TRACK**
			Visit 1	**Visit 2**	**Visit 1**	**Visit 2**	**Visit 1**	**Visit 2**	**Visit 1**	**Visit 2**	**Visit 1**	**Visit 2**	**Visit 1**	**Visit 2**							
Accipitridae	*Buteo jamaicensis*	Red-tailed Hawk			C												G5	S5			N
Bombycillidae	*Bombycilla cedrorum*	Cedar Waxwing		S		S			S	S				S			G5	S5			N
Cardinalidae	*Cardinalis cardinalis*	Northern Cardinal		S				S	S		S						G5	S5			N
Cardinalidae	*Passerina cyanea*	Indigo Bunting					S										G5	S5B			N
Cathartidae	*Cathartes aura*	Turkey Vulture	F/O												VIS		G5	S5B,S3N			N
Charadriidae	*Charadrius vociferus*	Killdeer		S		S		S							S		G5	S4B			N
Columbidae	*Zenaida macroura*	Mourning Dove								S	VIS	VIS					G5	S5			N
Corvidae	*Corvus brachyrhynchos*	American Crow	C						C	C, VIS	S	C		C			G5	S5			N
Corvidae	*Cyanocitta cristata*	Blue Jay									C			C			G5	S5			N
Fringillidae	*Spinus tristis*	American Goldfinch	S	C, S	S,C	S	C	S	C	S	S, C		C				G5	S5			N
Icteridae	*Agelaius phoeniceus*	Red-winged Blackbird	C	S, C	C	C, S	C, S	C	C		C, VIS	C	C	C			G5	S5			N
Icteridae	*Molothrus ater*	Brown-headed Cowbird							S	S		S					G5	S5			N
Icteridae	*Quiscalus quiscula*	Common Grackle											C				G5	S5			N
Icteridae	*Sturnella magna*	Eastern Meadowlark			S	S, C	S	S									G5	S4B,S3N	THR	THR	Y
Laridae	*Larus argentatus*	Gull *sp.*				C									C		G5	S4B,S5N			N
Mimidae	*Dumetella carolinensis*	Gray Catbird						S								√	G5	S5B,S3N			N
Parulidae	*Geothlypis trichas*	Common Yellowthroat	S			S	S	S					C	S, C			G5	S5B,S3N			N
Parulidae	*Seiurus aurocapilla*	Ovenbird													S		G5	S5B			N
Parulidae	*Setophaga petechia*	Yellow Warbler			S		S	S									G5	S5B			N
Parulidae	*Setophaga pinus*	Pine Warbler							S	S							G5	S5B,S3N			N
Parulidae	*Setophaga ruticilla*	American Redstart			S		S			S							G5	S5B			N
Passerellidae	*Melospiza melodia*	Song Sparrow	S	S	S	S	C	S, C	S	S	S	S		S, C			G5	S5			N
Passerellidae	*Spizella passerina*	Chipping Sparrow		S		S											G5	S5B,S3N			N
Passerellidae	*Spizella pusilla*	Field Sparrow			S												G5	S4B,S3N			N
Phasianidae	*Meleagris gallopavo*	Wild Turkey	VIS									C					G5	S5			N
Picidae	*Dryocopus pileatus*	Pileated Woodpecker					C										G5	S5			N
Sturnidae	*Sturnus vulgaris*	European Starling	S	S	S	S		S	S		S						G5	SNA			N
Troglodytidae	*Troglodytes aedon*	House Wren										S					G5	S5B			N
Turdidae	*Turdus migratorius*	American Robin	S	C	S	S, C	S, C	S	S	S	S	S		C, S	S		G5	S5			N
Tyrannidae	*Contopus virens*	Eastern Wood-pewee											S		S		G5	S4B	SC	SC	Y
Tyrannidae	*Empidonax traillii*	Willow Flycatcher				S											G5	S4B			N
Tyrannidae	*Sayornis phoebe*	Eastern Phoebe	S														G5	S5B			N
Tyrannidae	*Tyrannus tyrannus*	Eastern Kingbird			S		S	S									G5	S4B			N
Vireonidae	*Vireo gilvus*	Warbling Vireo			S	S		S					S				G5	S5B			N
Vireonidae	*Vireo olivaceus*	Red-eyed Vireo				S				S		S					G5	S5B			N

[1] **Visit 1**: June 2, 2022, Observer: S. Tarof, Tempurature 13ºC, Cloud Cover 10% , Wind: B3, Precipitation: No rain, Survey Time 08:44 to 08:49; **Visit 2:** June 15, 2022, Observer: S.Tarof, Tempurature 16ºC, Cloud Cover 5% , Wind: B2, Precipitation: No rain, Survey Time 08:49 to 08:54

[2] Breeding Bird Evidence Codes: X/√ - Species observed or heard, C - Call heard, FO - Flyover (Species presence); H - Species observed in its breeding season in suitable nesting habitat, S - Singing male (Possible Breeding); P - Pair observed , T - Territorial behaviour, A - Agitated behaviour or anxiety calls of adult, V - Visiting a probably nest site, N - Nest building or excavation of nest hole (Probable Breeding); DD - Distraction display or injury feigning, NU - Used Nest or egg shells, FY - Recently fledged young, AE - Adult leaving or entering nest sites, FS - Adult carrying fecal sac, CF - Adult carrying food for young, NE - Nest containing eggs, NY - Nest with young seen or heard (Confirmed Breeding).

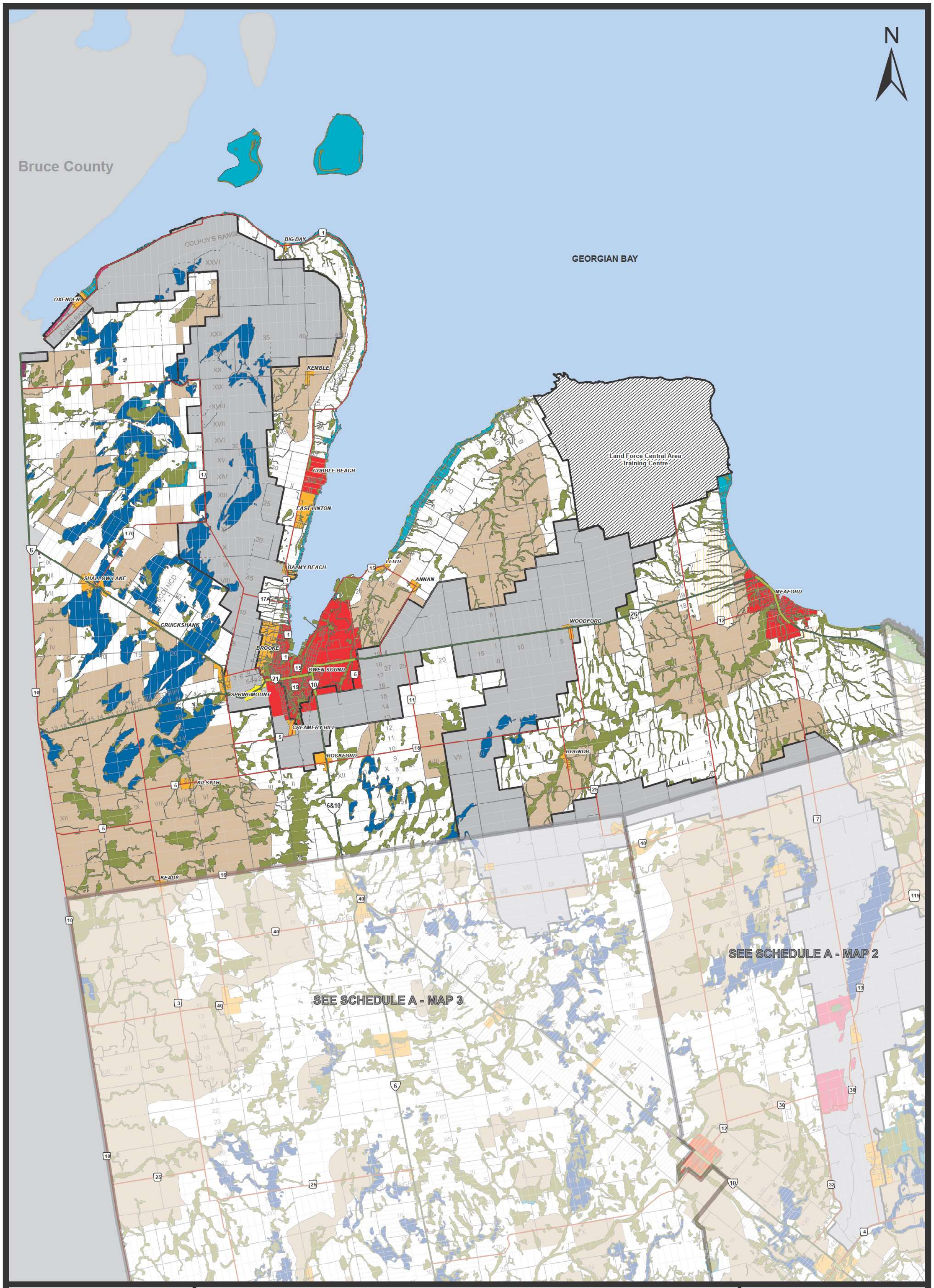
[3] Conservation Rankings: From Ontario Ministry of Natural Resources, Natural Heritage Information Centre (http://nhic.mnr.gov.on.ca/nhic_.cfm)
S-Rank = Sub-national/provincial scale (from 1-5), S1 - Extremely Rare, S2 - Very Rare, S3 - Rare to Uncommon, S4 - Common, S5 - Very Common, E - Exotic
G-Rank = Global scale (from 1 - "Critically Imperiled" to 5 - "Secure" or common), G1 - Critically Imperiled, G2 - Imperiled, G3 - Vulnerable, G4 - Apparently Secure, G5 - Secure.
B = Breeding Populations, N = Non-breeding Populations; M = Migratory Populations; SARO: EXT - Extirpated, END - Endangered, THR - Threatened, SC - Special Concern.
Track (Is the species tracked provincially?) = Y - Yes, N = No, P = Partial
NA - Not Applicable (*i.e.* not native to Ontario), Blank - Not at Risk in Ontario.

APPENDICES

Appendix A: Municipal and Regional Background Information and Correspondence
Appendix B: Provincial Background Mapping
Appendix C: Photographic Record

APPENDIX A

Municipal and Regional Background Information and Correspondence



Grey County

THE COUNTY OF GREY OFFICIAL PLAN

SCHEDULE A
Land Use Types

MAP 1

LEGEND

- Provincial Highway Connecting Link
- Provincial Highway
- County Road
- Local Road
- Seasonal Road
- Agricultural
- Special Agricultural
- Rural
- Primary Settlement Area *
- Secondary Settlement Area *
- Inland Lakes & Shoreline
- Recreational Resort Area
- Sunset Strip Area
- Industrial Business Park
- Space Extensive Industrial and Commercial
- Niagara Escarpment Plan Boundary **
- Niagara Escarpment Development Control Area
- Escarpment Recreation Area
- Hazard Lands
- Provincially Significant Wetlands and Significant Costal Lands

* refer to Secondary Schedules for further detail.

** certain settlement areas within the Niagara Escarpment Plan Boundary may be subject to Development Control.

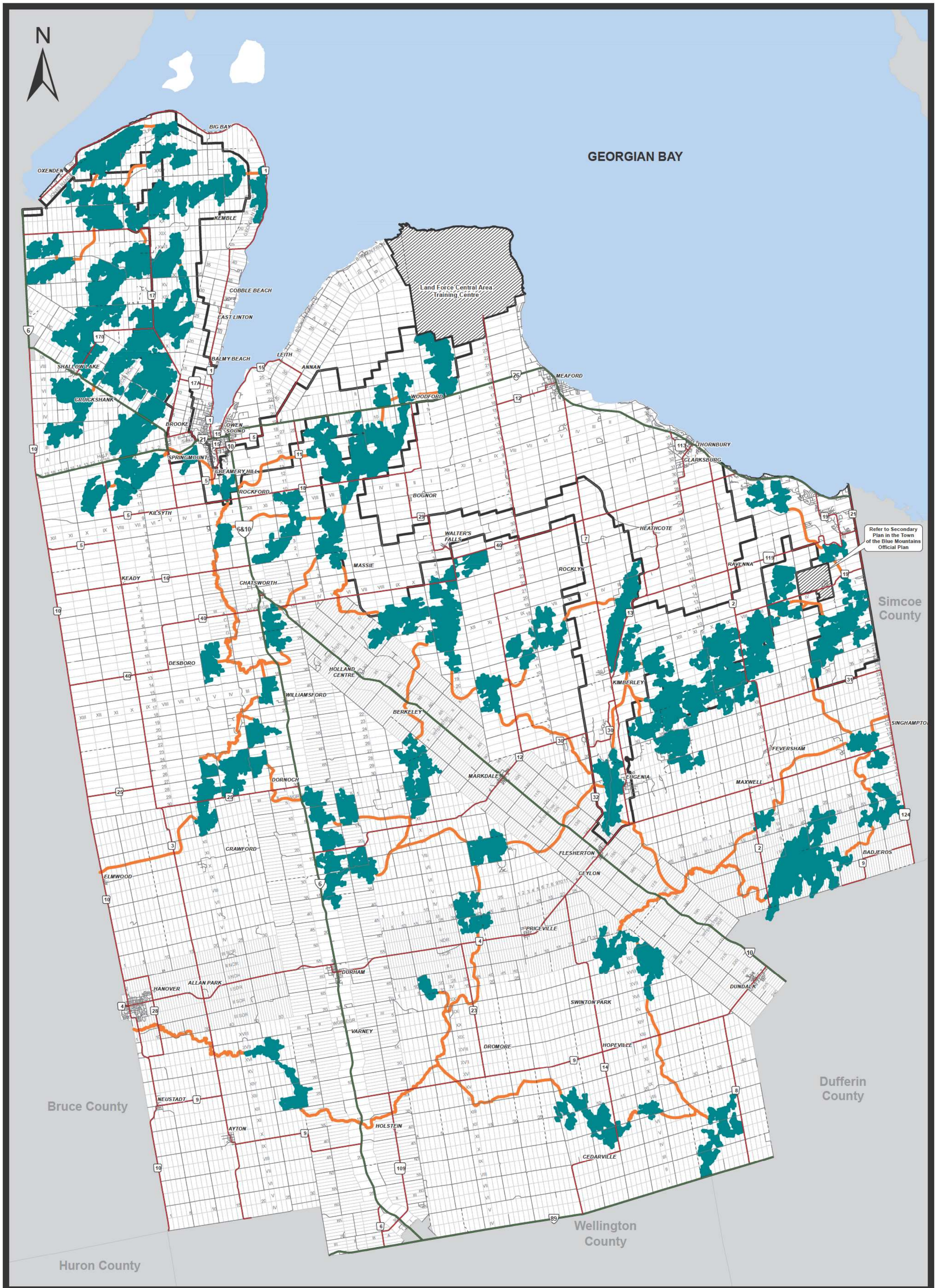
SCALE 1:95,000

0 1,125 2,250 4,500 6,750 9,000 Meters

AUTHOR: Grey County Planning and Development
FILE NAME: GR_OP_SchedA_Map1northX36.mxd
APPLICATION: ArcMap
DATE: June 7, 2019
PROJECTION: UTM zone 17N / NAD83
SOURCE: Teranet, Ministry of Natural Resources and Forestry

INTERACTIVE MAP: geo.grey.ca
DOWNLOAD PDF: grey.ca/planning-development

This map is for illustrative purposes only. Do not rely on this map as being a precise indicator of routes, location of features or surveying purposes. This map may contain cartographical errors or omissions.



Grey County

THE COUNTY OF GREY
OFFICIAL PLAN

SCHEDULE C
Natural Heritage System
Core Areas and Linkages

LEGEND

- Provincial Highway
- County Road
- Local Road
- Seasonal Road
- 🟦 Core Area
- 🟧 Linkage (200m wide)
- ▭ Niagara Escarpment Plan Area

SCALE 1: 135,000

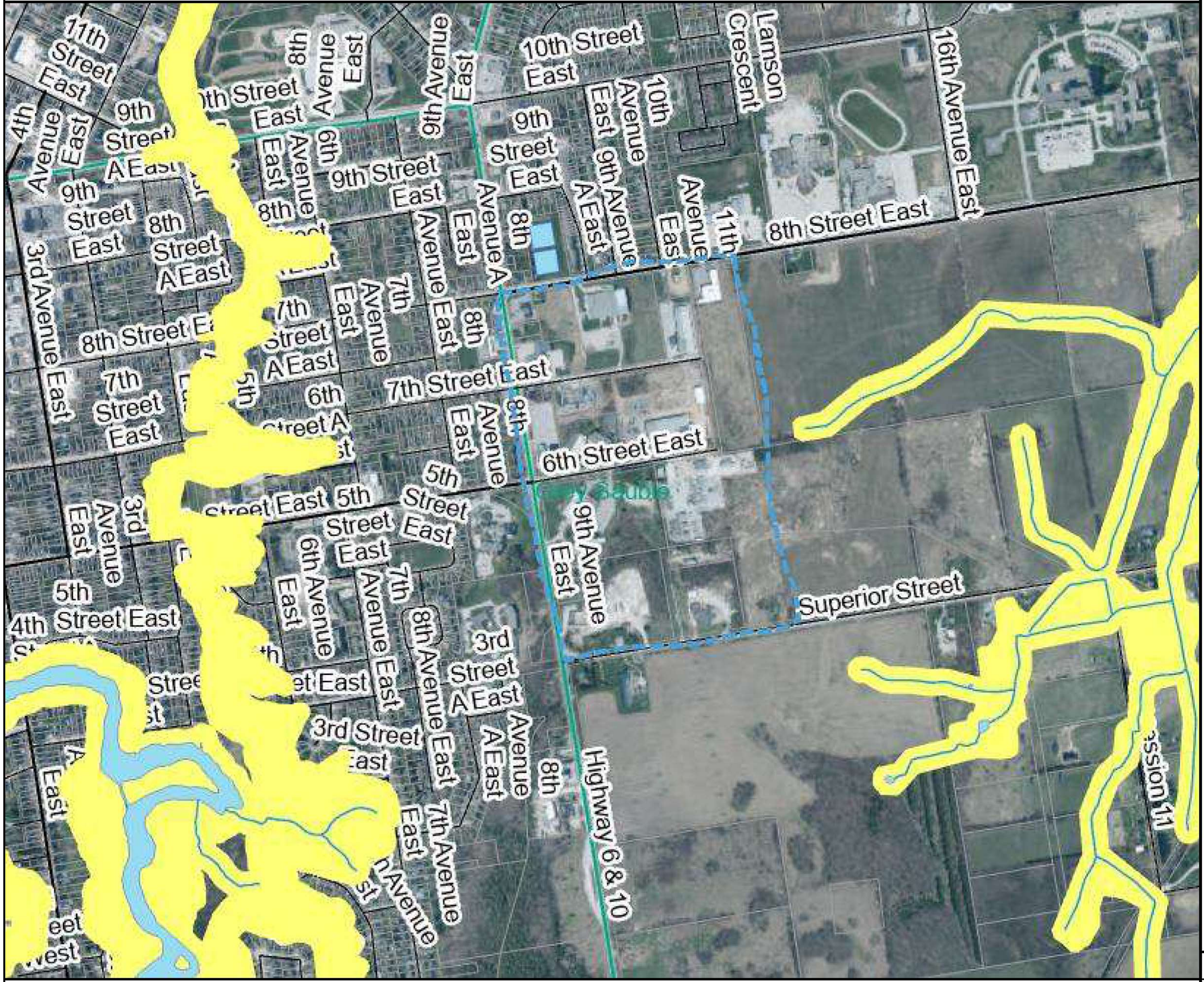
0 1,600 3,200 6,400 9,600 12,800 Meters

AUTHOR: Grey County Planning and Development
FILE NAME: GR_OP_SchedC_Map0X36.mxd
APPLICATION: ArcMap
DATE: June 7, 2019
PROJECTION: UTM zone 17N / NAD83
SOURCE: Teranet, Ministry of Natural Resources and Forestry

INTERACTIVE MAP: geo.grey.ca
DOWNLOAD PDF: grey.ca/planning-development

This map is for illustrative purposes only. Do not rely on this map as being a precise indicator of routes, location of features or surveying purposes. This map may contain cartographical errors or omissions.

21-453 Owen Sound Class EA



889 0 444 889 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere

Printed:August 29, 2022

THIS MAP IS NOT TO BE USED FOR NAVIGATION

Legend

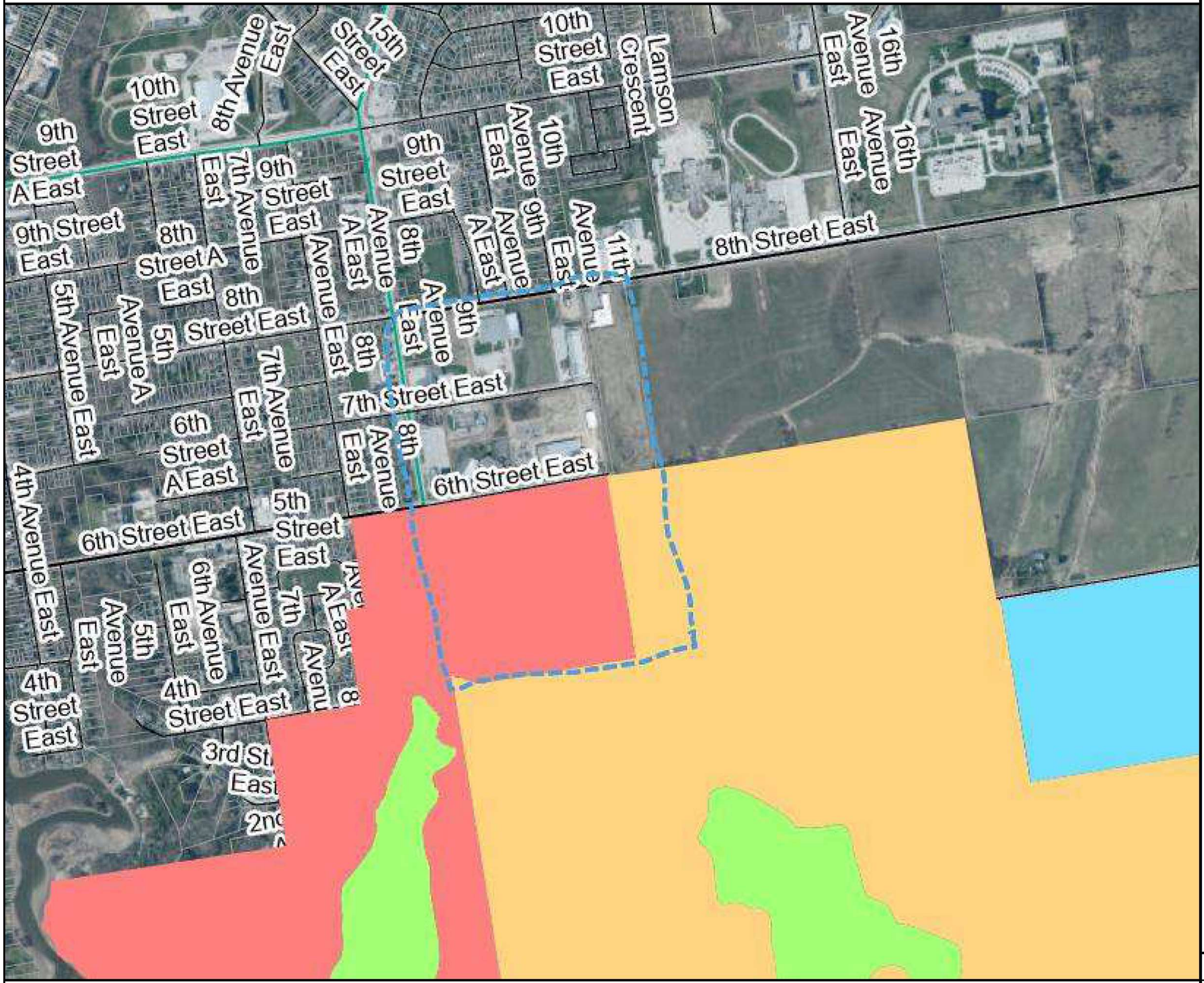
- ☐ Forest Outline
- ● Forest Entrances
- ☐ CA Boundaries
- 🟩 Properties - GSCA
- 🟩 Properties - SVCA
- 🟦 Wet Areas - GSCA
- 🟦 Wet Areas - GRCA
- 🟦 Water Features
- — Watercourses
- 🟦 Floodplains - NVCA
- 🟦 Floodplains - GRCA
- Approximate Regulated and Screen SVCA
  - 🟨 Approximate Regulated Area
  - 🟧 Approximate Screening Area
- 🟨 Regulations - GSCA
- 🟨 Regulations - NVCA
- Large Scale Roads
  - — Provincial Highway
  - — County Road
  - — Township Road
  - — Seasonal Road
- ☐ Parcels - Current
- ☐ Grey County Boundary

Notes

Azimuth Environmental Consulting, Inc.

Grey County

21-453 Owen Sound EIS



Legend

Large Scale Roads

- Provincial Highway
- County Road
- Township Road
- Seasonal Road

☐ Parcels - Current

Niagara Escarpment Plan 2017

- 🟩 Escarpment Natural Area
- 🟧 Escarpment Protection Area
- 🟨 Escarpment Recreation Area
- 🟦 Escarpment Rural Area
- 🟪 Mineral Resource Extraction Area
- 🟥 Urban Area

☐ Grey County Boundary

889 0 444 889 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere

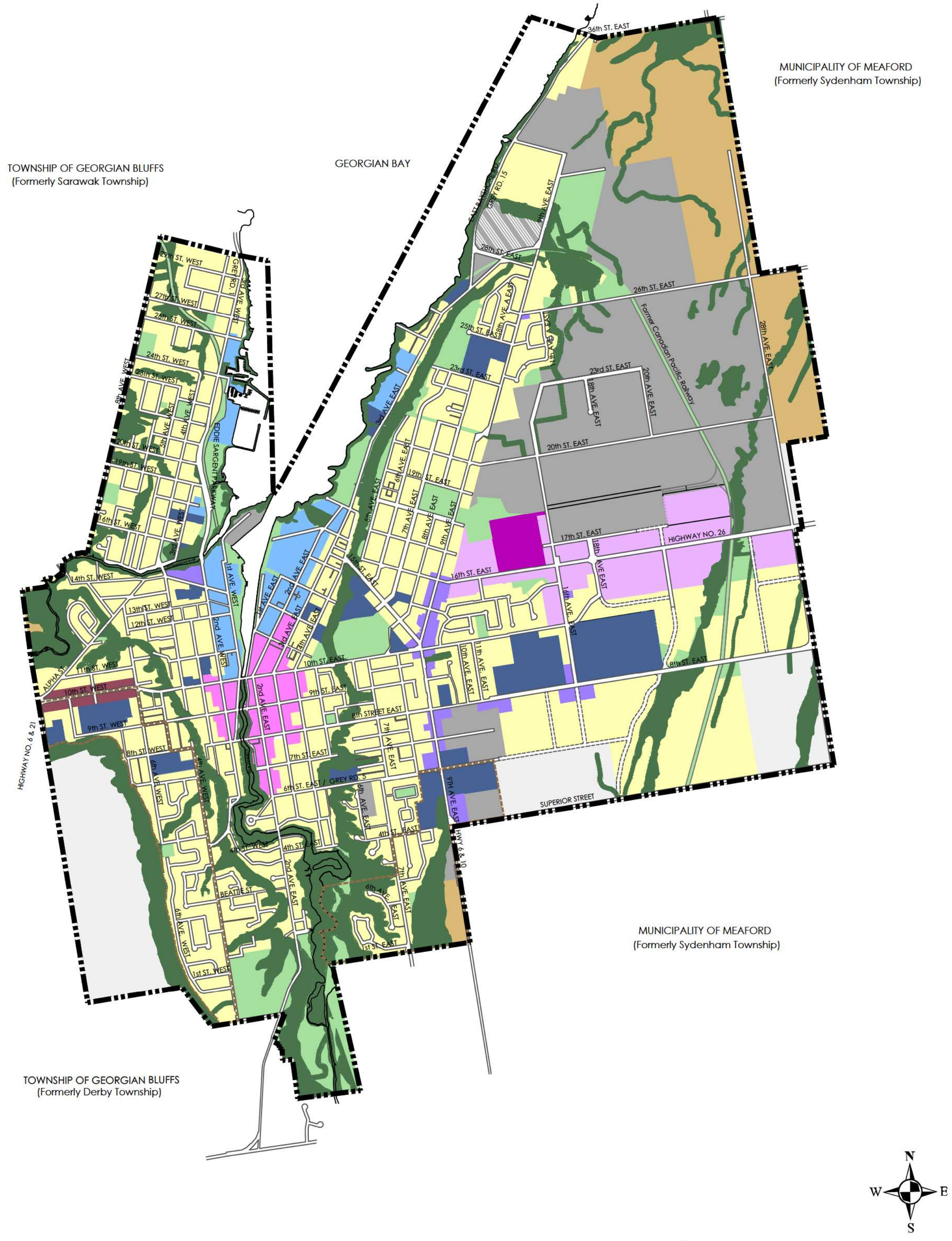
© County of Grey

This map is a user generated static output from an Internet mapping site and is for reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable.

Printed:August 25, 2022 THIS MAP IS NOT TO BE USED FOR NAVIGATION

Notes

Azimuth Environmental Consulting, Inc.



Legend

- 🟨 Residential
- 🟪 River District Commercial
- 🟪 Regional Shopping Centre
- 🟪 East City Commercial
- 🟥 West City Commercial
- 🟪 Arterial Commercial
- 🟦 Waterfront Mixed Use
- ▨ Industrial Transitional
- ⬜ Employment
- 🟦 Institutional
- 🟩 Open Space
- 🟫 Rural
- 🟩 Hazard Lands
- ⬜ Niagara Escarpment Plan Area
- ▭ Niagara Escarpment Plan Area - Urban
- ▭ Planned Road

Schedule 'A'

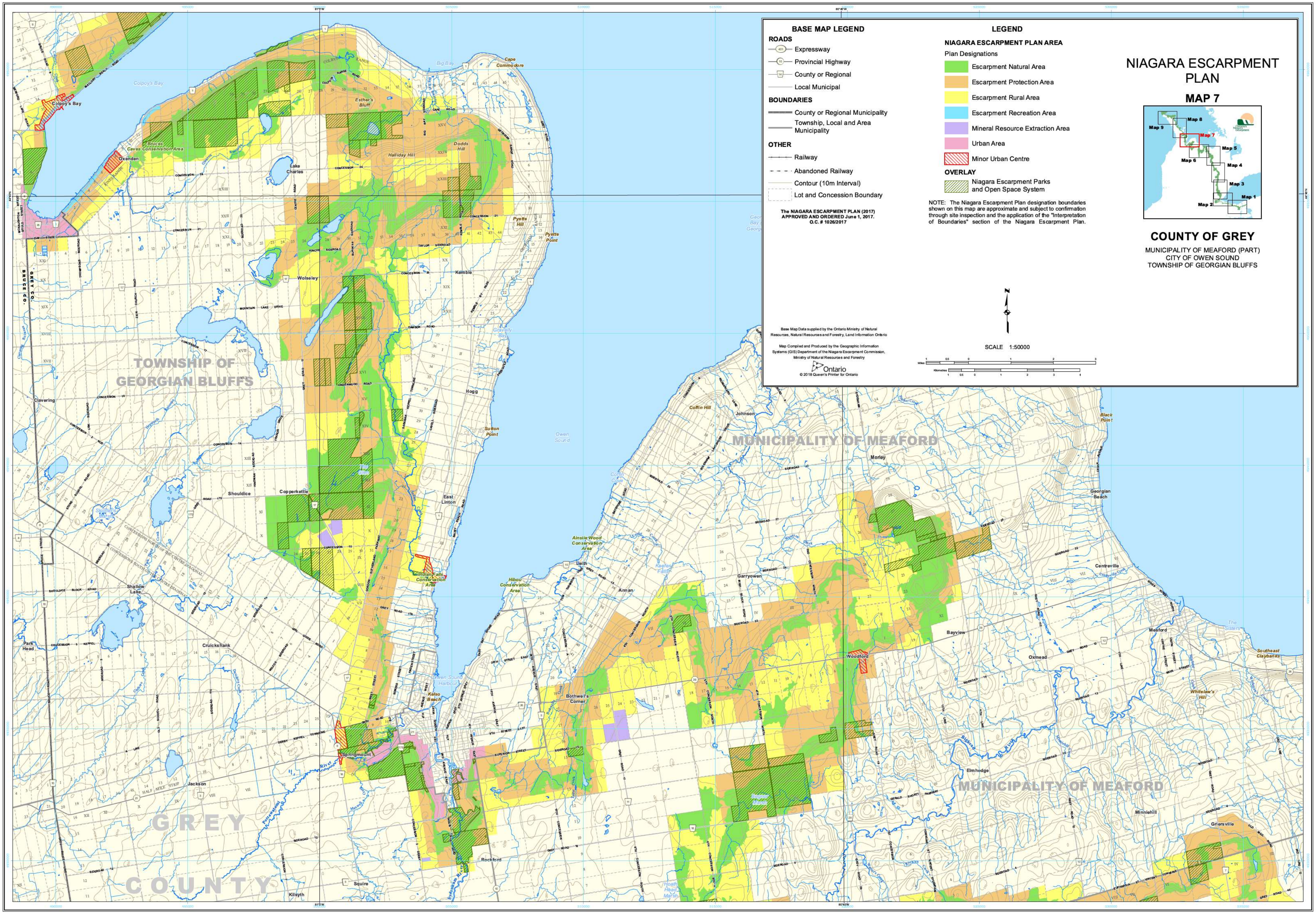
Official Plan

City of Owen Sound

Land Use Plan

owen sound
where you *want* to live

May 2021
1:28,000



NIAGARA ESCARPMENT PLAN

MAP 7

COUNTY OF GREY

MUNICIPALITY OF MEAFORD (PART)
CITY OF OWEN SOUND
TOWNSHIP OF GEORGIAN BLUFFS

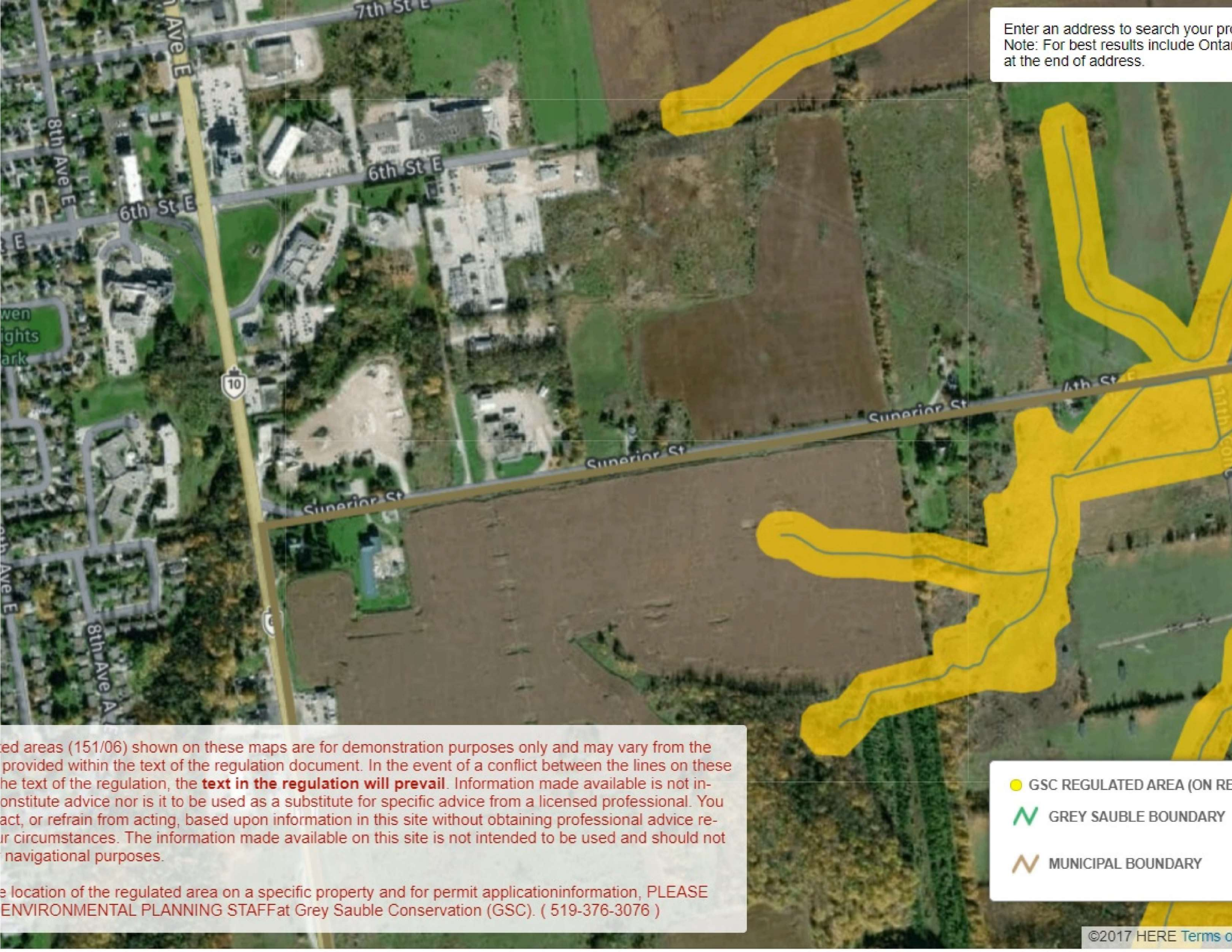
The NIAGARA ESCARPMENT PLAN (2017)
APPROVED AND ORDERED June 1, 2017.
O.C. # 1026/2017

NOTE: The Niagara Escarpment Plan designation boundaries shown on this map are approximate and subject to confirmation through site inspection and the application of the "Interpretation of Boundaries" section of the Niagara Escarpment Plan.

Base Map Data supplied by the Ontario Ministry of Natural Resources, Natural Resources and Forestry, Land Information Ontario

Map Compiled and Produced by the Geographic Information Systems (GIS) Department of the Niagara Escarpment Commission, Ministry of Natural Resources and Forestry

Ontario



Enter an address to search your pr
Note: For best results include Ontar
at the end of address.

ted areas (151/06) shown on these maps are for demonstration purposes only and may vary from the provided within the text of the regulation document. In the event of a conflict between the lines on these he text of the regulation, the **text in the regulation will prevail**. Information made available is not in- onstitute advice nor is it to be used as a substitute for specific advice from a licensed professional. You act, or refrain from acting, based upon information in this site without obtaining professional advice re- ur circumstances. The information made available on this site is not intended to be used and should not navigational purposes.

e location of the regulated area on a specific property and for permit applicationinformation, PLEASE ENVIRONMENTAL PLANNING STAFFat Grey Sauble Conservation (GSC). (519-376-3076)

APPENDIX B

Provincial Background Mapping

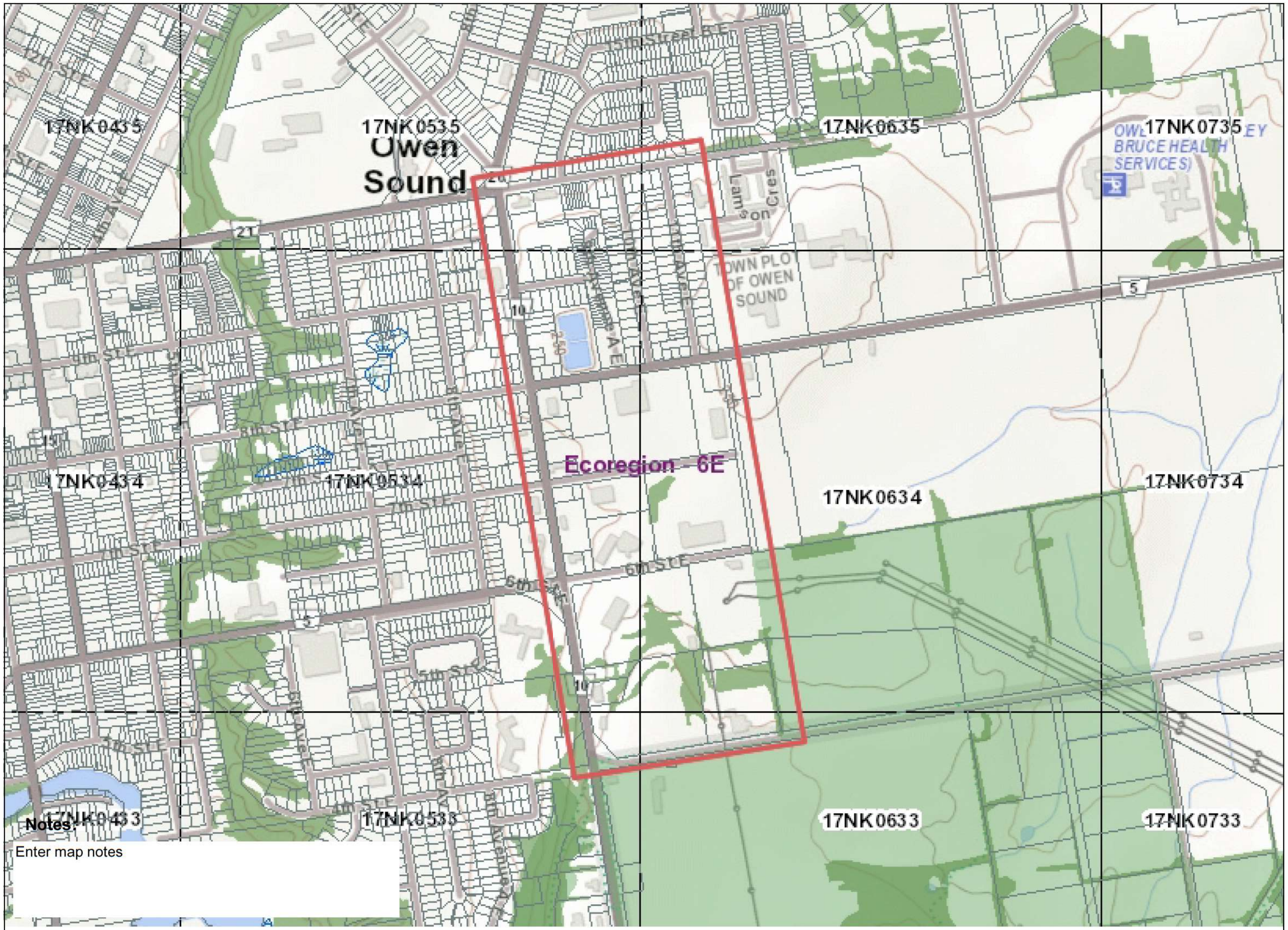
Ontario

Ministry of Natural Resources and Forestry

Make-a-Map: Natural Heritage Areas

21-453

Map created:12/15/2021



Notes:

Enter map notes

Legend

- ☐ Assessment Parcel
- ☐ NHIC 1 Km Grid
- ☐ Ecoregion
- ANSI
  - ▣ Earth Science Provincially Significant/sciences de la terre d'importance provinciale
  - ▣ Earth Science Regionally Significant/sciences de la terre d'importance régionale
  - ▣ Life Science Provincially Significant/sciences de la vie d'importance provinciale
  - ▣ Life Science Regionally Significant/sciences de la vie d'importance régionale
- Evaluated Wetland
  - ▨ Provincially Significant/considérée d'importance provinciale
  - ▨ Non-Provincially Significant/non considérée d'importance provinciale
- ▨ Unevaluated Wetland
- 🟩 Woodland
- 🟩 Conservation Reserve
- ■ Provincial Park
- 🟩 Natural Heritage System

0.7 0 0.33 0.7 Kilometres

Absence of a feature in the map does not mean they do not exist in this area.

This map should not be relied on as a precise indicator of routes or locations, nor as a guide to navigation. The Ontario Ministry of Natural Resources and Forestry(OMNRF) shall not be liable in any way for the use of, or reliance upon, this map or any information on this map.

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GTA 2005 / SWOOP 2006 / Simcoe-Muskoka-Dufferin © FirstBase Solutions, 2005 / 2006 / 2008

NHIC Data

To work further with this data select the content and copy it into your own word or excel documents.

OGF ID	Element Type	Common Name	Scientific Name	SRank	SARO Status	COSEWIC Status	ATLAS NAD83 IDENT	COMMENTS
905289	SPECIES	Northern Brook Lamprey	Ichthyomyzon fossor		SC	SC	17NK0535	
905289	SPECIES	Chimney Swift	Chaetura pelagica		THR	THR	17NK0535	
905289	SPECIES	Eastern Meadowlark	Sturnella magna		THR	THR	17NK0535	
905299	SPECIES	Northern Brook Lamprey	Ichthyomyzon fossor		SC	SC	17NK0635	
905299	SPECIES	Eastern Meadowlark	Sturnella magna		THR	THR	17NK0635	
905299	SPECIES	Bobolink	Dolichonyx oryzivorus		THR	THR	17NK0635	
905288	NATURAL AREA	Niagara Escarpment Biosphere Reserve					17NK0534	
905288	SPECIES	Rusty-patched Bumble Bee	Bombus affinis		END	END	17NK0534	
905288	SPECIES	Hart's-tongue Fern	Asplenium scolopendrium				17NK0534	
905288	SPECIES	Midland Painted Turtle	Chrysemys picta marginata			SC	17NK0534	
905288	SPECIES	Northern Brook Lamprey	Ichthyomyzon fossor		SC	SC	17NK0534	
905288	SPECIES	Eastern Meadowlark	Sturnella magna		THR	THR	17NK0534	
905287	NATURAL AREA	Niagara Escarpment Biosphere Reserve					17NK0533	
905287	SPECIES	Hart's-tongue Fern	Asplenium scolopendrium				17NK0533	
905287	SPECIES	Midland Painted Turtle	Chrysemys picta marginata			SC	17NK0533	
905287	SPECIES	Northern Brook Lamprey	Ichthyomyzon fossor		SC	SC	17NK0533	
905287	SPECIES	Eastern Meadowlark	Sturnella magna		THR	THR	17NK0533	
905287	SPECIES	Butternut	Juglans cinerea		END	END	17NK0533	
905287	SPECIES	Snapping Turtle	Chelydra serpentina		SC	SC	17NK0533	

OGF ID	Element Type	Common Name	Scientific Name	SRank	SARO Status	COSEWIC Status	ATLAS NAD83 IDENT	COMMENTS
905298	NATURAL AREA	Niagara Escarpment Biosphere Reserve					17NK0634	
905298	SPECIES	Northern Brook Lamprey	Ichthyomyzon fossor		SC	SC	17NK0634	
905298	SPECIES	Eastern Meadowlark	Sturnella magna		THR	THR	17NK0634	
905298	SPECIES	Bobolink	Dolichonyx oryzivorus		THR	THR	17NK0634	
905297	NATURAL AREA	Niagara Escarpment Biosphere Reserve					17NK0633	
905297	SPECIES	Hart's-tongue Fern	Asplenium scolopendrium				17NK0633	
905297	SPECIES	Eastern Meadowlark	Sturnella magna		THR	THR	17NK0633	
905297	SPECIES	Snapping Turtle	Chelydra serpentina		SC	SC	17NK0633	

Imagery ©2021 CNES / Airbus, Maxar Technologies

provided by: FIRST BASE SOLUTIONS GEOSPATIAL EXPERTS

APPENDIX C

Photographic Record

Photograph 1. THDM3 ELC community in hydro corridor north of 1025 6th Street East (in detection area of Dawn Breeding Bird Point Count Station #1), facing west (June 10, 2022).

Photograph 2. TAGM5 ELC community/hedgerow between 1025 6th Street East and 595 9th Avenue East, facing east (June 10, 2022).

Photograph 3. FODM4-2 ELC community immediately west of 1000 Superior Street near Dawn Breeding Bird Point Count Station #4, facing south (June 10, 2022).

Photograph 4. MEMM3 ELC community along driveway immediately west of 1010 Superior Street (in detection area of Dawn Breeding Bird Point Count Station #5), facing north/northwest) (June 10, 2022).

Photograph 5. MEFM1 ELC community at 1000 Superior Street (in detection area of Dawn Breeding Bird Point Count Station #3), facing east (June 10, 2022).

Photograph 6. MEMM3 ELC community immediately east of 1025 6th Street East, (in detection area of Dawn Breeding Bird Point Count Station #2) facing east (June 10, 2022).

Photograph 7. MAMM1-2 ELC community east of 1025 6th Street East (in detection area of Dawn Breeding Bird Survey Point Count Station #2), with MEMM3 in background, facing east (June 10, 2022).

Photograph 8. FOMM ELC community immediately northeast of 1010 Superior Street (in detection area of Dawn Breeding Bird Point Count Station #3), facing west (June 10, 2022).

Appendix E:
Geotechnical Investigation Report

Consulting
Engineers and
Scientists

Geotechnical Investigation

Proposed Watermain Replacement and Road Reconstruction

9th Avenue East, Owen Sound, Ontario

Submitted to:
Tatham Engineering Limited
115 Sanford Fleming Drive, Suite 200
Collingwood, Ontario, L9Y 5A6

Submitted by:
GEI Consultants Ltd.
647 Welham Road, Unit 14
Barrie, Ontario, L4N 0B7
www.canada.geiconsultants.com

March 24, 2023
Project No. 2201530

Table of Contents

Figures

Appendices

1. Introduction

GEI Consultants (GEI) was retained by Tatham Engineering Limited, on behalf of the City of Owen Sound, to complete a subsurface investigation and provide a geotechnical report in support of the proposed watermain replacement and road reconstruction on 9th Avenue East, Owen Sound, Ontario. A site location plan is shown in Figure 1.

The City of Owen sound is proposing to replace the watermain water services on a section of 9th Avenue East in Owen Sound, Ontario from Superior Street to just north of 9th Street East approximately 1000 m in length. Some sections of sanitary and storm sewer may also be replaced along with all sanitary laterals. The current section of road is a four-lane road with curb and gutter and sidewalks. The road cross section will not change and the service trenches will be repaired after service installation (full road reconstruction is not required). It is understood that the inverts for the watermain would be about 2.0 m and inverts for the storm and sanitary sewer would be as deep as 3.5 m below the road grade.

Also, a looping watermain is part of the project. The alignment is about 1,350 m in length and extends from 8th Street East southerly to 6th Street East (through a Hydro One corridor), then west along 6th Street East for about 150 m, then south along private lands to Superior Street, then west along Superior Street to 9th Avenue East. then east to the dead end of 4th Street East. The watermain invert is about 2 m below existing grade.

Lastly, it is understood that the project will have several phases.

The purpose of this geotechnical investigation was to determine the subsurface conditions along the various alignments and provide a report with geotechnical engineering recommendations for the proposed service installations and pavement design for the road, along with general constructability recommendations.

An Assessment of Past Uses (APU) report and Soil Characterization report were also part of the scope of work and are completed under separate cover.

2. Procedures and Methodology

It is noted that all elevations in this report are metric/geodetic and expressed in meters (m). All measurements in this report are also in metric and expressed in millimetres (mm), metres (m) or kilometers (km).

The borehole locations were laid out in the field by GEI staff prior to commencement of drilling operations. The locations of underground utilities were co-ordinated with locating companies.

The drilling for the site was carried out between January 30 and February 3, 2023, and were drilled to 1.5 to 6.6 m depth (Elev. 227.0 and 264.2) along the various proposed alignments with some boreholes encountering auger refusal. Boreholes 1 to 12 were drilled on 9th Avenue East, Borehole 14 was east of 9th Avenue East near 4th Street East, Boreholes 15 to 17 and 19 to 25 drilled on the looping watermain alignment. It is noted that Boreholes 13, 18 and 26 could not be drilled due to access or permission to enter concerns.

Ground surface elevations of the boreholes and horizontal coordinates (referencing NAD 83 geodetic datum) were surveyed by GEI with a Topcon FC – 5000 GPS Survey unit. The elevations and coordinates are provided on the borehole logs in Appendix A. Borehole locations are shown on Figure 2.

Traffic control services for the project were provided by GEI. All traffic control set ups were executed in accordance with Ontario Traffic Manual – Book 7 Temporary Conditions (OTM Book 7).

Drilling and sampling of the boreholes was completed using truck mounted drilling equipment operated by a specialty drilling subcontractor retained and supervised by GEI. The boreholes were advanced to predetermined depths through the use of solid stem augers and sampling was conducted using a 51 mm O.D. Split Spoon (SS) sampler. Standard Penetration Test (SPT) “N” Values (N values) were recorded for the sampled intervals as the number of blows required to drive an SS sampler 305 mm into the soil using a 63.5 kg drop hammer falling 750 mm, in accordance with ASTM D1586. Soil sampling was conducted at 0.75 m intervals for the upper 3.0 m, and at 1.5 m intervals thereafter.

A monitoring well was installed in eleven (11) of the boreholes to facilitate the measurement of the stabilized groundwater level and for subsequent monitoring or testing purposes. The monitoring well installation was performed in accordance with Ontario Regulation (O.Reg.) 903. The boreholes without a well were backfilled in accordance with O.Reg. 903 and patched with cold mix asphalt, as required.

The GEI field staff examined, and classified characteristics of the soils encountered in the boreholes, including the presence of fill materials, groundwater observations during and upon completion of the drilling, recorded observations of borehole advancement, and processed the recovered samples. All recovered soil samples were logged in the field, carefully packaged, and transported to the laboratory for more detailed examination and classification.

In the laboratory, the samples were classified as to their visual and textural characteristics. All samples were submitted for moisture content determination. Four (4) composite samples of pavement granular and seven (7) samples of the underlying strata were submitted for grain size analysis and two (2) samples were submitted for Atterberg limits testing. Laboratory testing results are provided in Figures B1 to B11 in Appendix B.

3. Subsurface Conditions

3.1 General Overview

Borehole locations are shown on Figure 2. Detailed soil profiles encountered in the boreholes are indicated on the attached borehole logs in Appendix A, with the results of geotechnical laboratory testing included in Appendix B.

It should be noted that the conditions indicated on the borehole logs are for specific locations only and can vary between and beyond the locations. It should be noted that the soil boundaries indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling. These boundaries are intended to reflect approximate transition zones and should not be interpreted as exact planes of geological change.

In addition, the descriptions provided in the borehole logs are inferred from a variety of factors, including visual observations of the soil samples retrieved, laboratory testing, measurements prior to and after drilling, and the drilling process itself (speed of drilling, shaking/grinding of the augers, etc.). The passage of time also may result in changes in conditions interpreted to exist at locations where sampling was conducted.

3.2 Stratigraphy

3.2.1 Pavement Structure

Most boreholes were drilled through the various paved road surfaces, except Boreholes 14, 19, 20, 24 and 24. Component thicknesses are provided below.

Borehole	Asphalt (mm)	Granular Thickness (mm)	Total Thickness (mm)
1	220	120	340
2	220	580	800
3	260	500	760
4	150	650	800
5	300	360	660
6	130	290	420
7	120	200	320
8	150	450	600

Borehole	Asphalt (mm)	Granular Thickness (mm)	Total Thickness (mm)
9	170	590	760
10	100	660	760
11	120	650	770
12	160	600	760
15	90	520	610
16	210	400	610
17	100	660	760
21	125	625	750
22	100	660	760
23	125	-	

Distinction between granular base and subbase layers could not be determined.

Four (4) composite samples of granular material consisting of auger samples were submitted for sieve analysis and comparison to OPSS.MUNI 1010 standards for granular materials, with the results provided in Figure B1 to B8 in Appendix B. The samples analyzed did not satisfy gradation specifications for Granular A being finer on multiple sieves. The samples did not meet the specifications for Granular B Type I, due to excessive material passing the 75µm sieve (13 to 24% versus the 8% standard).

3.2.2 Topsoil

Boreholes 14, 19, 20, 24 and 25 encountered topsoil at the surface of the boreholes that was 75 to 100 mm in thickness.

3.2.3 Fill

A fill layer was encountered beneath the pavement structure and topsoil in all boreholes except 2,5, 8, 15 and 16 and was penetrated at 0.8 to 3.8 m depth (Elev. 231.4 to 261.2), locally extending to the 1.5 m depth of exploration in Boreholes 10 to 12 (Elev. 244.0 to 261.1). The fill consisted of silty sand in Boreholes 1, 3, 4, 6, 7, 10 and 12, sand and silt in Borehole 9 and sandy silt in Boreholes 14, 22 and 23. The sandy fill varied to clayey silt in Borehole 3 and 4 and sandy clayey silt in Borehole 7. In Boreholes 17, 19, 20, 21, 22, 24 and 25, fill consisted of clayey silt. Trace to some organics and rootlets were observed in Boreholes 14, 20, 23, 24, and 25. One (1) sample of the material was submitted for grain size analysis and the results are provided in Figure B9 in Appendix B. Atterberg Limits on the sample are shown in Figure 11 in Appendix B. The fill was moist, with moisture contents ranging from 5 to 22%. The fill had N values ranging from 3 to 49 blows, showing a loose to dense condition typically compact in cohesionless soil and soft to very stiff cohesive fill soil.

3.2.4 Sandy Silt

Underneath the topsoil and fill in Borehole 14 a local sandy silt layer (trace to some clay and trace gravel) was observed from 0.8 m to 2.3 m depth (Elev. 246.5 to 248.0). Beneath the pavement and fill in Borehole 21, another sandy silt layer was revealed from 1.5 to the 2.3 m depth of exploration (Elev. 243.0). The soil was moist to wet with moisture contents of 12 to 15. The material was loose with an N value of 7 in boreholes 21 and compact to dense in Borehole 14 with a N values of 26 and 31.

3.2.5 Glacial Till

A glacial till deposit was encountered in Boreholes 1 to 9, 14 to 17, 19 to 20 and 22 to 25 below the upper soil layers and extended below the 1.5 m to 6.6 m depth of exploration (Elev. 227.0 to 264.2). The till matrix was variable and predominantly consisted of sandy silt, sand and silt, silty sand and locally clayey silt and sandy clayey silt in Boreholes 7, 8, 19 and 20. Cobbles and boulders should be expected based on augers grinding during advancement of the boreholes. Six (6) samples of the material were submitted for grain size analysis and the results are provided in Figure B10 in Appendix B. Atterberg Limits on one sample are shown in Figure B11. The glacial till was brown to grey near the base, and was typically moist, with moisture contents ranging from 14 to 24%. N values were 7 to more than 50 blows, indicating a range of loose to very dense / stiff to hard conditions, but typically compact.

3.2.6 Auger Refusal

Auger refusals was observed in Boreholes 10, 11, 12, 15, 16, 17, 19 and 25 at depths noted below. An auger probe was advanced beside all theses boreholes to confirm the depth of refusal. The auger probes met with similar refusal depths. Auger refusal could have been due to the cobbles/boulders in the till and/or shallow bedrock common to the area. It is noted that the augers grinded at the borehole locations for several minutes and may have penetrated to some degree into the upper weathered bedrock. As such the, the depths noted below might be slightly lower than the top of the actual bedrock surface.

Borehole	Refusal Depth (m) / Elev.	Borehole	Refusal Depth (m) / Elev.
10	1.5/244.0	11	1.5/252.7
12	1.5/261.0	15	1.5/263.5
16	1.8/264.2	17	2.4/260.3

Borehole	Refusal Depth (m) / Elev.	Borehole	Refusal Depth (m) / Elev.
19	3.5/245.7	21	2.3/243.0
25	2.9/245.4		

3.3 Groundwater

Unstabilized groundwater level measurements and borehole sloughing (cave) measurements were taken upon completion of drilling of each borehole. These measurements were taken to provide an estimate of possible excavation and temporary groundwater control issues that may arise during construction. Eleven (11) boreholes were outfitted with a monitoring well with 50 mm diameter PVC pipe and 1.5 m long screens. Monitoring well configuration and groundwater observations are noted on the borehole logs in Appendix A.

A summary of the ground water level measurements is below:

Borehole	Depth of Cave (m) / Elev.	Unstabilized Groundwater Level Depth (m) / Elev.	Depth (m) / Elev. of Groundwater Table in Well, February 13, 2023
1	Open (5.0 / 229.3)	No Water	No Water
2	Open (5.0 / 232.3)	No Water	--
3	Open (5.0 / 237.7)	No Water	No Water
4	Open (5.0 / 239.3)	No Water	--
5	Open (5.0 / 232.0)	No Water	3.2 / 233.9
6	Open (5.0 / 230.2)	No Water	--
7	Open (5.0 / 228.7)	4.4 / 229.3	1.4 / 232.3
8	Open (6.6 / 227.0)	No Water	--
9	Open (5.0 / 232.3)	No Water	1.8 / 235.5
10	Open (1.5 / 227.0)	0.8 / 244.7	--
11	Open (1.5 / 252.7)	No Water	--
12	Open (1.5 / 261.0)	No Water	--
14	Open (3.5 / 245.3)	No Water	0.6 / 248.2
15	Open (1.5 / 263.5)	No Water	--
16	Open (1.8 / 264.2)	No Water	--

Borehole	**Depth of Cave (m) / Elev.**	**Unstabilized Groundwater Level Depth (m) / Elev.**	**Depth (m) / Elev. of Groundwater Table in Well, February 13, 2023**
17	Open (2.4 / 260.3)	No Water	No Water
19	Open (3.5 / 245.7)	No Water	1.7 / 247.5
20	Open (3.5 / 244.5)	No Water	--
21	Open (2.3 / 243.0)	No Water	1.2 / 244.0
22	Open (3.5 / 242.5)	No Water	--
23	Open (3.5 / 243.7)	No Water	0.1 / 247.2
24	Open (3.5 / 243.9)	No Water	--
25	Open (2.9 / 245.4)	No Water	0.2 / 248.1

Almost all boreholes were dry upon completion. About ten (10) days later, the stabilized groundwater levels in the wells were measured at 0.1 to 3.2 m (Elev. 232.3 and 248.2) below the existing ground surface. It is noted some groundwater is in the till and perched water is in the fill above the less pervious till.

The existing fill and sandy silt are permeable and will allow for the free flow of water when wet. The glacial till is generally not permeable.

Groundwater levels are expected to show seasonal fluctuations and vary in response to prevailing climate conditions.

3.4 Soil Corrosivity and Sulphate Attack on Concrete

The following soil samples were collected from the site and submitted to CALA-accredited Caduceon Laboratories for testing to determine the potential for soil corrosivity and sulphate attack on concrete:

- BH14 / SS2
- BH14 / SS4
- BH20 / SS2
- BH23 / SS4
- BH25 / SS2

The results of the chemical testing are provided in Appendix C.

The American Water Works Association (AWWA) has developed a scoring system in their C-105 Standard to determine the potential for soil to corrode cast iron alloys. The scoring system assigns points based on several soil parameters, including resistivity, pH, redox potential, sulfides, and moisture content. A rank of 10 or more indicates a potential for corrosion and suggests that corrosion protection measures should be considered. The results from the testing at this site is summarized below and the laboratory Certificate of Analysis is included as Appendix C.

Soil Parameter	AWWA Score				
	BH14 / SS2	BH14 / SS3	BH20 / SS2	BH23 / SS4	BH25 / SS2
Resistivity (ohm·cm)	0	0	0	0	0
pH	0	0	0	0	0
Redox Potential (mV)	0	0	0	0	0
Sulfides (µg/g)	2	2	2	2	2
Moisture	1	1	1	1	1
TOTAL SCORE	3	3	3	3	3

Based on the AWWA scoring system, samples scored less than 10 points which indicates a low potential for the soil corrosivity to affect cast iron alloys and corrosion protection measures are therefore not recommended for the site.

It should be noted that this ranking system provides a general indication of soil corrosivity potential only. Other external factors may increase corrosivity potential, such as stray electrical currents or the application of de-icing salts in the winter that can leach into the ground.

The samples were also tested for water-soluble sulphate content and compared to *Table 3: Additional Requirements for Concrete Subjected to Sulphate Attack* as found in CSA A23.1 *Concrete Materials and Methods of Construction*. Table 3 is used to determine the cementing materials required in concrete based on degree of exposure to sulphate attack. The testing shows the samples have less than 0.1% water-soluble sulphate, and therefore there will have negligible exposure to sulphate attack, as such no additives are required.

4. Engineering Design Parameters & Analysis

The City of Owen sound is proposing to replace the watermain water services on a section of 9th Avenue East in Owen Sound, Ontario from Superior Street to just north of 9th Street East approximately 1000 m in length. Some sections of sanitary and storm sewer may also be replaced along with all sanitary laterals. The current section of road is a four-lane road with curb and gutter and sidewalks. The road cross section will not change and the service trenches will be repaired after service installation (full road reconstruction is not required). It is understood that the inverts for the watermain would be about 2.0 m and inverts for the storm and sanitary sewer would be as deep as 3.5 m below the road grade.

Also, a looping watermain is part of the project. The alignment is about 1,350 m in length and extends from 8th Street East southerly to 6th Street East (through a Hydro One corridor), then west along 6th Street East for about 150 m, then south along private lands to Superior Street, then west along Superior Street to 9th Avenue East. then east to the dead end of 4th Street East. The watermain invert is about 2 m below existing grade.

Lastly, it is understood that the project will have several phases.

4.1 Service Installation

4.1.1 Bedding

The type of material and depth of granular bedding below the pipe will, to some extent, depend on the method of construction used by the contractor. Pipe bedding for flexible pipes should follow the requirements in Ontario Provincial Standard Drawing (OPSD) 802.010 or 802.013 or applicable municipal standards. Pipe bedding for rigid pipes should follow the requirements in OPSD 802.030 to 802.033 or applicable municipal standards.

The subgrade generally consisting of competent native soil at the site will provide adequate support for pipes with the bedding requirements as laid out in the above referenced OPS drawings. Earth fill was encountered in most boreholes which extended to 0.8 m to 3.8 m depth below the road grade. The fill below the invert level (if encountered) will need to be removed/sub-excavated and replaced with an increased thickness of granular bedding. On-site geotechnical inspections are required to verify encountered subgrade conditions and provide any required remedial recommendations on subgrade support for bedding materials.

Where disturbance of the trench base has occurred from ground water seepage, construction traffic, etc., the disturbed soils should be sub excavated and replaced with suitably compacted granular material. Details on temporary ground water control are provided in Section 5.2.

Locally in the looping water alignment auger refusal was encountered shallower than the waterman invert at 1.5 to 1.8 m depth, Elev. 244.0 to 264.2 (Boreholes 10 to 12, 15 and 16), with refusal slightly deeper than the watermain invert at 2.3 to 2.9 m depth, Elev. 243.0 to 260.3 (Boreholes 17, 21 and 25). Where bedrock is present, rock excavation can be carried out to the proposed invert, or the pipes can be supported on the bedrock with insulation to provide the remaining frost protection. It is noted that 25 mm of insulation is equivalent to 300 mm of earth cover. The insulation will need to be placed in such a was such that the path for frost to the pipe is more than the 1.7 m of earth cover proposed.

Regardless of whether flexible or rigid pipes are implemented, granular bedding and cover material should consist of a well graded, free draining material, such as Granular "A" (OPSS.MUNI 1010). All granular bedding must be compacted to a minimum of 95% Standard Proctor maximum dry density (SPmdd).

4.1.2 Backfill

Excavated pavement structure granular soils, sandy inorganic earth fill, and native soils may be used as backfill in trenches, provided they are moisture conditioned so the moisture content is within 2% of optimum. The backfill should be compacted to a minimum of 95% SPmdd (see Section 5.3 for more details on soil compaction). In confined areas the layer thickness will have to be reduced to utilize smaller compaction equipment efficiently or by using granular material instead of locally sourced fill. Any backfill that is frozen, contains a high percentage of organic material (topsoil, peat, wood, etc.) or moisture, or has otherwise unsuitable deleterious inclusion should not be used as backfill. The maximum cobble or boulder size should not exceed half of the loose lift thickness (i.e., all particles with a diameter greater than 100 mm should be removed).

Where trenches are within the traveled portions of a roadway, backfill within the frost penetration depth of 1.5 m should consist of native, non-organic, excavated material consistent with the soils surrounding the trench. If this technique is not undertaken, then frequent problems arise with yearly differential frost heave movements between the trench backfill and the adjacent native soil. This would occur, for example, if imported granular material is used to backfill trenches which is less susceptible to frost effects compared to the native soils on site. Alternatively, if different soil is used as the backfill due to issues with achieving compaction, a frost taper of 10H:1V can be implemented to help mitigate the potential for differential settlement and frost heave.

4.2 Pavement Design and Construction

As noted earlier, over the service trenches, the pavement is to be repaired to match or slightly exceed the existing thicknesses.

Based on Boreholes 1 to 12 on 9th Avenue, 100 to 300 mm of asphalt (average 175 mm) is over a 120 to 660 mm of granular (average 470 mm) for a total thickness of 320 to 800 mm (average 645 mm). The recommended pavement reinstatement is as follows:

Pavement Layer	Compaction Requirements	Component Thickness
Surface Course Asphaltic Concrete: SP 12.5 (OPSS 1150, OPSS.MUNI 1151, and OPSS.MUNI 1101)	OPSS 310	50 mm
Upper Binder Course Asphaltic Concrete: SP 19.0 (OPSS 1150, OPSS.MUNI 1151, and OPSS.MUNI 1101)		75 mm
Lower Binder Course Asphaltic Concrete: SP 19.0 (OPSS 1150, OPSS.MUNI 1151, and OPSS.MUNI 1101)		75 mm
Base Course: Granular A (OPSS.MUNI 1010)	100% Standard Proctor Maximum Dry Density (ASTM-D698)	150 mm
Subbase Course: Granular B Type I (OPSS.MUNI 1010)		500 mm

Based on Boreholes 15 to 17 and 21and 22, Superior Street and 6th Street East, 90 to 210 mm of asphalt (average 125 mm) is over a 400 to 660 mm of granular (average 573 mm) for a total thickness of 610 to 760 mm (average 700 mm). The recommended pavement reinstatement is as follows:

Pavement Layer	Compaction Requirements	Component Thickness
Surface Course Asphaltic Concrete: SP 12.5 (OPSS 1150, OPSS.MUNI 1151, and OPSS.MUNI 1101)	OPSS 310	40 mm
Binder Course Asphaltic Concrete: SP 19.0 (OPSS 1150, OPSS.MUNI 1151, and OPSS.MUNI 1101)		80 mm
Base Course: Granular A (OPSS.MUNI 1010)	100% Standard Proctor Maximum Dry Density (ASTM-D698)	150 mm
Subbase Course: Granular B Type I (OPSS.MUNI 1010)		500 mm

Traffic volumes will be required to determine Categories for Superpave.

Subgrade preparation in road repair areas should involve proof rolling the exposed subgrade under supervision of geotechnical personnel to ensure the subgrade is compacted to a minimum 95% SPmdd. Any organic rich or deleterious soils are not a suitable subgrade and must be removed prior to placement of granular fill materials within reinstatement or widening areas. Zones with high moisture, deleterious materials, or excessive organics and, must be sub-excavated and replaced with clean earth fill, placed and compacted following the specifications in Section 5.4 to a minimum of 95% SPmdd.

Special care should be taken to ensure that the elevation and slope of the pavement subgrade is maintained, so as to not create a sump within the pavement structure, at the edge of the pavement repair.

The long-term performance of the pavement structure is highly dependent upon the subgrade support conditions. Stringent construction control procedures must be maintained to ensure that uniform subgrade moisture and density conditions are achieved as much as and the subgrade is not disturbed or weakened after it is exposed.

The granular materials should be placed in lifts 200 mm thick or less and be compacted to a minimum of 100% SPmdd for both granular base and subbase. Asphalt materials should be rolled and compacted as per OPSS.MUNI 310. The granular and asphalt pavement materials and their placement should conform to OPSS.MUNI 1101, 1010, 1151 and 1150.

As discussed earlier in the report, the existing pavement structure granular material does not conform to OPSS.MUNI 1010 specifications for Granular A or B and cannot be re-used in a new pavement structure as the base or subbase courses but is suitable for re-use as bulk fill.

It should be noted that in addition to adherence of the above pavement design recommendations, a close control on the pavement construction process will also be required in order to obtain the desired pavement life. Therefore, it is recommended that regular inspection and testing should be conducted during the pavement construction to confirm material quality, thickness, and to ensure adequate compaction.

Longitudinal asphalt joints should be milled into the existing asphalt a minimum 0.5 m for each lift.

5. Constructability Considerations

5.1 Excavations

Excavation for the service installation is anticipated to extend as deep as approximately 2.0 to 3.5 m below the road grade to allow for pipe bedding. Excavation will encounter the pavement, fill, and underlying glacial till. Harder digging can be experienced in the glacial till. Boulders and cobbles may be encountered in the glacial till.

Locally, bedrock will be encountered in the watermain loop as noted earlier. Where blasting is employed to remove the bedrock below the pipe inverts, precondition surveys are recommended around the site. This document will assist in resolution of claims arising from complaints of construction related damage. A blasting monitoring program should be implemented to optimize the effectiveness of the blasting while monitoring/maintaining vibration to acceptable levels.

Excavations must be carried out in accordance with the Occupational Health and Safety Act, Ontario Regulation 213/91 (as amended), Construction Projects, Part III - Excavations, Section 222 through 242. Where workers must enter a trench or excavation the soil must be suitably sloped and/or braced in accordance with the OHSA.

These regulations designate four (4) broad classifications of soils to stipulate appropriate measures for trench safety. If more than one soil type is encountered in a trench, the soil type with the highest number will govern the trench/excavation sidewall geometry. Subject to adequate groundwater control, as required and discussed in the next section, trenches for utility installation/replacement shall be carried out with Type 3 Soil geometry, with sidewalls to be constructed no steeper than 1H:1V from the base of the excavation.

Minimum support system requirements for steeper excavations are stipulated in Sections 235 through 238 and 241 of the OHSA and include provisions for timbering, shoring and moveable trench boxes. To reduce the potential for instability of the trench excavations, materials excavated from the service trenches and/or other fill materials or heavy equipment should not be placed near the crest of the trench excavations.

It is important to note that soils encountered in the construction excavations may vary significantly across the site. Our preliminary soil classifications are based solely on the materials encountered in the boreholes advanced on site. The contractor should verify that similar conditions exist throughout the proposed area of excavation. If different subsurface conditions are encountered at the time of construction, it is recommended that GEI be contacted immediately to evaluate the conditions encountered.

5.2 Temporary Construction Excavation Groundwater Control

As noted in the last section, the trench excavation is anticipated to approximately 2.0 to 3.5 m depth below the road grade.

Almost all boreholes were dry upon completion. About ten (10) days later, the stabilized groundwater levels in the wells were measured at 0.1 to 3.2 m (Elev. 232.3 and 248.2) below the existing ground surface. It is noted some groundwater is in the till and perched water is in the fill above the less pervious till.

It is important to control the groundwater adequately. If the groundwater table is not controlled during construction, the base of the excavation/culvert foundation pipe bed may become unstable. For trench excavation as described above the excavation will extend through the pavement, fill and into the underlying glacial till deposits. No major groundwater problems are anticipated for the installation of services to the depths noted. Any water seepage should be controlled by the use of conventional sump pumping, for most excavations. Greater localized seepage may be encountered, and these areas may require pumping from keg wells or the like to control ground water.

It is recommended to carry out the work during the dry time of the year when the ground water table is lowest, to mitigate groundwater control measures. Also reducing the size of the excavation that is open at any one time will aid in reducing groundwater control requirements.

The exact scenario where these groundwater control techniques will work are estimates only and are directly correlated to how coarse/fine the native soils are in an excavation, and both the lateral and vertical extent of the cohesionless deposits encountered. If the groundwater table is not controlled during construction, the base of the excavations will probably be unstable, leading to difficulties in excavating and placement of the service pipes.

A preliminary assessment on the amount of dewatering required for the service installations due to groundwater entering an open trench is likely less than 50,000 L/day. A Permit to Take Water (PTTW) from the MECP, is not required (dewatering greater than 400,000 L/day). Registry on the ESAR system may be prudent to allow for greater pumping, if required.

5.3 Compaction Specifications

Standard Proctor maximum dry density is the specification to indicate the degree to which soil or aggregate is compacted. To achieve the specified SPmdd as indicated in this report, all soils or aggregates must be placed in lift thicknesses no greater than 200 mm. If this is not the case, only the upper portion of the lift will be adequately compacted, and the lower portion of the lift has a high probability of not meeting compaction specifications. In addition, industry standard equipment used to determine the degree of compaction consists of nuclear densometers. These devices have an inherent limitation in that they cannot test beyond 300 mm in depth, and so the degree of compaction beyond this depth cannot be quantitatively determined.

Along with lift thickness, ensuring that the soil or aggregate is within 2% of its optimum moisture content ensures that the specified compaction can be reached. If the soil or aggregate is too dry/wet, it is either very difficult or impossible to reach the specified compaction. This is especially true for when higher compaction specifications such as 98% and 100% SPmdd are required.

Moisture can be increased by adding water and mixing the soil prior to re-use, or by importing soil to the site that is at optimum and can be readily compacted.

Moisture can be reduced by tilling or spreading out the soil to dry or blending it with drier material. In-situ moisture contents can change based on the season and local groundwater levels and can also change for stockpiled material due to precipitation. Zones of the fine-grained soil beneath the site have very high moisture contents and moisture conditioning may be difficult to accomplish.

In addition to the above compaction specifications, in any areas where compacted fill will be placed over the exposed native soil subgrade, any loose, soft, organic soil, wet or unstable areas should be sub-excavated, and backfilled with site inorganic soil or Granular 'B' (OPSS.MUNI 1010) compacted to a minimum of 95% SPmdd. This recommendation applies to site servicing and pavement subgrades.

5.4 Quality Verification Services

On-site quality verification services are an integral part of the geotechnical design function. Quality verification services are used to confirm that construction is being conducted in general conformance with the requirements as outlined in the drawings, reports and specifications prepared for the proposed development.

GEI Consultants can provide all the on-site quality verification services outlined below:

- Part-time monitoring of the subgrade support capabilities, material quality, lift thickness, moisture content, degree of compaction, etc. is recommended for the following areas to ensure the recommendations within this report are followed and they perform adequately in the long-term:
  - Pavement structure (granular layers and asphalt); and
  - Bedding/backfilling of culvert.
- Full-time monitoring of the subgrade support capabilities, material quality, lift thickness, moisture content, degree of compaction, etc. is recommended for engineered fill under structures;

- Testing of the concrete (compressive strength, slump, air content, etc.) and testing of the asphalt (asphalt content and gradation) are recommended to ensure that the quality of the materials being brought to site meet the requirements of the project. This would only apply to poured in place foundations and not pre-cast structures.

6. Limitations and Conclusions

6.1 Limitations

The recommendations and comments provided are necessarily on-going as new information of underground conditions becomes available. More specific information with respect to the conditions between samples, or the lateral and vertical extent of materials may become apparent during excavation operations. The interpretation of the borehole information must, therefore, be validated during excavation operations. Consequently, conditions not observed during this investigation may become apparent. Should this occur, GEI should be contacted to assess the situation and additional testing and reporting may be required.

GEI should be retained for a general review of the final design drawings and specifications to verify that this report has been properly interpreted and implemented. If not accorded the privilege of making this review, GEI will assume no responsibility for interpretation of the recommendations in the report.

The comments given in this report are intended only for the guidance of the design engineers. The number of boreholes required to determine the localized underground conditions between boreholes affecting construction costs, techniques, sequencing, equipment, scheduling, etc. could be greater than has been carried out for design purposes. Contractors bidding on or undertaking the works should, in this light, decide on their own investigations, as well as their own interpretations of the factual borehole results, so that they may draw their own conclusions as to how the subsurface conditions may affect them.

This report was authorized by, and prepared by GEI for, the account of Tatham Engineering Limited (as provided the signed Agreement for Professional Consulting Services provided by Tatham Engineering Limited). Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. GEI accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made, or actions based on this project.

6.2 Conclusion

It is recognized that municipal/regional governing bodies, in their capacity as the planning and building authority under Provincial statues, will make use of and rely upon this report, cognizant of the limitations thereof, both as are expressed and implied.

GEI trusts this report is complete within our terms of reference, and the information presented is sufficient for your present purposes. If you have any questions, or when we may be of further assistance, please do not hesitate to contact our office.

Yours Truly,

GEI Consultants

LICENSED PROFESSIONAL ENGINEER
G.R. WHITE
Mar. 24, 2023
PROVINCE OF ONTARIO

Mohd Razeen

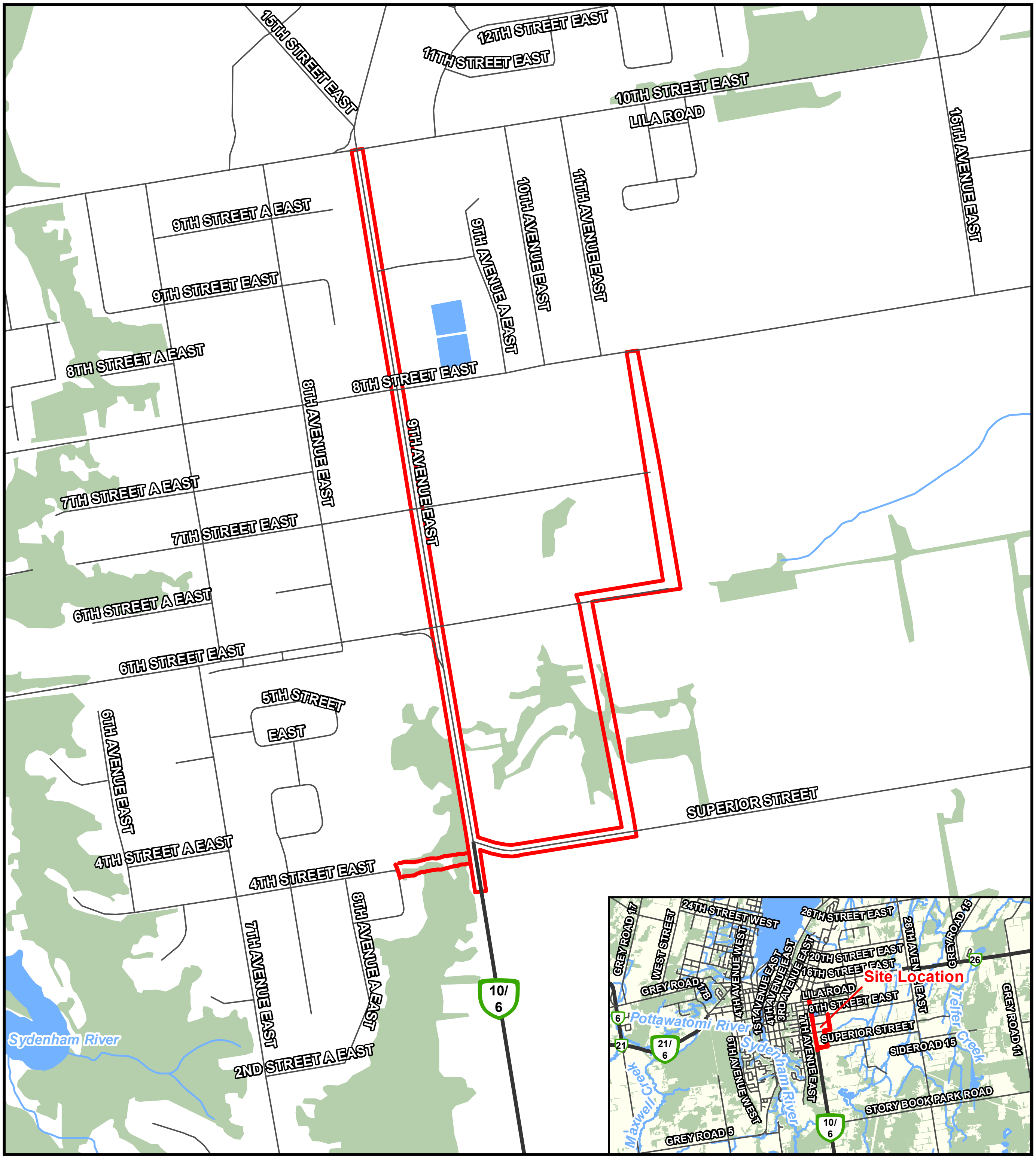
Mohammed Razeen
Geotechnical E.I.T.

Geoffrey R. White, P.Eng.
Geotechnical Practice Lead

Figures

Site Location Plan

Borehole Location Plan



NOTES:
1. Coordinate System: NAD 1983 UTM Zone 17N.
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2023.

Legend

🟥	Site Location	—	Road
━	Highway	—	Watercourse
		🟩	Wooded Area (LIO)
		🟦	Waterbody

N

0 125 250
m
1:10,000

9th Avenue East, Owen Sound, ON
Proposed Watermain Replacement
and Road Reconstruction

Tatham Engineering Limited

GEI Consultants

Project 2201530

SITE LOCATION PLAN

March 2023

Fig. 1

NOTES:
1. Coordinate System: NAD 1983 UTM Zone 17N.
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2023.

Legend

🟥 Site Location

● Approximate Borehole/Monitoring Well Location

● Approximate Borehole

N

0 80 160 m

1:7,000

9th Avenue East, Owen Sound, ON
Proposed Watermain Replacement and Road Reconstruction

Tatham Engineering Limited

GEI Consultants

Project 2201530

BOREHOLE LOCATION PLAN (AERIAL)

March 2023

Fig. 2

Appendix A

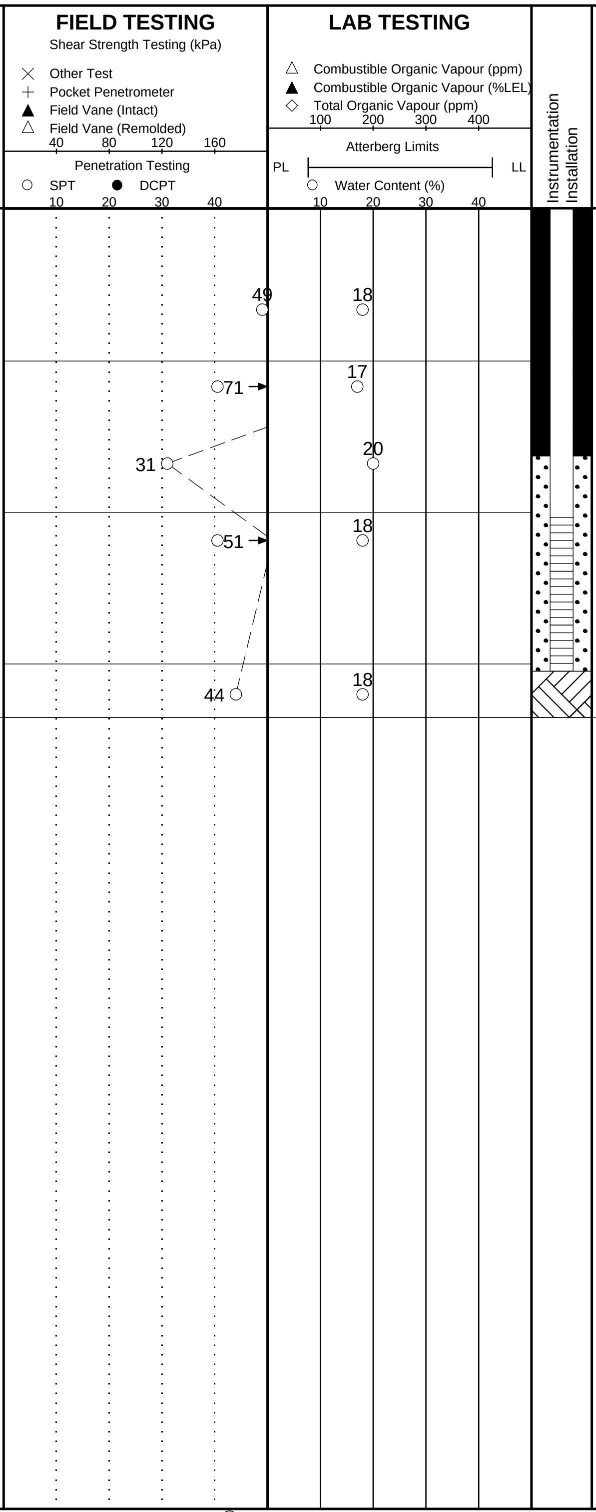
Borehole Logs

RECORD OF BOREHOLE No. 1

GEI Consultants

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:
Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing: **4935009**
Easting: **505716**
Date Started: **Feb 1/23**
Date Completed: **Feb 3/23**

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Depth / Elev.	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	SPT	Water Content (%)	Instrumentation Installation	GR	SA	SI	CL
0.0 / 234.4 0.3 / 234.0	ASPHALT: 220 mm GRANULAR FILL: 120 mm	AS	1			0	234							
	FILL: Silty sand, trace gravel, dense, brown, moist	SS	2	100	49			49	18					
1.5 / 232.8	SANDY SILT GLACIAL TILL: Some clay, trace to some gravel, trace shale fragments, very dense, greyish brown, moist	SS	3	75	71	1.5	232.5	71 →	17					
	- - - Dense, brownish red - - -	SS	4	100	31			31	20		10	32	40	18
	- - - Very Dense - - -	SS	5	100	51	3	231	51 →	18					
	- - - Dense, grey - - -	SS	6	100	44	4.5	229.5	44	18					
5.0 / 229.3	Borehole Terminated at 5.0 m													



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▽ Groundwater depth encountered on completion of drilling: Dry
▼ Groundwater depth observed on: Feb 13/23 at depth of: Dry
Cave depth after auger removal: Open
Groundwater Elevation:

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

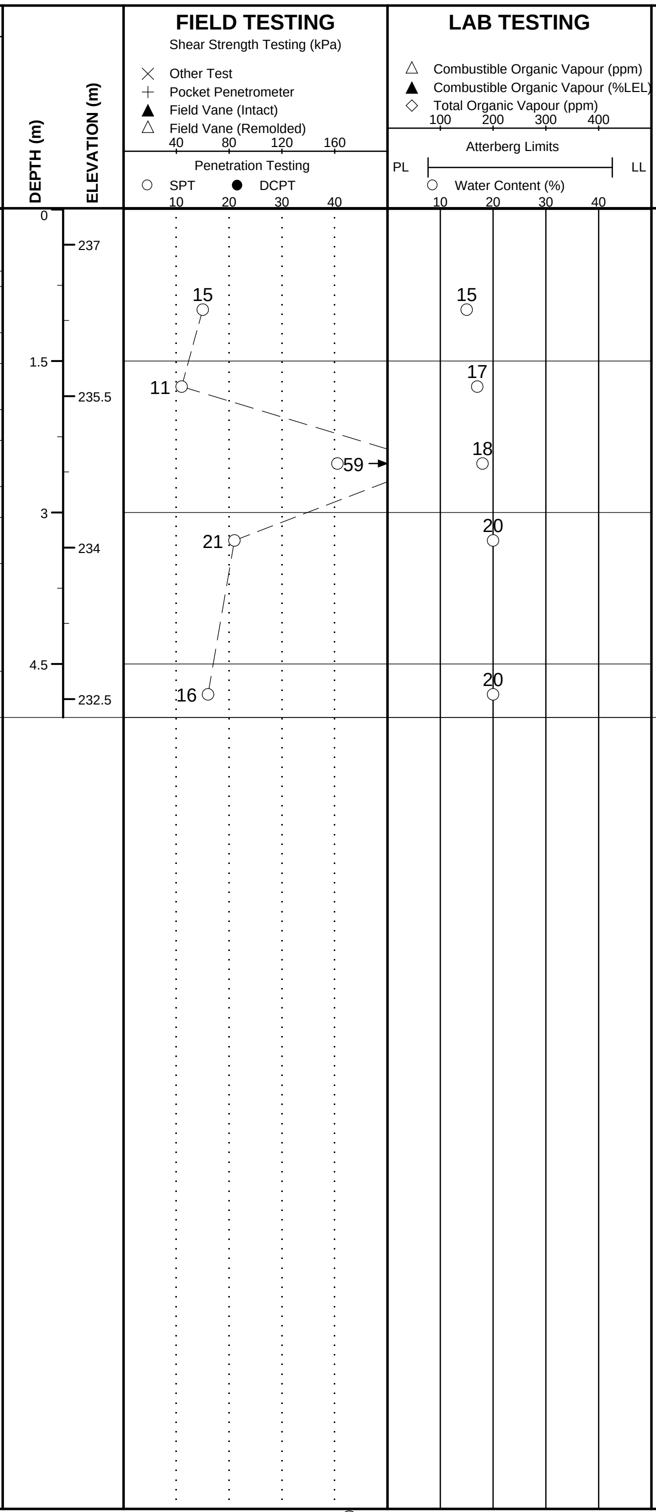
Scale: **1 :75**
Page: **1 of 1**

RECORD OF BOREHOLE No. 2

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing: **4934935**
Easting: **505727**
Date Started: **Feb 1/23**
Date Completed: **Feb 3/23**

Depth (m)	Elevation (m)	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	Water Content (%)	COMMENTS & GRAIN SIZE DISTRIBUTION (%)
0.0	237.3	ASPHALT: 220 mm GRANULAR FILL: 580 mm	AS	1				
0.8	236.6	SANDY SILT TILL: Trace to some clay, trace gravel, compact, brownish red, moist	SS	2	100	15	15	
			SS	3	100	11	17	
		- - - Shale fragments, very dense - - -	SS	4	100	59	18	First Water Strike SS4
		- - - Compact - - -	SS	5	100	21	20	
		- - - Brown to grey - - -	SS	6	100	16	20	
5.0	232.3	Borehole Terminated at 5.0 m						



Instrumentation Installation

GR | SA | SI | CL

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Groundwater depth encountered on completion of drilling: Dry
Cave depth after auger removal: Open
Groundwater depth observed on:
Groundwater Elevation:

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

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RECORD OF BOREHOLE No. 3

GEI Consultants

Project Number: **2201530**

Project Client: **Tatham Engineering Ltd.**

Project Name: **Watermain Replacement and Road**

Project Location: **9th Ave E, Owen Sound, ON**

Drilling Location: **See Borehole Location Plan**

Local Benchmark:

Drilling Method: **Truck Mount**

Drilling Machine: **Solid Stem Augers**

Logged By: **MH**

Reviewed By: **GW**

Northing: **4934850**

Easting: **505793**

Date Started: **Feb 1/23**

Date Completed: **Feb 3/23**

LITHOLOGY PROFILE / SOIL SAMPLING

Depth (m)	Elevation (m)	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	Water Content (%)
0.0	242.7	ASPHALT: 260 mm GRANULAR FILL: 500 mm	AS	1			
0.8	242.0	FILL: Silty sand, trace gravel, compact, brown, moist	SS	2	75	13	16
			SS	3	45	11	15
		- - - Clayey silt, some sand, trace gravel, soft - - -	SS	4	10	3	18
			SS	5	25	4	14
3.8	238.9	SANDY SILT TILL: Some clay, trace gravel, compact, brownish red, moist	SS	6	75	16	16
		- - - Grey - - -	SS	7	100	22	
5.0	237.7	Borehole Terminated at 5.0 m					

FIELD TESTING

Shear Strength Testing (kPa)

- × Other Test
- + Pocket Penetrometer
- ▲ Field Vane (Intact)
- △ Field Vane (Remolded)

40 80 120 160

Penetration Testing

○ SPT ● DCPT

10 20 30 40

LAB TESTING

- △ Combustible Organic Vapour (ppm)
- ▲ Combustible Organic Vapour (%LEL)
- ◇ Total Organic Vapour (ppm)

100 200 300 400

Atterberg Limits

PL ├────┤ LL

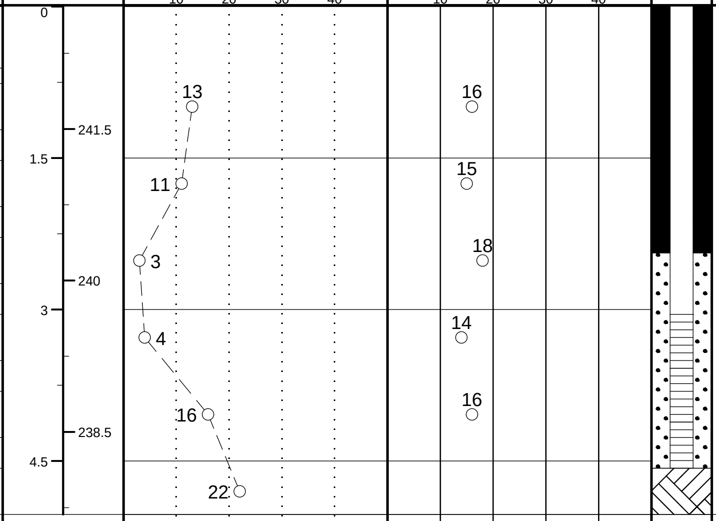
○ Water Content (%)

10 20 30 40

Instrumentation Installation

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL



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Groundwater depth encountered on completion of drilling: Dry

Groundwater depth observed on: Feb 13/23 at depth of: Dry

Cave depth after auger removal: Open

Groundwater Elevation:

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

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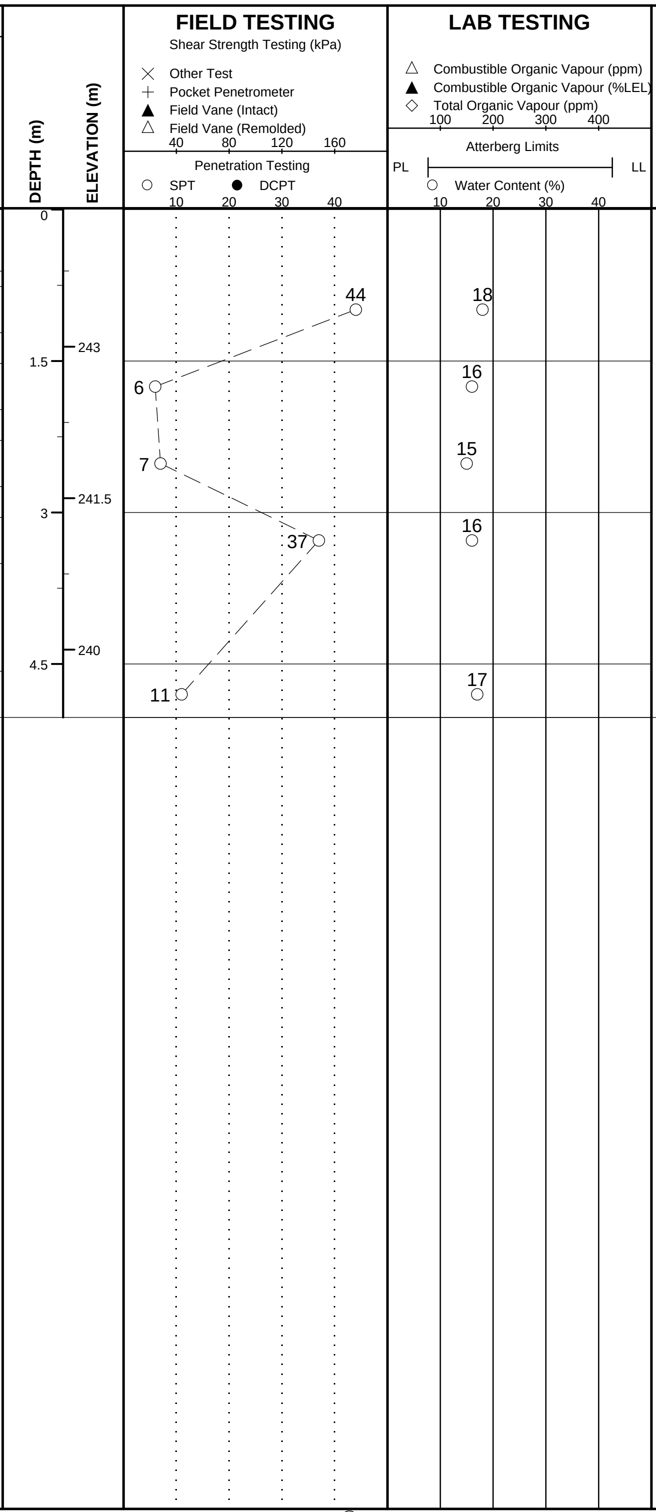
RECORD OF BOREHOLE No. 4

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:
Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing: **4934771**
Easting: **505757**
Date Started: **Feb 1/23**
Date Completed: **Feb 3/23**

Depth (m)	Elevation (m)	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	Water Content (%)
0.0	244.4						
0.2	244.2	ASPHALT: 150 mm					
		GRANULAR FILL: 650 mm	AS	1			
0.8	243.6	FILL: Silty sand, trace gravel, brownish red, dense, brown, moist	SS	2	35	44	18
		- - - Clayey silt, trace sand, trace gravel, brownish red, firm - - -	SS	3	75	6	16
			SS	4	35	7	15
3.0	241.3	SANDY SILT TILL: Some clay, trace gravel, dense, brownish red, moist	SS	5	100	37	16
		- - - Compact - - -	SS	6	75	11	17
5.0	239.3	Borehole Terminated at 5.0 m					



Instrumentation Installation

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL

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Groundwater depth encountered on completion of drilling: Dry
Cave depth after auger removal: Open
Groundwater depth observed on:
Groundwater Elevation:

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

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RECORD OF BOREHOLE No. 5

Project Number: **2201530**

Project Client: **Tatham Engineering Ltd.**

Project Name: **Watermain Replacement and Road**

Project Location: **9th Ave E, Owen Sound, ON**

Drilling Location: **See Borehole Location Plan**

Local Benchmark:

Drilling Method: **Truck Mount**

Drilling Machine: **Solid Stem Augers**

Logged By: **MH**

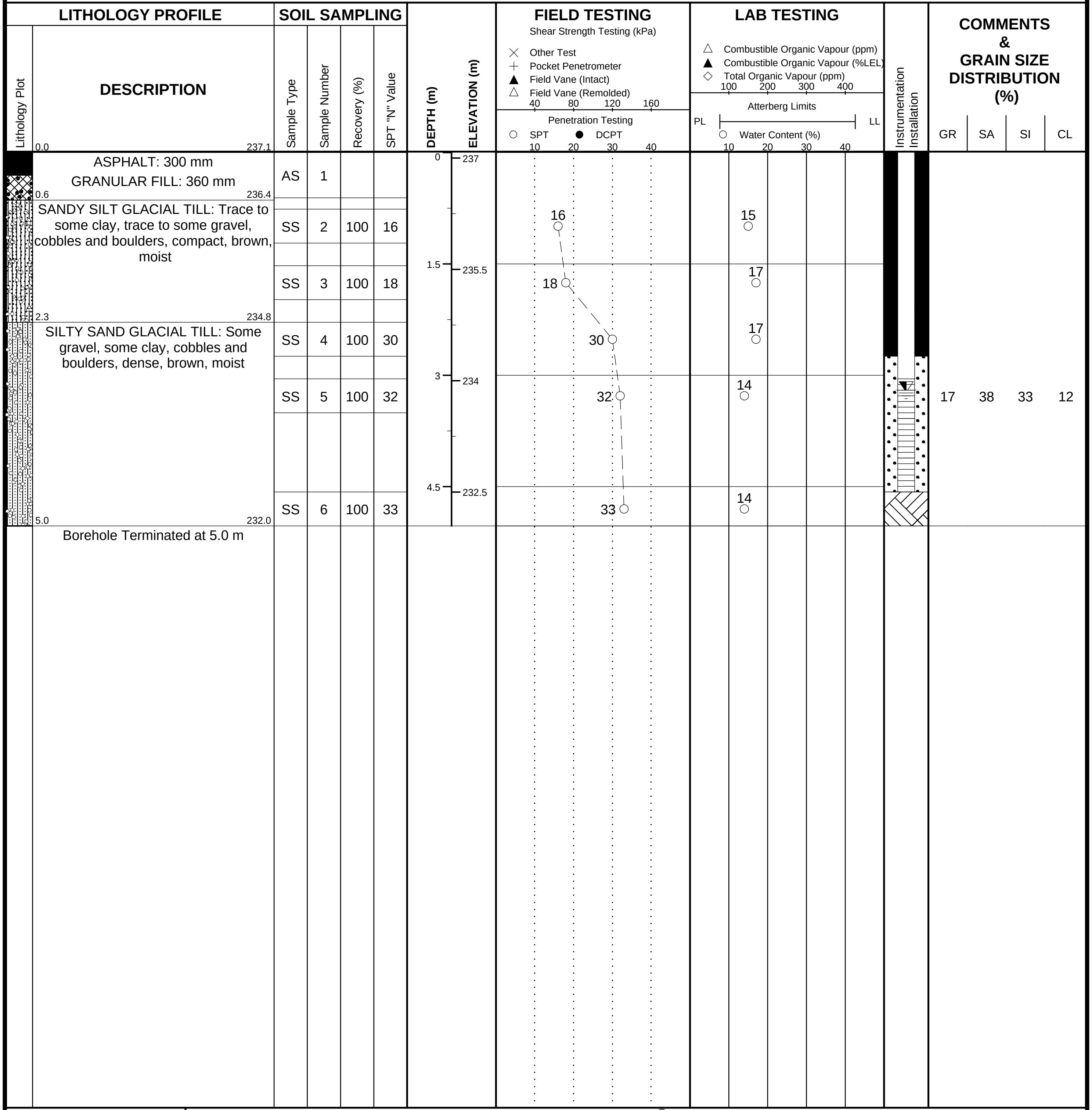
Reviewed By: **GW**

Northing: **4934619**

Easting: **505781**

Date Started: **Jan 31/23**

Date Completed: **Feb 3/23**



Depth (m)	Elevation (m)	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	Water Content (%)	GR	SA	SI	CL
0.0	237.1	ASPHALT: 300 mm GRANULAR FILL: 360 mm	AS	1							
0.6	236.4	SANDY SILT GLACIAL TILL: Trace to some clay, trace to some gravel, cobbles and boulders, compact, brown, moist	SS	2	100	16	15				
			SS	3	100	18	17				
2.3	234.8	SILTY SAND GLACIAL TILL: Some gravel, some clay, cobbles and boulders, dense, brown, moist	SS	4	100	30	17				
			SS	5	100	32	14	17	38	33	12
			SS	6	100	33	14				
5.0	232.0	Borehole Terminated at 5.0 m									

Groundwater depth encountered on completion of drilling: Dry

Cave depth after auger removal: Open

Groundwater depth observed on: Feb 13/23 at depth of: 3.2 m.

Groundwater Elevation: 233.9 m

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Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

Scale: **1 :75**

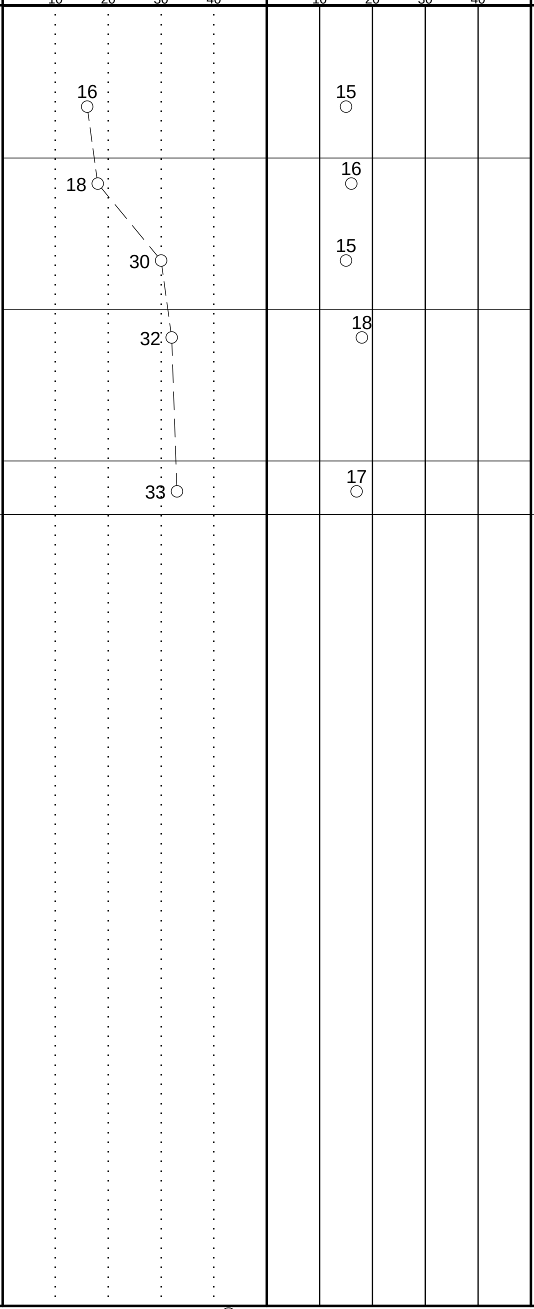
RECORD OF BOREHOLE No. 6

GEI Consultants

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing: **4934545**
Easting: **505794**
Date Started: **Jan 31/23**
Date Completed: **Feb 3/23**

Depth (m)	Elevation (m)	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	Water Content (%)
0.0	235.3	ASPHALT: 130 mm					
0.4	234.8	GRANULAR FILL: 290 mm	AS	1			
		FILL: Silty sand, some clay, trace gravel, compact, brown, moist	SS	2	100	16	15
1.5	233.8	SANDY SILT GLACIAL TILL: Trace to some clay, trace gravel, cobbles and boulders, compact, brown, moist	SS	3	100	18	16
		- - - Dense - - -	SS	4	100	30	15
			SS	5	100	32	18
			SS	6	100	33	17
5.0	230.2	Borehole Terminated at 5.0 m					



Depth scale (m): 0, 1.5, 3, 4.5; Elevation scale (m): 234, 232.5, 231

Instrumentation Installation

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL

Groundwater depth encountered on completion of drilling: Dry
Cave depth after auger removal: Open
Groundwater depth observed on:
Groundwater Elevation:

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Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

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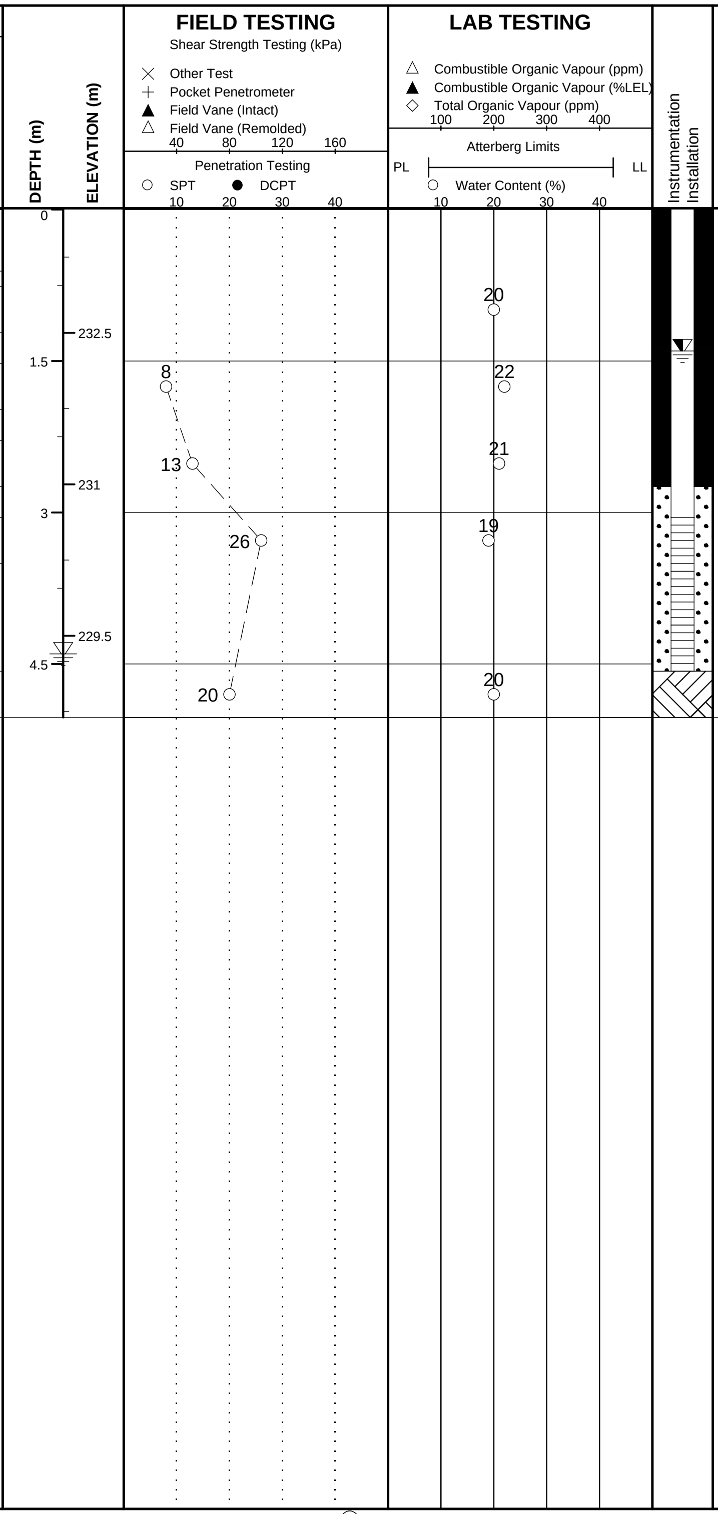
RECORD OF BOREHOLE No. 7

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing: **4934433**
Easting: **505812**
Date Started: **Jan 31/23**
Date Completed: **Feb 3/23**

LITHOLOGY PROFILE		SOIL SAMPLING				COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	GR	SA	SI	CL
	0.0 233.7								
	ASPHALT: 120 mm 0.3 GRANULAR FILL: 200 mm 233.4	AS	1						
	FILL: Silty sand, some gravel, very loose, brown, wet	AS	2						
	- - - Sandy clayey silt, trace gravel, loose - - -	SS	3	100	8				
	2.3 231.4 SANDY CLAYEY SILT GLACIAL TILL: Trace gravel, cobbles and boudlers, stiff/compact, brown, moist	SS	4	100	13				
	- - - Very stiff, grey - - -	SS	5	100	26				
	5.0 228.7	SS	6	100	20				
	Borehole Terminated at 5.0 m								



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Groundwater depth encountered on completion of drilling: 4.4 m.
Cave depth after auger removal: Open
Groundwater depth observed on: Feb 13/23 at depth of: 1.4 m.
Groundwater Elevation: 232.3 m

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

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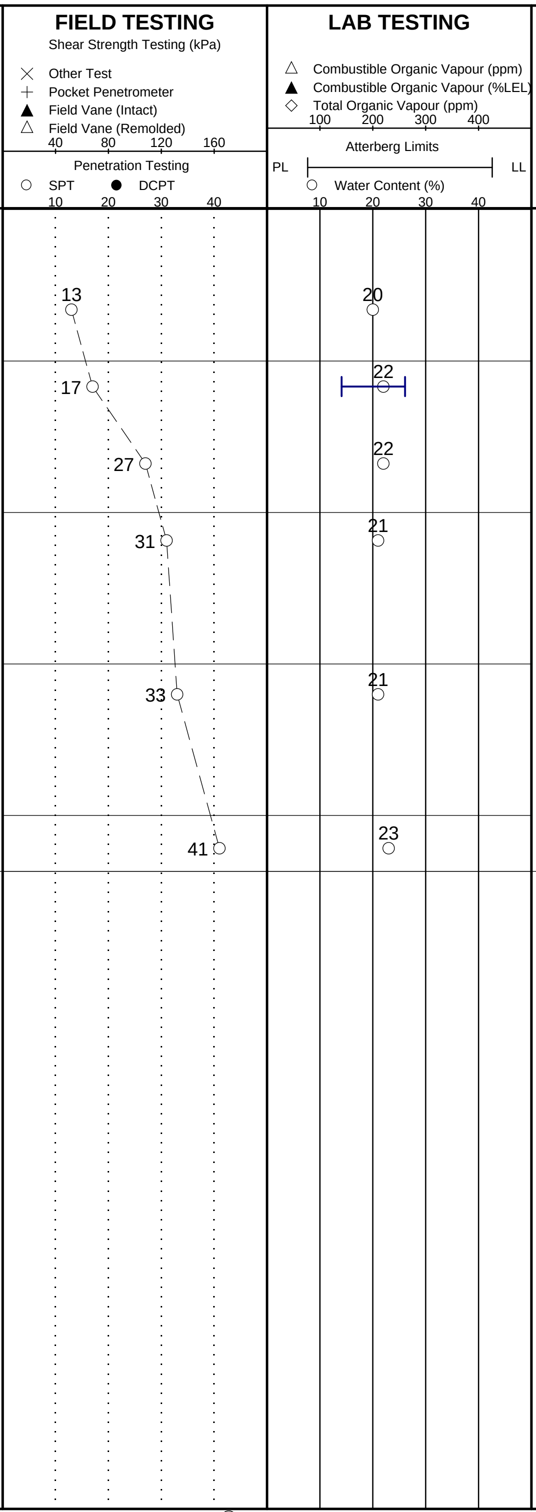
RECORD OF BOREHOLE No. 8

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing: **4934356**
Easting: **505826**
Date Started: **Jan 31/23**
Date Completed: **Feb 3/23**

LITHOLOGY PROFILE		SOIL SAMPLING						LAB TESTING	COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
DESCRIPTION	Depth / Elevation	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	Water Content (%)	GR	SA	SI	CL
	0.0 / 233.5					0						
ASPHALT: 150 mm GRANULAR FILL: 450 mm		AS	1									
CLAYEY SILT GLACIAL TILL: Trace to Some sand, trace gravel, cobbles and boulders, stiff, brown, wet	0.6 / 232.9	SS	2	100	13		232.5	20				
- - - Very stiff - - -		SS	3	100	17	1.5		22	6	12	47	35
		SS	4	100	27		231	22				
- - - Hard - - -		SS	5	100	31	3		21				
							229.5					
		SS	6	100	33	4.5		21				
							228					
CLAYEY SANDY SILT GLACIAL TILL: Trace gravel, cobbles and boudlers, hard/very dense, brown, moist	6.1 / 227.4	SS	7	100	41	6		23				
Borehole Terminated at 6.6 m	6.6 / 227.0											



Instrumentation Installation

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Groundwater depth encountered on completion of drilling: Dry
Cave depth after auger removal: Open
Groundwater depth observed on:
Groundwater Elevation:

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

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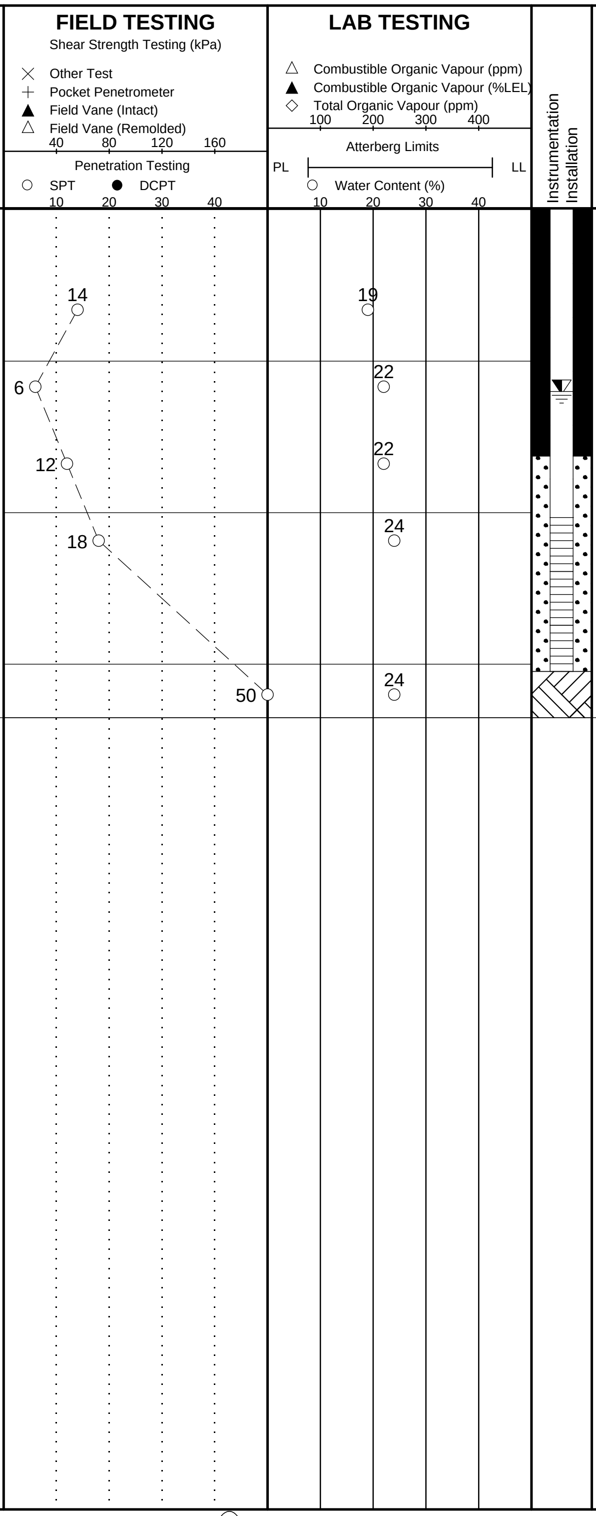
RECORD OF BOREHOLE No. 9

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing: **4934179**
Easting: **505854**
Date Started: **Feb 2/23**
Date Completed: **Feb 3/23**

Depth (m) / Elevation (m)	LITHOLOGY PROFILE – DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)
0.0 / 237.3	ASPHALT: 170 mm GRANULAR FILL: 590 mm	AS	1			0	237
0.8 / 236.6	FILL: Sand and silt, trace gravel, compact, dark color, moist	SS	2	100	14		
	- - - Loose - - -	SS	3	100	6	1.5	235.5
2.3 / 235.0	SANDY SILT GLACIAL TILL: Trace to some clay, trace gravel, cobbles and boulders, compact, brown, wet	SS	4	100	12		
		SS	5	100	18	3	234
	- - - Very dense - - -	SS	6	100	50	4.5	232.5
5.0 / 232.3	Borehole Terminated at 5.0 m						



COMMENTS & GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL

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Groundwater depth encountered on completion of drilling: Dry
Cave depth after auger removal: Open
Groundwater depth observed on: Feb 13/23 at depth of: 1.8 m.
Groundwater Elevation: 235.5 m

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

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RECORD OF BOREHOLE No. 10

GEI Consultants

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing: **4934057**
Easting: **505861**
Date Started: **Feb 2/23**
Date Completed: **Feb 3/23**

FIELD TESTING
Shear Strength Testing (kPa)
- × Other Test
- + Pocket Penetrometer
- ▲ Field Vane (Intact)
- △ Field Vane (Remolded)

40 80 120 160

Penetration Testing
- ○ SPT
- ● DCPT

10 20 30 40

LAB TESTING
- △ Combustible Organic Vapour (ppm)
- ▲ Combustible Organic Vapour (%LEL)
- ◇ Total Organic Vapour (ppm)

100 200 300 400

Atterberg Limits: PL ├──┤ LL
- ○ Water Content (%)

10 20 30 40

LITHOLOGY PROFILE		SOIL SAMPLING													
Lithology Plot	DESCRIPTION 0.0 245.5	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	Instrumentation Installation	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
▨	ASPHALT: 100 mm GRANULAR FILL: 660 mm 0.8 244.8	AS	1			0								
▨	FILL: Silty sand, some rock fragments, compact, brown, moist 1.5 244.0	SS	2	35	13	1.5	244.5	13 ○	15 ○					
	Borehole Terminated at 1.5 m Upon Auger Refusal													

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Groundwater depth encountered on completion of drilling: 0.8 m.
Cave depth after auger removal: Open
Groundwater depth observed on:
Groundwater Elevation:

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

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RECORD OF BOREHOLE No. 11

GEI Consultants

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing: **4933944**
Easting: **505883**
Date Started: **Feb 2/23**
Date Completed: **Feb 3/23**

FIELD TESTING

Shear Strength Testing (kPa)

- × Other Test
- + Pocket Penetrometer
- ▲ Field Vane (Intact)
- △ Field Vane (Remolded)

40 80 120 160

Penetration Testing

○ SPT ● DCPT

10 20 30 40

LAB TESTING

- △ Combustible Organic Vapour (ppm)
- ▲ Combustible Organic Vapour (%LEL)
- ◇ Total Organic Vapour (ppm)

100 200 300 400

Atterberg Limits

PL ├──┤ LL

○ Water Content (%)

10 20 30 40

LITHOLOGY PROFILE		SOIL SAMPLING									COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Depth (m) / Elevation (m)	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	Instrumentation Installation	GR	SA	SI	CL
0.0 / 254.2	ASPHALT: 120 mm GRANULAR FILL: 650 mm	AS	1			0								
0.8 / 253.4	FILL: Silty sand, dense, brown, moist	SS	2	75	30		253.5	30 ○	14 ○					
1.5 / 252.7	Borehole Terminated at 1.5 m Upon Auger Refusal					1.5								

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Groundwater depth encountered on completion of drilling: Dry

Cave depth after auger removal: Open

Groundwater depth observed on:

Groundwater Elevation:

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

Scale: **1 :75**

RECORD OF BOREHOLE No. 12

GEI Consultants

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing: **4933848**
Easting: **505897**
Date Started: **Feb 2/23**
Date Completed: **Feb 3/23**

FIELD TESTING: Shear Strength Testing (kPa)
- × Other Test
- + Pocket Penetrometer
- ▲ Field Vane (Intact)
- △ Field Vane (Remolded)
- 40 80 120 160
- Penetration Testing: ○ SPT ● DCPT
- 10 20 30 40

LAB TESTING:
- △ Combustible Organic Vapour (ppm)
- ▲ Combustible Organic Vapour (%LEL)
- ◇ Total Organic Vapour (ppm)
- 100 200 300 400
- Atterberg Limits: PL ├──┤ LL
- ○ Water Content (%)
- 10 20 30 40

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)			Instrumentation Installation	GR	SA	SI	CL
	0.0 262.5													
	ASPHALT: 160 mm GRANULAR FILL: 600 mm	AS	1			0	262.5							
	0.8 261.8													
	FILL: Silty sand, some gravel, dense, brown, mosit	SS	2	55	30			30 ○	12 ○					
	1.5 261.0					1.5								
	Borehole Terminated at 1.5 m Upon Auger Refusal													

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Groundwater depth encountered on completion of drilling: Dry
Cave depth after auger removal: Open
Groundwater depth observed on:
Groundwater Elevation:

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

Scale: **1 :75**

RECORD OF BOREHOLE No. 14

GEI Consultants

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing: **-**
Easting: **-**
Date Started: **Feb 2/23**
Date Completed: **Feb 3/23**

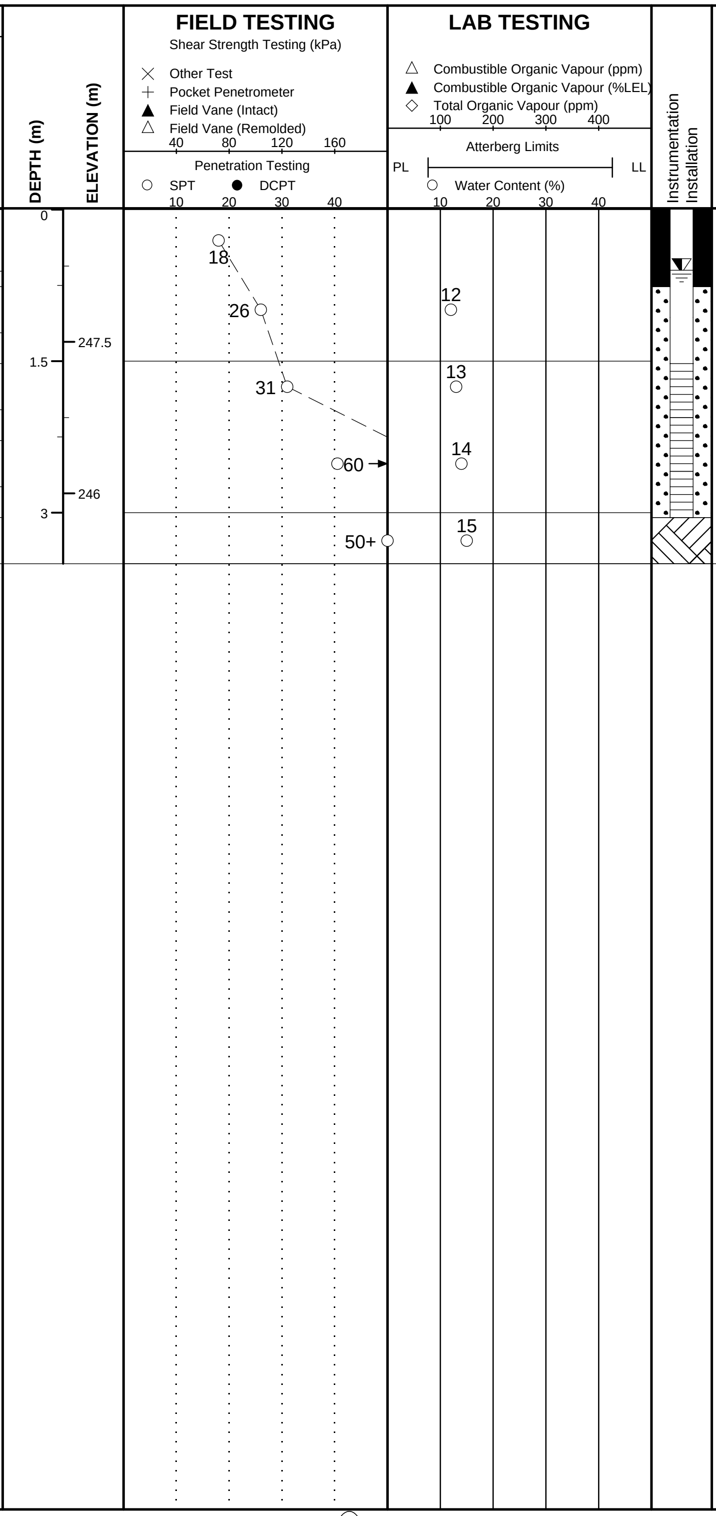
LITHOLOGY PROFILE

Depth (m)	DESCRIPTION	Elevation (m)
0.0		248.8
0.1	TOPSOIL: 75 mm	248.7
0.8	FILL: Sandy silt, trace gravel, trace organics and rootlets, compact, brown, moist	248.0
2.3	SANDY SILT: Trace gravel, trace clay, compact, brown, moist - - - Dense - - -	246.5
3.5	SAND AND SILT GLACIAL TILL: Trace clay, trace gravel and clay, cobbles and boulders, very dense, grey - - - Trace rock fragments - - -	245.3

Borehole Terminated at 3.5 m

SOIL SAMPLING / COMMENTS & GRAIN SIZE DISTRIBUTION (%)

Sample Type	Sample Number	Recovery (%)	SPT "N" Value	GR	SA	SI	CL
SS	1	85	18				
SS	2	100	26				
SS	3	100	31				
SS	4	100	60	3	55	35	7
SS	5	40	50+				



Groundwater depth encountered on completion of drilling: Dry
Cave depth after auger removal: Open
Groundwater depth observed on: Feb 13/23 at depth of: 0.6 m.
Groundwater Elevation: 248.2 m

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RECORD OF BOREHOLE No. 15

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing:
Easting:
Date Started: **Feb 2/23**
Date Completed: **Feb 3/23**

FIELD TESTING
Shear Strength Testing (kPa)
- × Other Test
- + Pocket Penetrometer
- ▲ Field Vane (Intact)
- △ Field Vane (Remolded)

40 80 120 160

Penetration Testing
○ SPT ● DCPT
10 20 30 40

LAB TESTING
- △ Combustible Organic Vapour (ppm)
- ▲ Combustible Organic Vapour (%LEL)
- ◇ Total Organic Vapour (ppm)

100 200 300 400

Atterberg Limits
PL ├──┤ LL
○ Water Content (%)
10 20 30 40

LITHOLOGY PROFILE		SOIL SAMPLING									COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	Instrumentation Installation	GR	SA	SI	CL
0.0	265.0													
	ASPHALT: 90 mm GRANULAR FILL: 520 mm	AS	1			0								
0.6	264.4													
	SANDY SILT GLACIAL TILL: Some clay, trace gravel, very dense, brown, moist	SS	2	100	50+		264	50+	14					
1.5	263.5					1.5								
	Borehole Terminated at 1.5 m Upon Auger Refusal													

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Groundwater depth encountered on completion of drilling: Dry
Cave depth after auger removal: Open
Groundwater depth observed on:
Groundwater Elevation:

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

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RECORD OF BOREHOLE No. 16

GEI Consultants

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing: **4933912**
Easting: **506070**
Date Started: **Feb 2/23**
Date Completed: **Feb 3/23**

FIELD TESTING
Shear Strength Testing (kPa): × Other Test; + Pocket Penetrometer; ▲ Field Vane (Intact); △ Field Vane (Remolded) — 40, 80, 120, 160
Penetration Testing: ○ SPT; ● DCPT — 10, 20, 30, 40

LAB TESTING
△ Combustible Organic Vapour (ppm); ▲ Combustible Organic Vapour (%LEL); ◇ Total Organic Vapour (ppm) — 100, 200, 300, 400
Atterberg Limits: PL ├─┤ LL
○ Water Content (%) — 10, 20, 30, 40

LITHOLOGY PROFILE: Depth (m)	Elevation (m)	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	Penetration Testing (SPT)	Water Content (%)	Instrumentation Installation	GR	SA	SI	CL
0.0	266.0	ASPHALT: 210 mm GRANULAR FILL: 400 mm	AS	1									
0.6	265.4	SANDY SILT GLACIAL TILL: Some clay, trace gravel, cobbles and boulders, compact, brownish red, moist	SS	2	100	12	12	16					
			SS	3	35	11	11	15					
1.8	264.2	Borehole Terminated at 1.8 m Upon Auger Refusal											

DEPTH (m) scale: 0, 1.5; ELEVATION (m) scale: 265.5

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

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Groundwater depth encountered on completion of drilling: Dry
Cave depth after auger removal: Open
Groundwater depth observed on:
Groundwater Elevation:

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

Scale: **1 :75**
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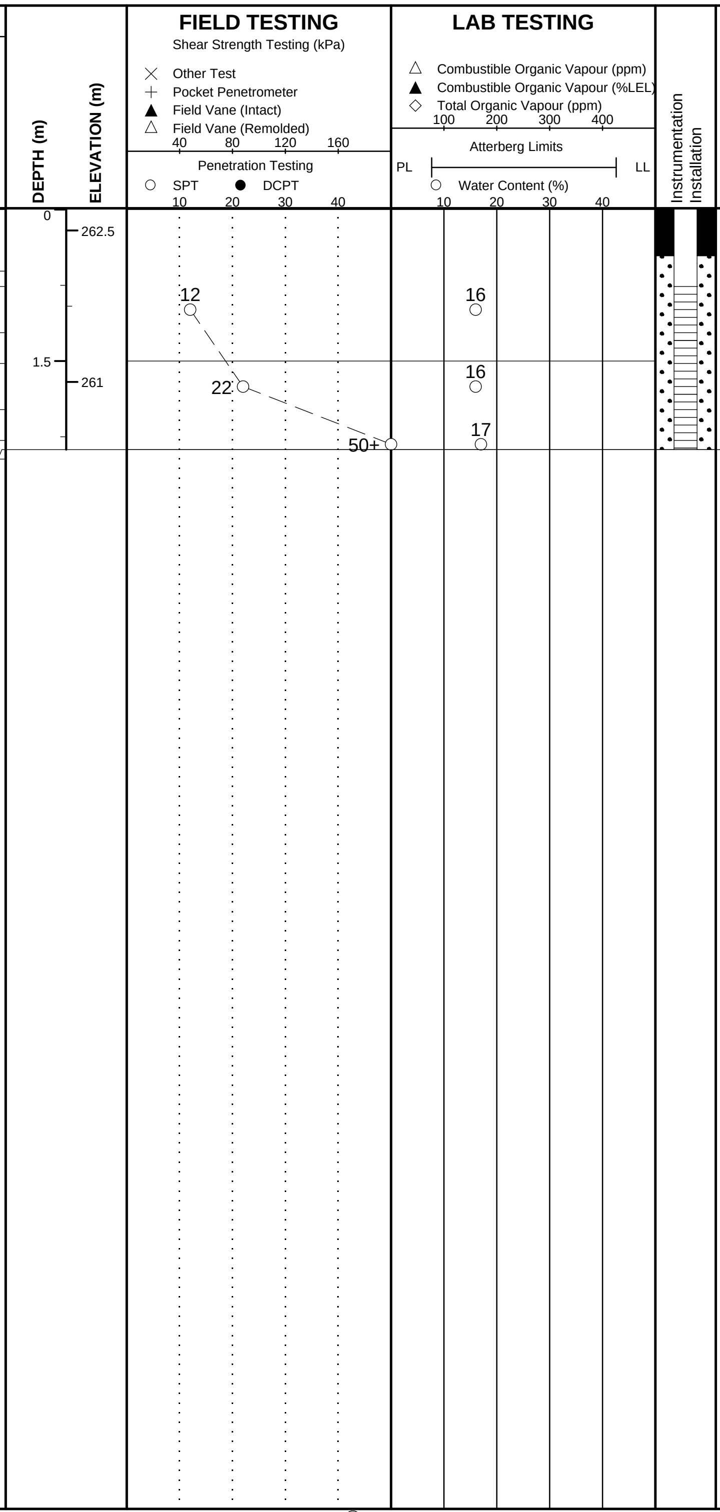
RECORD OF BOREHOLE No. 17

GEI Consultants

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing: **4933925**
Easting: **506164**
Date Started: **Feb 2/23**
Date Completed: **Feb 3/23**

Depth (m)	Elevation (m)	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	Water Content (%)	Instrumentation Installation	GR	SA	SI	CL
0.0	262.7	ASPHALT: 100 mm GRANULAR FILL: 660 mm	AS	1								
0.8	261.9	FILL: Clayey silt, some sand, trace gravel, cobbles and boulbers, stiff, brown, moist	SS	2	100	12	16					
1.5	261.2	SANDY SILT GLACIAL TILL: Some clay, trace gravel, cobbles and boulders, compact to very dense, brown, moist	SS	3	0	22	16					
			SS	4	100	50+	17					
2.4	260.3	Borehole Terminated at 2.4 m Upon Auger Refusal										



Groundwater depth encountered on completion of drilling: Dry
Groundwater depth observed on: Feb 13/23 at depth of: Dry
Cave depth after auger removal: Open
Groundwater Elevation:

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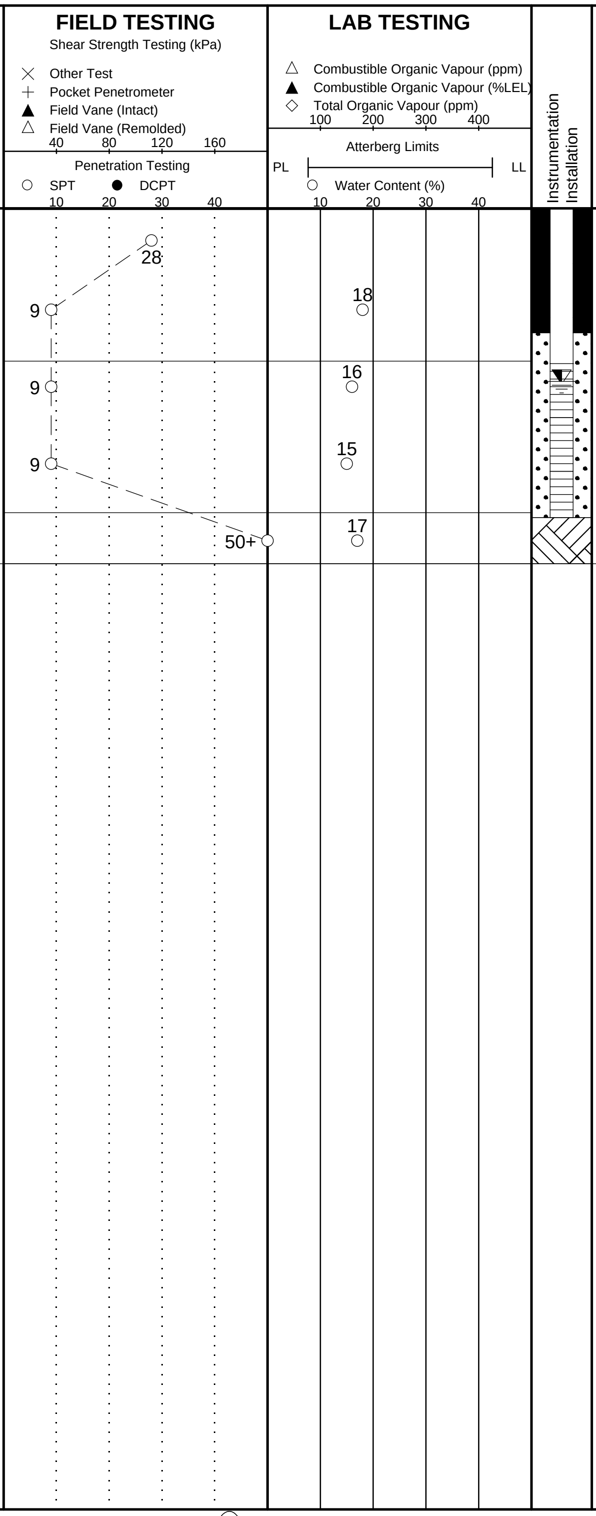
RECORD OF BOREHOLE No. 19

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing: **4934148**
Easting: **506120**
Date Started: **Feb 2/23**
Date Completed: **Feb 3/23**

Depth (m) / Elevation (m)	Description	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	Water Content (%)	GR	SA	SI	CL
0.0 / 249.2 – 0.1 / 249.1	TOPSOIL: 100 mm									
0.1 / 249.1 – 1.2 / 248.0	FILL: Clayey silt, trace sand, some rock fragments, very stiff to stiff, brown, moist	SS	1	100	28					
		SS	2	100	9	18				
1.2 / 248.0 – 3.5 / 245.7	SANDY CLAYEY SILT GLACIAL TILL: trace gravel, cobbles and boulders, stiff/loose, brown	SS	3	100	9	16	8	26	39	27
		SS	4	45	9	15				
	- - - Trace rock fragments, hard/very dense - - -	SS	5	55	50+	17				

Borehole Terminated at 3.5 m
Upon Auger Refusal



Groundwater depth encountered on completion of drilling: Dry
Cave depth after auger removal: Open
Groundwater depth observed on: Feb 13/23 at depth of: 1.7 m.
Groundwater Elevation: 247.5 m

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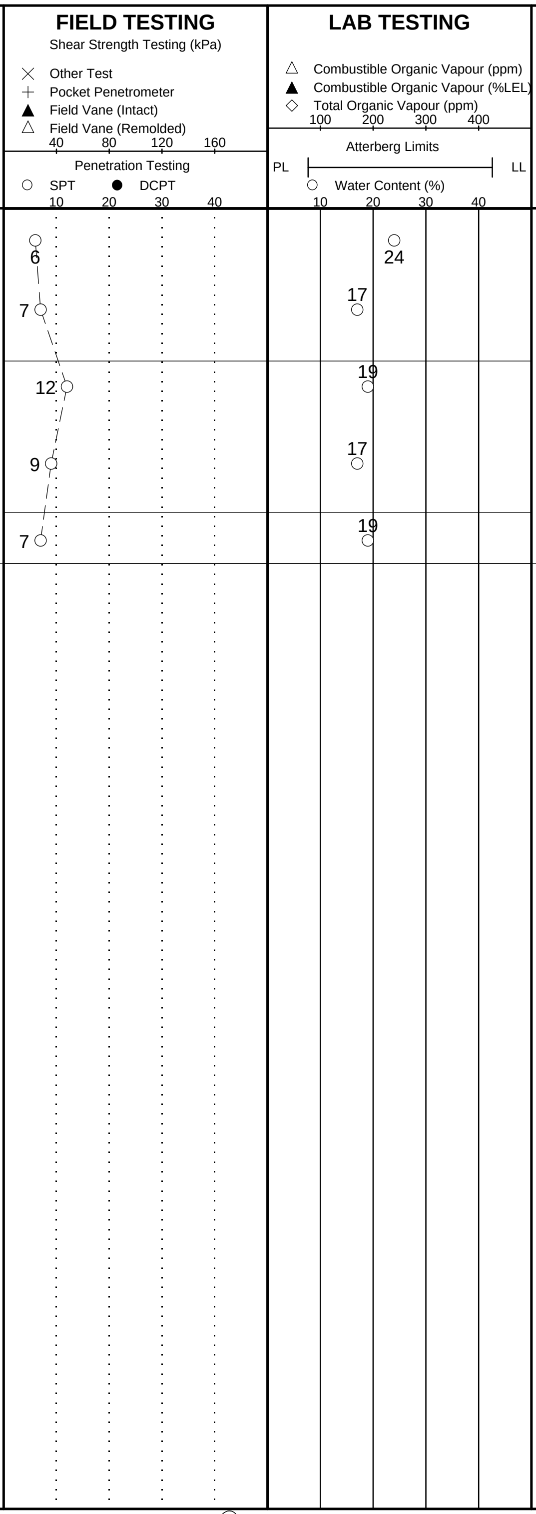
RECORD OF BOREHOLE No. 20

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Northing: **4934215**
Date Started: **Feb 2/23**
Reviewed By: **GW**
Easting: **506110**
Date Completed: **Feb 3/23**

LITHOLOGY PROFILE			SOIL SAMPLING						LAB TESTING	COMMENTS & GRAIN SIZE DISTRIBUTION (%)
Depth	DESCRIPTION	Elevation	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	Water Content (%)	GR / SA / SI / CL
0.0		248.0					0			
0.2	TOPSOIL: 150 mm	247.9								
	FILL: Clayey silt, trace to some sand, trace organics, stiff, brown, moist		SS	1	100	6		247.5	24	
			SS	2	100	7			17	
1.5		246.5					1.5			
	SANDY CLAYEY SILT GLACIAL TILL: Trace gravel, cobbles and boulders, stiff/ compact to loose, brown, moist		SS	3	100	12		246	19	
			SS	4	100	9			17	
							3			
3.5		244.5	SS	5	100	7			19	
	Borehole Terminated at 3.5 m									



Instrumentation Installation

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Groundwater depth encountered on completion of drilling: Dry
Cave depth after auger removal: Open
Groundwater depth observed on:
Groundwater Elevation:

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

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RECORD OF BOREHOLE No. 21

Project Number: **2201530**

Project Client: **Tatham Engineering Ltd.**

Project Name: **Watermain Replacement and Road**

Project Location: **9th Ave E, Owen Sound, ON**

Drilling Location: **See Borehole Location Plan**

Local Benchmark:

Drilling Method: **Truck Mount**

Drilling Machine: **Solid Stem Augers**

Logged By: **MH**

Reviewed By: **GW**

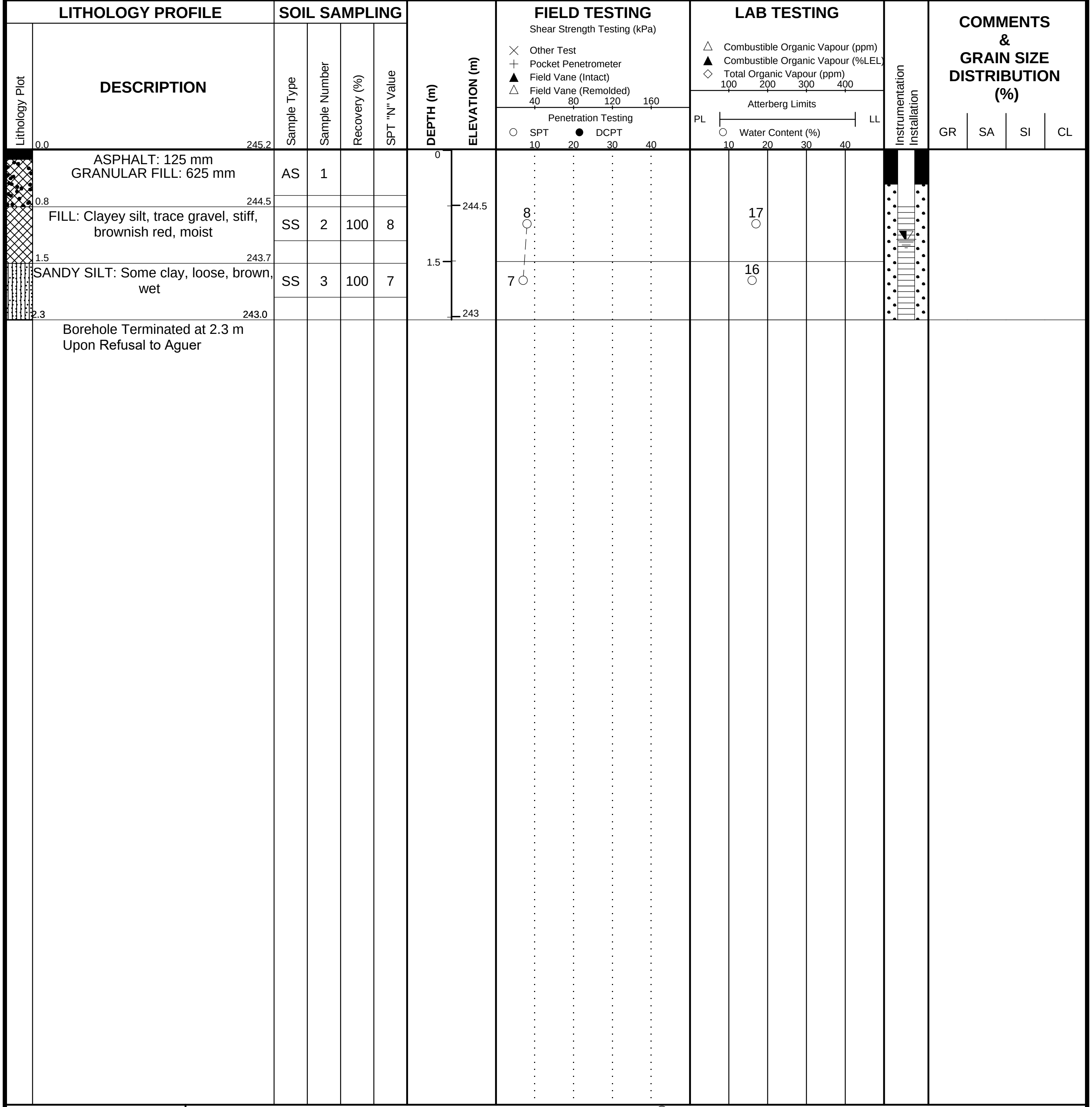
Northing: **4934337**

Easting: **506106**

Date Started: **Jan 30/23**

Date Completed: **Feb 3/23**

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Depth (m)	DESCRIPTION (Elevation 245.2 at 0.0)	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	SPT	Water Content (%)	Instrumentation Installation	GR	SA	SI	CL
0.0	ASPHALT: 125 mm GRANULAR FILL: 625 mm	AS	1			0								
0.8 (244.5)	FILL: Clayey silt, trace gravel, stiff, brownish red, moist	SS	2	100	8		244.5	8	17					
1.5 (243.7)	SANDY SILT: Some clay, loose, brown, wet	SS	3	100	7	1.5		7	16					
2.3 (243.0)	Borehole Terminated at 2.3 m Upon Refusal to Aguer						243							



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Groundwater depth encountered on completion of drilling: Dry

Cave depth after auger removal: Open

Groundwater depth observed on: Feb 13/23 at depth of: 1.2 m.

Groundwater Elevation: 244.0 m

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

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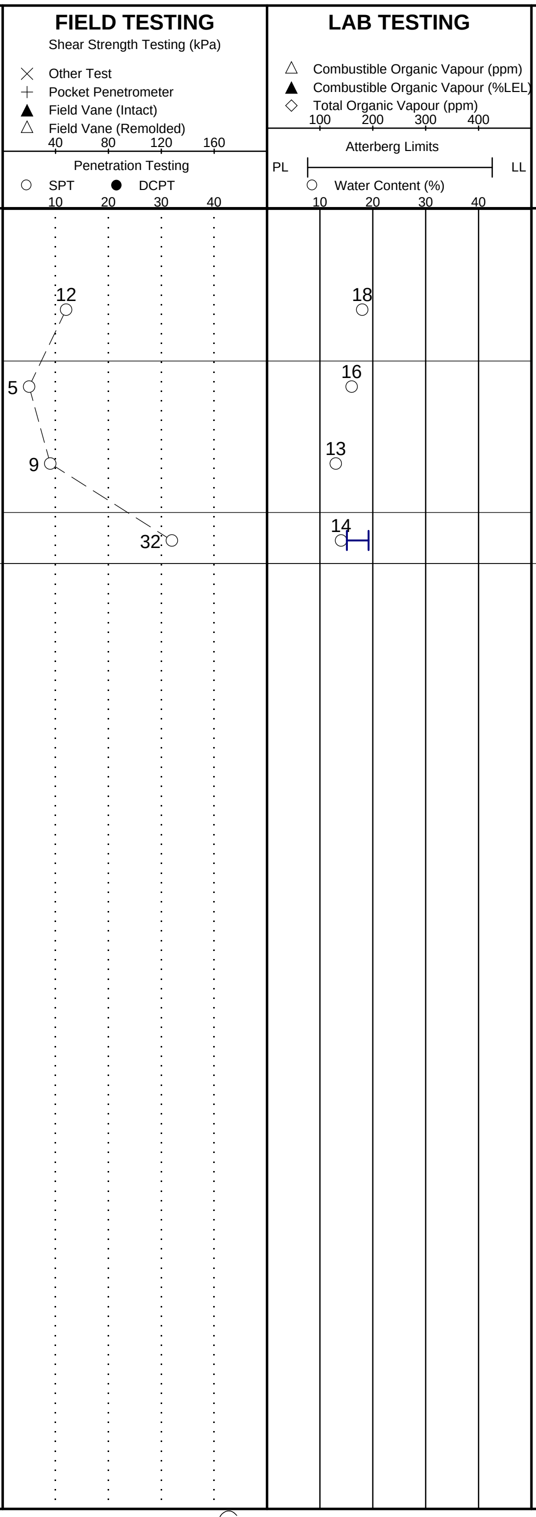
RECORD OF BOREHOLE No. 22

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:
Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing: **4934354**
Easting: **506237**
Date Started: **Jan 30/23**
Date Completed: **Feb 3/23**

Depth (m) / Elevation (m)	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	Field Testing: SPT	Lab Testing: Water Content (%)	GR	SA	SI	CL
0.0 / 246.0	ASPHALT: 100 mm GRANULAR FILL: 660 mm	AS	1			0	246						
0.8 / 245.3	FILL: Sandy silt, some clay, trace to some gravel, compact, brown, moist	SS	2	20	12			12	18				
	- - - Loose - - -	SS	3	75	5	1.5	244.5	5	16				
		SS	4	55	9			9	13	14	33	38	15
3.0 / 243.0	SANDY SILT GLACIAL TILL: Some clay, trace gravel, dense, brown, moist	SS	5	100	32	3	243	32	14				
3.5 / 242.5	Borehole Terminated at 3.5 m												



Instrumentation Installation

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

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Groundwater depth encountered on completion of drilling: Dry
Groundwater depth observed on:
Cave depth after auger removal: Open
Groundwater Elevation:

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

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RECORD OF BOREHOLE No. 23

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

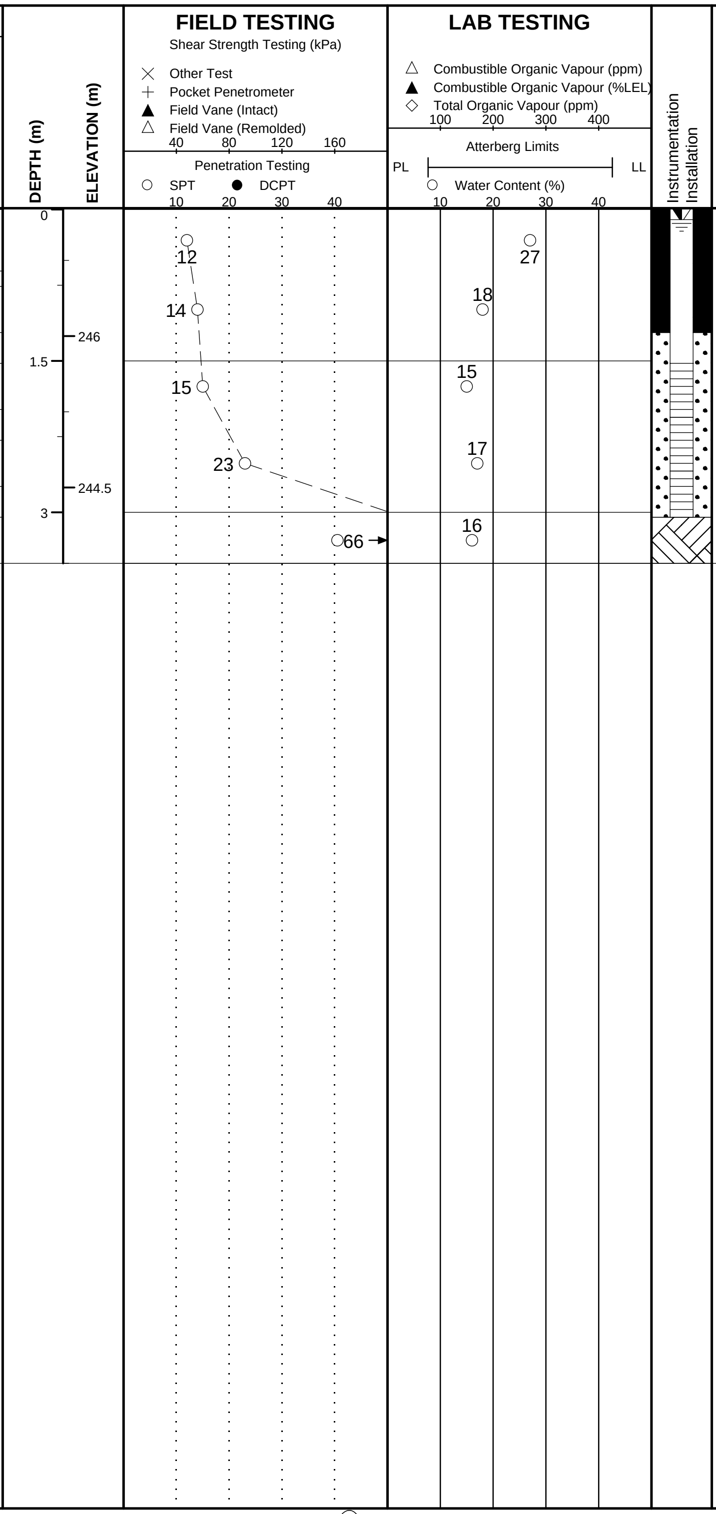
Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing: **4934484**
Easting: **506228**
Date Started: **Jan 30/23**
Date Completed: **Feb 3/23**

LITHOLOGY PROFILE

Depth (m)	Elevation (m)	DESCRIPTION
0.0	247.3	
0.1	247.1	ASPHALT: 125 mm
		FILL: Sandy Silt, some clay, trace organics, trace gravel, compact, brown, moist
0.8	246.5	SANDY SILT GLACIAL TILL: Trace to Some clay, trace to some gravel, cobbles and boulders, compact, brown, moist
		- - - Very dense - - -
3.5	243.7	Borehole Terminated at 3.5 m

SOIL SAMPLING

Sample Type	Sample Number	Recovery (%)	SPT "N" Value	Water Content (%)	GR	SA	SI	CL
SS	1	100	12	27				
SS	2	100	14	18				
SS	3	100	15	15				
SS	4	100	23	17				
SS	5	100	66	16	18	32	39	11



COMMENTS & GRAIN SIZE DISTRIBUTION (%)

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Groundwater depth encountered on completion of drilling: Dry
Cave depth after auger removal: Open
Groundwater depth observed on: Feb 13/23 at depth of: 0.1 m.
Groundwater Elevation: 247.2 m

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

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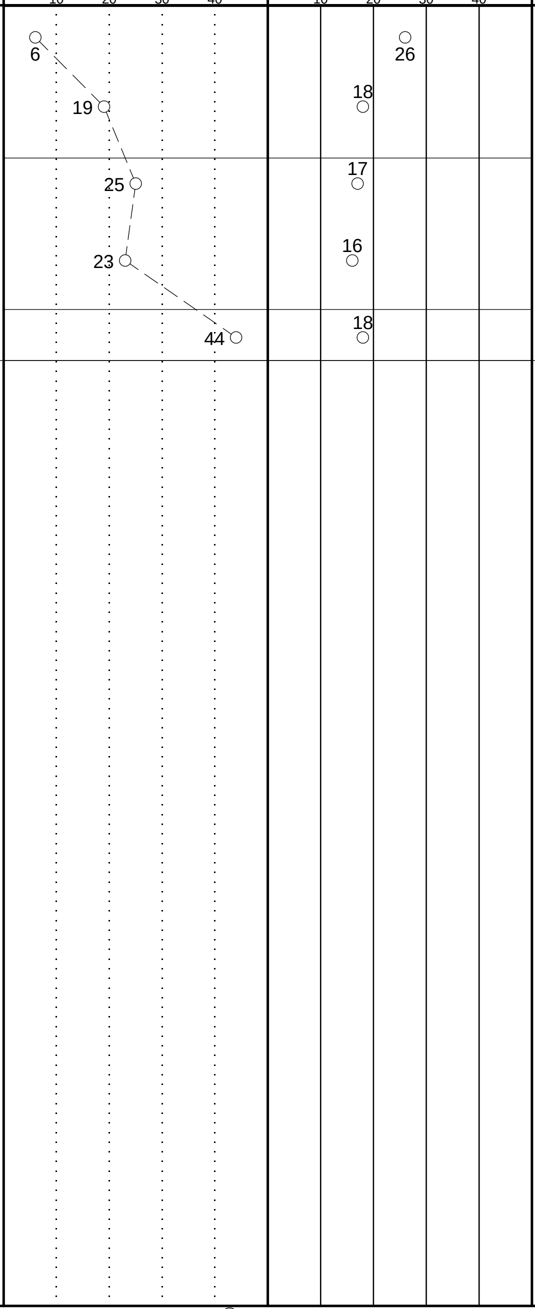
RECORD OF BOREHOLE No. 24

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing: **4934562**
Easting: **506214**
Date Started: **Jan 30/23**
Date Completed: **Feb 3/23**

Depth (m)	Elevation (m)	Description	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	Water Content (%)
0.0	247.4						
0.2	247.3	TOPSOIL: 150 mm					
0.8	246.6	FILL: Clayey silt, trace organics, soft, brown, moist	SS	1	100	6	26
3.5	243.9	SANDY SILT TILL: Some clay, trace gravel, cobbles and boulders, compact, brown, moist	SS	2	100	19	18
			SS	3	100	25	17
			SS	4	100	23	16
		- - - Dense - - -	SS	5	100	44	18

Borehole Terminated at 3.5 m



Depth scale: 0, 1.5, 3 m; Elevation scale: 246, 244.5 m

Instrumentation Installation

COMMENTS & GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

Groundwater depth encountered on completion of drilling: Dry
Cave depth after auger removal: Open
Groundwater depth observed on:
Groundwater Elevation:

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Scale: **1 :75**

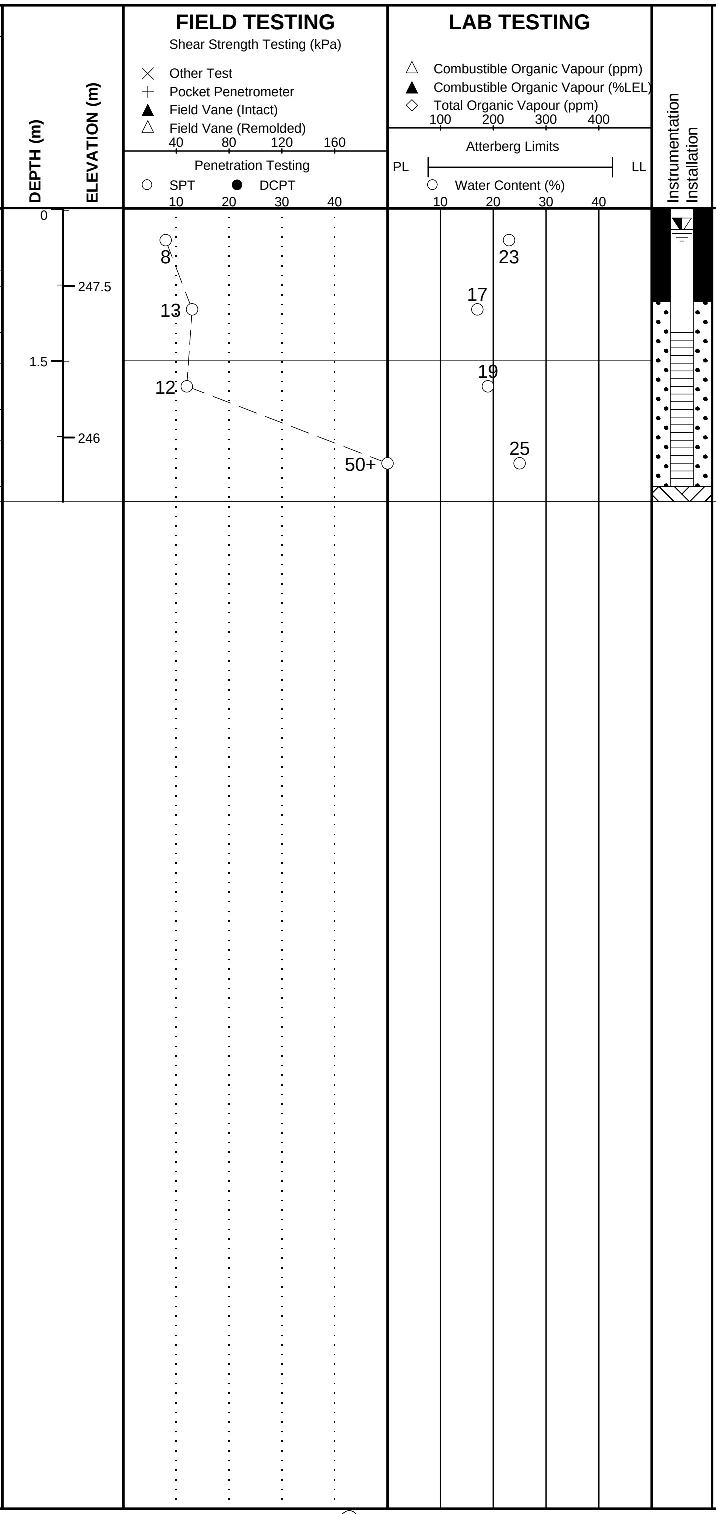
RECORD OF BOREHOLE No. 25

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing: **4934649**
Easting: **506201**
Date Started: **Jan 31/23**
Date Completed: **Feb 3/23**

LITHOLOGY PROFILE / SOIL SAMPLING

Depth (m)	Elevation (m)	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value
0.0	248.3					
0.1	248.2	TOPSOIL: 150 mm				
		FILL: Clayey silt, some organics, trace rootlets, stiff, dark color, moist	SS	1	100	8
0.8	247.5	SANDY SILT GLACIAL TILL: Trace to some clay, trace gravel, cobbles and boulders, compact, brown, moist	SS	2	100	13
			SS	3	100	12
		- - - Very dense - - -	SS	4	65	50+
2.9	245.4	Borehole Terminated at 2.9 m Upon Auger Refusal				



COMMENTS & GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL

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Groundwater depth encountered on completion of drilling: Dry
Cave depth after auger removal: Open
Groundwater depth observed on: Feb 13/23 at depth of: 0.2 m.
Groundwater Elevation: 248.1 m

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

Scale: **1 :75**
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Appendix B

Geotechnical Laboratory Testing

GRAIN SIZE DISTRIBUTION REPORT
GRANULAR A

Project Name: 9th Avenue East
Project No.: 2201530
Client: Tatham Engineering Limited
Supplier: -
Sampled From: BH6, AS1, 0-2'

Date Sampled: -
Date Tested: March 20, 2023
GEI Lab No. 5236
Figure No. B1

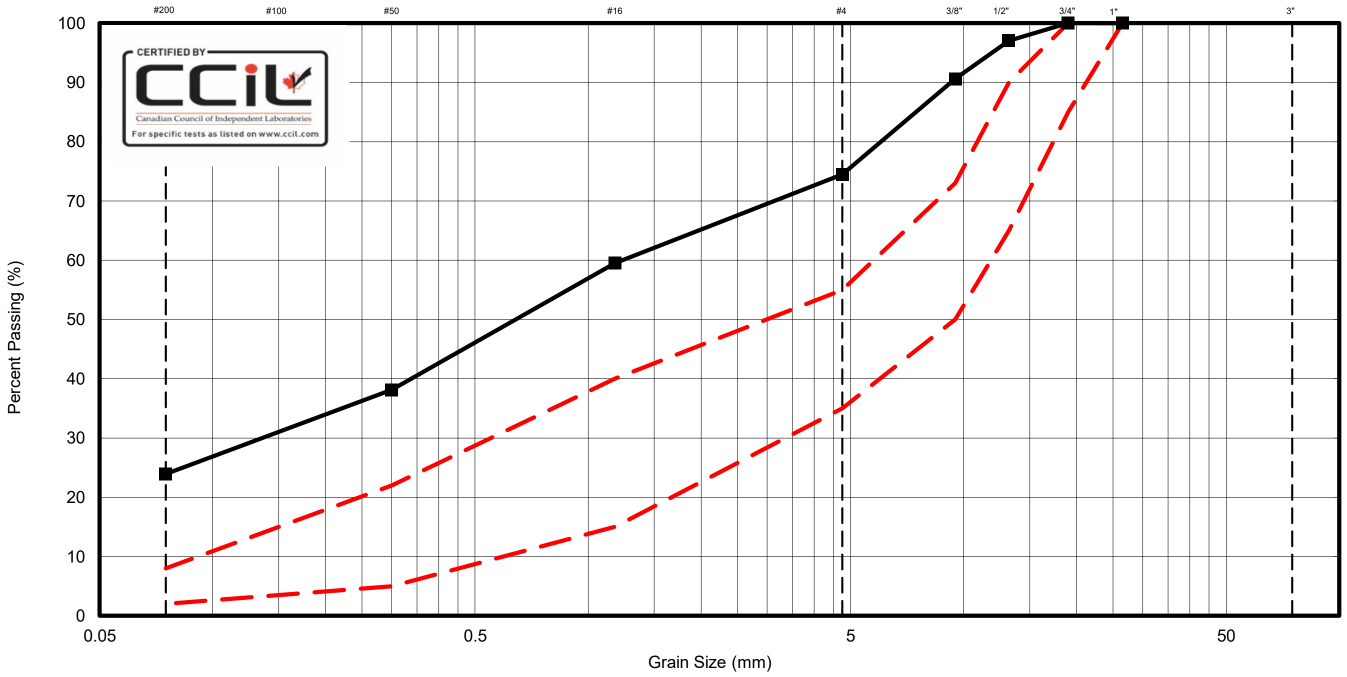
SAMPLE DATA

Total Mass of Sample (g):	2601.6	% Passing 75um by washing:	23.56
Total Mass retained on the 4.75mm sieve (g):	664	Total Losses (%): (Maximum 0.3%)	0.00
Total Mass passing the 4.75 mm sieve (g):	1937.6	Percent Crushed: (Min. 60% - Gran A) Not Applicable - Gran. "B" Type 1	-
Percent Coarse Aggregate:	25.52		
Percent Fine Aggregate:	74.48	Asphalt Coated Particles (%) (Max. 30%)	-

TOTAL SAMPLE PERCENTAGES					COARSE AND FINE PORTION PERCENTAGES		
Sieve Size (mm)	Percent Passing	Min Spec. (%)	Max Spec. (%)	Pass?	Sieve Size	Percent Retained *	Percent Retained **
150	-	-	-	-	150	-	-
26.5	100.0	100	100	Y	26.5	0.0	-
19.0	100.0	85	100	Y	19.00	0.0	-
13.2	97.0	65	90	N	13.2	11.6	-
9.5	90.6	50	73	N	9.5	36.8	-
4.75	74.5	35	55	N	4.75	100.0	-
1.18	59.5	15	40	N	1.18	-	20.1
0.30	38.1	5	22	N	0.30	-	48.8
0.15	-	-	-	-	0.15	-	-
0.075	23.9	2	8	N	0.075	-	67.9

* Based on Coarse Portion only ** Based on Fine Portion only

Material Does Not Meet OPSS.MUNI 1010 Specifications for Granular 'A'



GRAIN SIZE DISTRIBUTION REPORT
GRANULAR 'B' TYPE I

Project Name: 9th Avenue East
Project No.: 2201530
Client: Tatham Engineering Limited
Supplier: -
Sampled From: BH6, AS1, 0-2'

Date Sampled: -
Date Tested: March 20, 2023
GEI Lab No. 5236
Figure No. B2

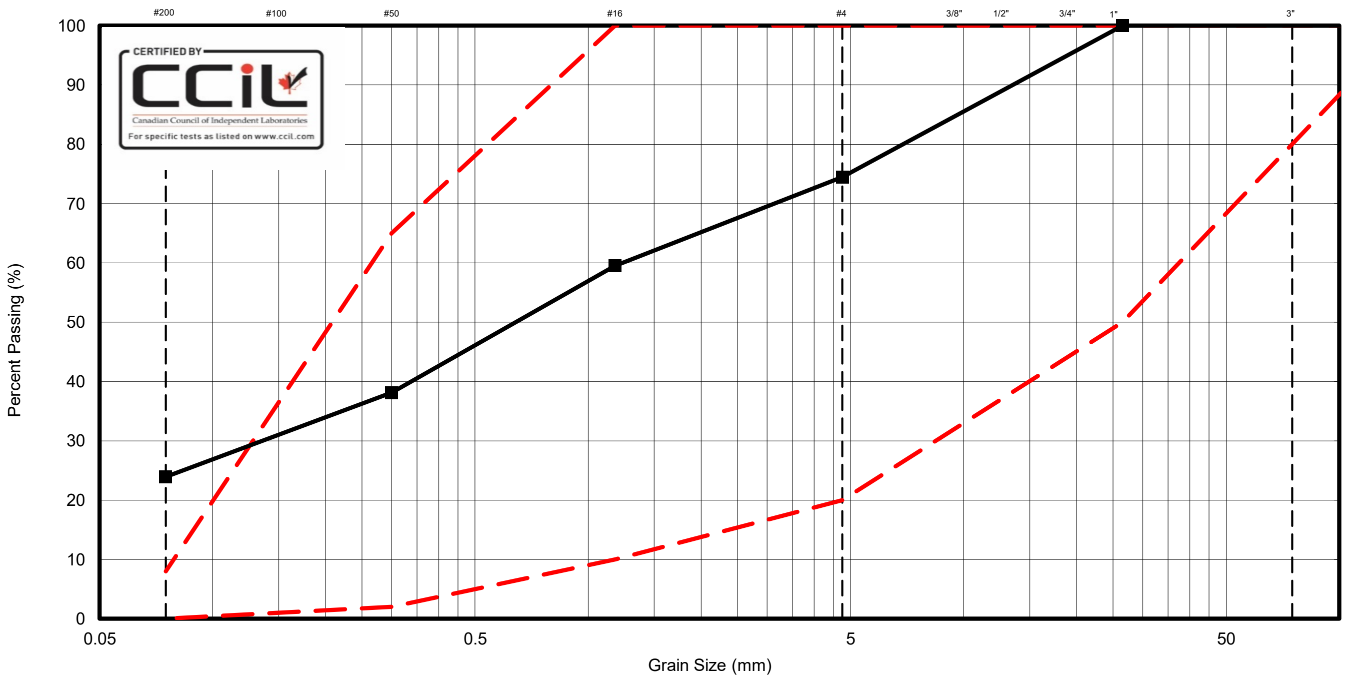
SAMPLE DATA

Total Mass of Sample (g):	2601.6	% Passing 75um by washing:	23.56
Total Mass retained on the 4.75mm sieve (g):	664	Total Losses (%): (Maximum 0.3%)	0.00
Total Mass passing the 4.75 mm sieve (g):	1937.6	Percent Crushed: (Min. 60% - Gran A)	N/A
Percent Coarse Aggregate:	25.52	Not Applicable - Gran. "B" Type 1	
Percent Fine Aggregate:	74.48	Asphalt Coated Particles (%) (Max. 30%)	-

TOTAL SAMPLE PERCENTAGES					COARSE AND FINE PORTION PERCENTAGES		
Sieve Size (mm)	Percent Passing	Min Spec. (%)	Max Spec. (%)	Pass?	Sieve Size	Percent Retained *	Percent Retained **
150	100.0	100	100	Y	150	0.0	-
26.5	100.0	50	100	Y	26.5	0.0	-
19.0	-	-	-	-	19.00	-	-
13.2	-	-	-	-	13.2	-	-
9.5	-	-	-	-	9.5	-	-
4.75	74.5	20	100	Y	4.75	100.0	-
1.18	59.5	10	100	Y	1.18	-	20.1
0.30	38.1	2	65	Y	0.30	-	48.8
0.15	-	-	-	-	0.15	-	-
0.075	23.9	0	8	N	0.075	-	67.9

* Based on Coarse Portion only ** Based on Fine Portion only

Material Does Not Meet OPSS.MUNI 1010 Specifications for Granular 'B' Type I



647 Welham Road, Unit 14
Barrie, Ontario

GRAIN SIZE DISTRIBUTION REPORT
GRANULAR A

Project Name: 9th Avenue East
Project No.: 2201530
Client: Tatham Engineering Limited
Supplier: -
Sampled From: BH9, AS1, 0-2'

Date Sampled: -
Date Tested: March 20, 2023
GEI Lab No. 5237
Figure No. B3

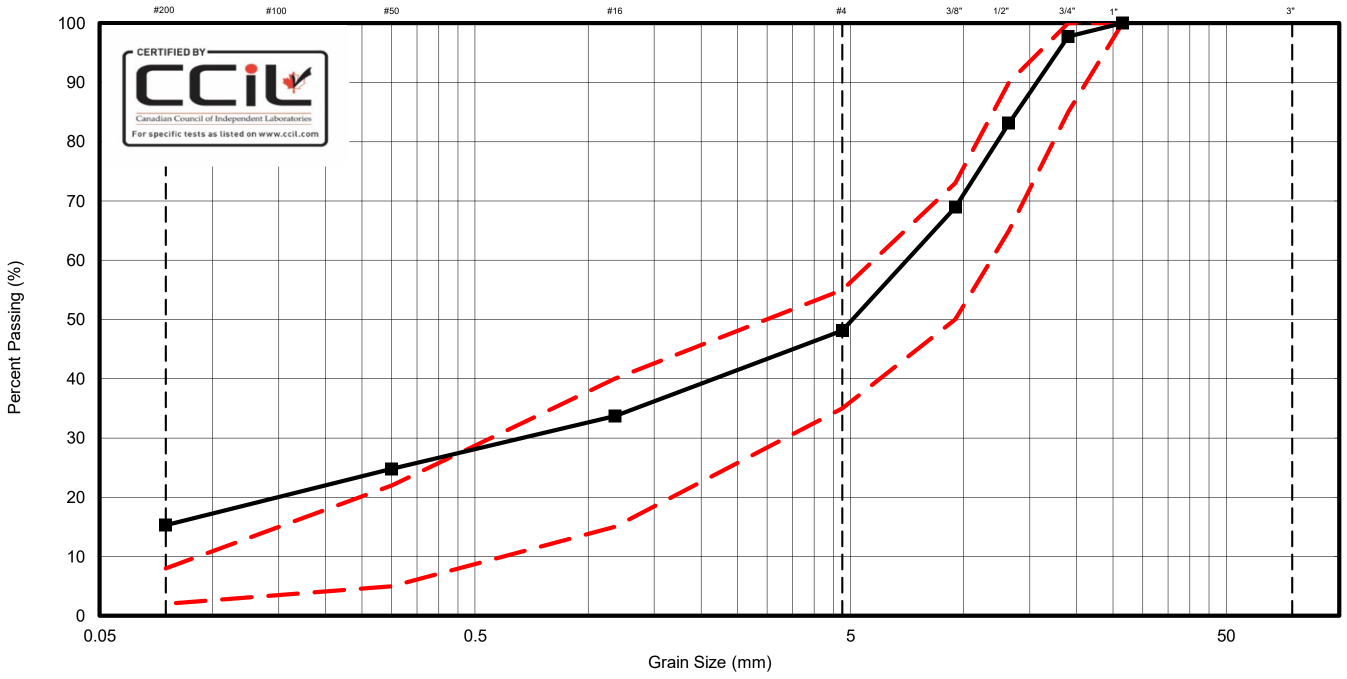
SAMPLE DATA

Total Mass of Sample (g):	1468.6	% Passing 75um by washing:	14.93
Total Mass retained on the 4.75mm sieve (g):	761.8	Total Losses (%): (Maximum 0.3%)	0.00
Total Mass passing the 4.75 mm sieve (g):	706.8	Percent Crushed: (Min. 60% - Gran A) Not Applicable - Gran. "B" Type 1	-
Percent Coarse Aggregate:	51.87		
Percent Fine Aggregate:	48.13	Asphalt Coated Particles (%) (Max. 30%)	-

TOTAL SAMPLE PERCENTAGES					COARSE AND FINE PORTION PERCENTAGES		
Sieve Size (mm)	Percent Passing	Min Spec. (%)	Max Spec. (%)	Pass?	Sieve Size	Percent Retained *	Percent Retained **
150	-	-	-	-	150	-	-
26.5	100.0	100	100	Y	26.5	0.0	-
19.0	97.7	85	100	Y	19.00	4.4	-
13.2	83.1	65	90	Y	13.2	32.6	-
9.5	68.9	50	73	Y	9.5	59.9	-
4.75	48.1	35	55	Y	4.75	100.0	-
1.18	33.7	15	40	Y	1.18	-	30.0
0.30	24.8	5	22	N	0.30	-	48.5
0.15	-	-	-	-	0.15	-	-
0.075	15.3	2	8	N	0.075	-	68.2

* Based on Coarse Portion only ** Based on Fine Portion only

Material Does Not Meet OPSS.MUNI 1010 Specifications for Granular 'A'



GRAIN SIZE DISTRIBUTION REPORT
GRANULAR 'B' TYPE I

GEI Consultants

Project Name: 9th Avenue East
Project No.: 2201530
Client: Tatham Engineering Limited
Supplier: -
Sampled From: BH9, AS1, 0-2'

Date Sampled: -
Date Tested: March 20, 2023
GEI Lab No. 5237
Figure No. B4

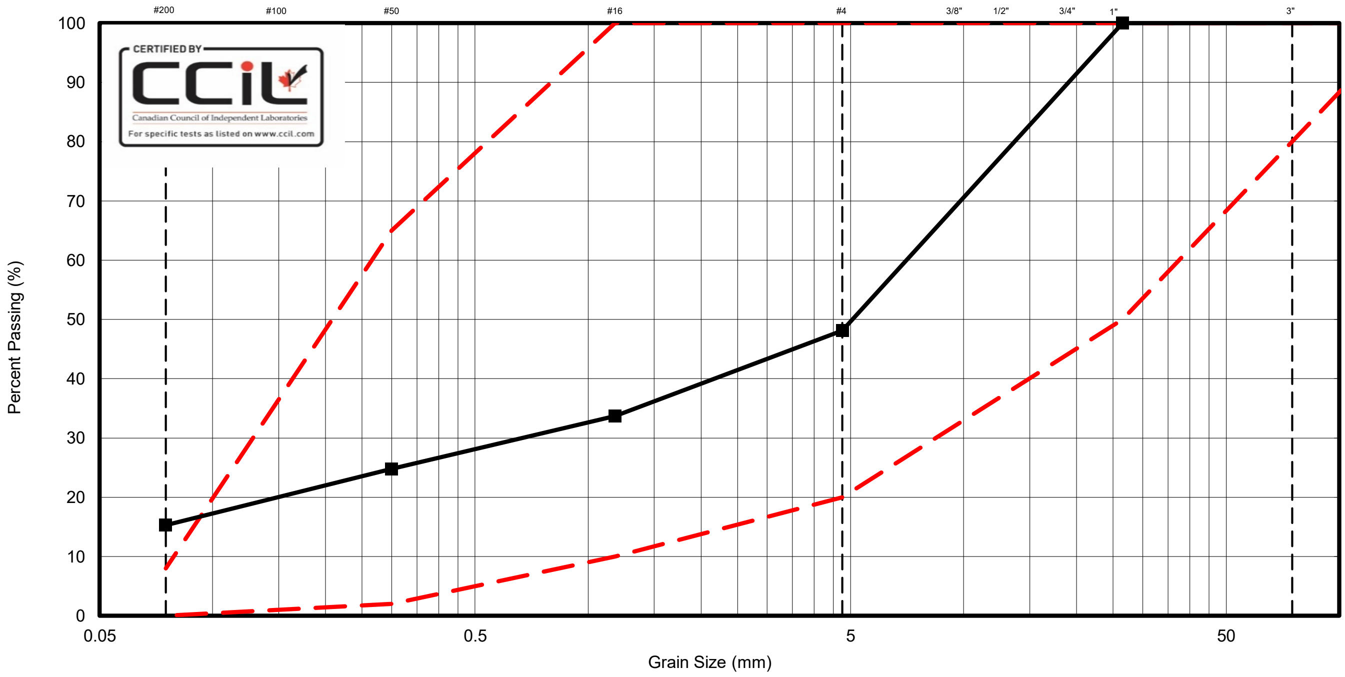
SAMPLE DATA

Total Mass of Sample (g):	1468.6	% Passing 75um by washing:	14.93
Total Mass retained on the 4.75mm sieve (g):	761.8	Total Losses (%): (Maximum 0.3%)	0.00
Total Mass passing the 4.75 mm sieve (g):	706.8	Percent Crushed: (Min. 60% - Gran A)	N/A
Percent Coarse Aggregate:	51.87	Not Applicable - Gran. "B" Type 1	
Percent Fine Aggregate:	48.13	Asphalt Coated Particles (%) (Max. 30%)	-

TOTAL SAMPLE PERCENTAGES					COARSE AND FINE PORTION PERCENTAGES		
Sieve Size (mm)	Percent Passing	Min Spec. (%)	Max Spec. (%)	Pass?	Sieve Size	Percent Retained *	Percent Retained **
150	100.0	100	100	Y	150	0.0	-
26.5	100.0	50	100	Y	26.5	0.0	-
19.0	-	-	-	-	19.00	-	-
13.2	-	-	-	-	13.2	-	-
9.5	-	-	-	-	9.5	-	-
4.75	48.1	20	100	Y	4.75	100.0	-
1.18	33.7	10	100	Y	1.18	-	30.0
0.30	24.8	2	65	Y	0.30	-	48.5
0.15	-	-	-	-	0.15	-	-
0.075	15.3	0	8	N	0.075	-	68.2

* Based on Coarse Portion only ** Based on Fine Portion only

Material Does Not Meet OPSS.MUNI 1010 Specifications for Granular 'B' Type I



GRAIN SIZE DISTRIBUTION REPORT
GRANULAR A

Project Name: 9th Avenue East
Project No.: 2201530
Client: Tatham Engineering Limited
Supplier: -
Sampled From: BH16, AS1, 0-2'

Date Sampled: -
Date Tested: March 20, 2023
GEI Lab No. 5238
Figure No. B5

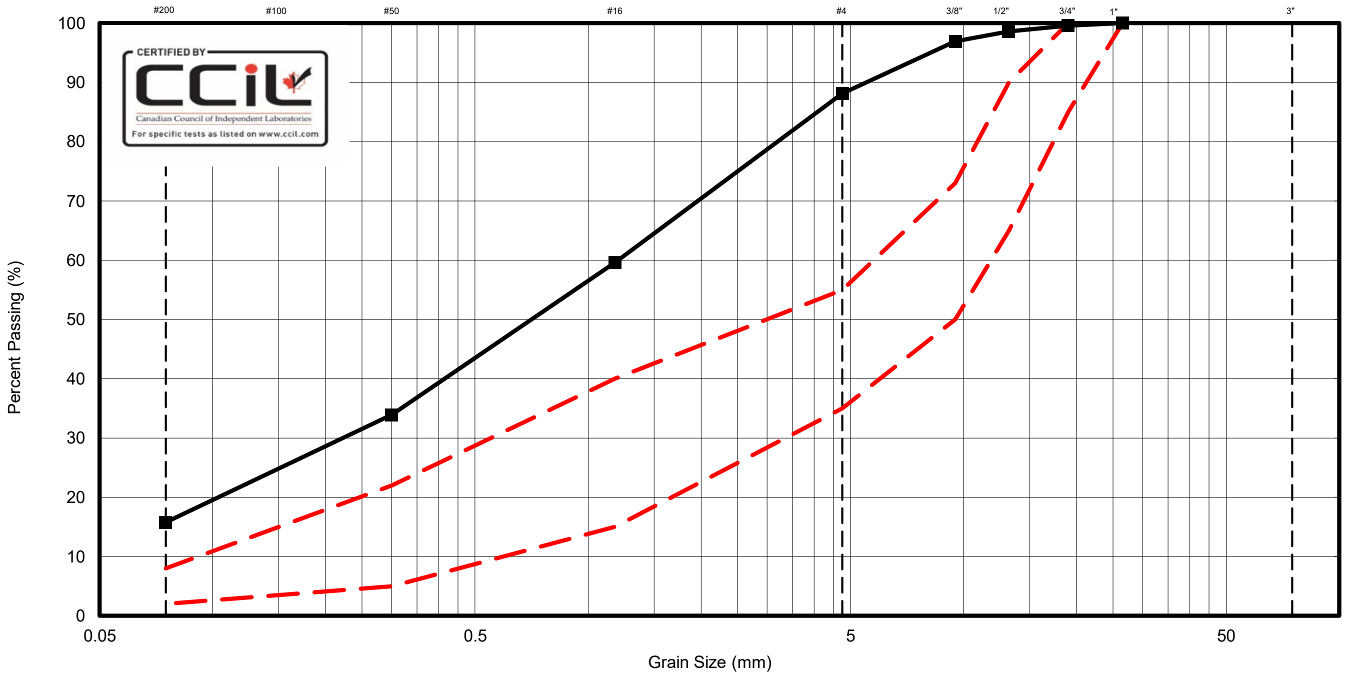
SAMPLE DATA

Total Mass of Sample (g):	3447.4	% Passing 75um by washing:	15.31
Total Mass retained on the 4.75mm sieve (g):	409.1	Total Losses (%): (Maximum 0.3%)	0.00
Total Mass passing the 4.75 mm sieve (g):	3038.3	Percent Crushed: (Min. 60% - Gran A) Not Applicable - Gran. "B" Type 1	-
Percent Coarse Aggregate:	11.87		
Percent Fine Aggregate:	88.13	Asphalt Coated Particles (%) (Max. 30%)	-

TOTAL SAMPLE PERCENTAGES					COARSE AND FINE PORTION PERCENTAGES		
Sieve Size (mm)	Percent Passing	Min Spec. (%)	Max Spec. (%)	Pass?	Sieve Size	Percent Retained *	Percent Retained **
150	-	-	-	-	150	-	-
26.5	100.0	100	100	Y	26.5	0.0	-
19.0	99.6	85	100	Y	19.00	3.7	-
13.2	98.6	65	90	N	13.2	12.0	-
9.5	96.9	50	73	N	9.5	25.7	-
4.75	88.1	35	55	N	4.75	100.0	-
1.18	59.6	15	40	N	1.18	-	32.4
0.30	33.9	5	22	N	0.30	-	61.5
0.15	-	-	-	-	0.15	-	-
0.075	15.8	2	8	N	0.075	-	82.1

* Based on Coarse Portion only ** Based on Fine Portion only

Material Does Not Meet OPSS.MUNI 1010 Specifications for Granular 'A'



GRAIN SIZE DISTRIBUTION REPORT
GRANULAR 'B' TYPE I

GEI Consultants

Project Name: 9th Avenue East
Project No.: 2201530
Client: Tatham Engineering Limited
Supplier: -
Sampled From: BH16, AS1, 0-2'

Date Sampled: -
Date Tested: March 20, 2023
GEI Lab No. 5238
Figure No. B6

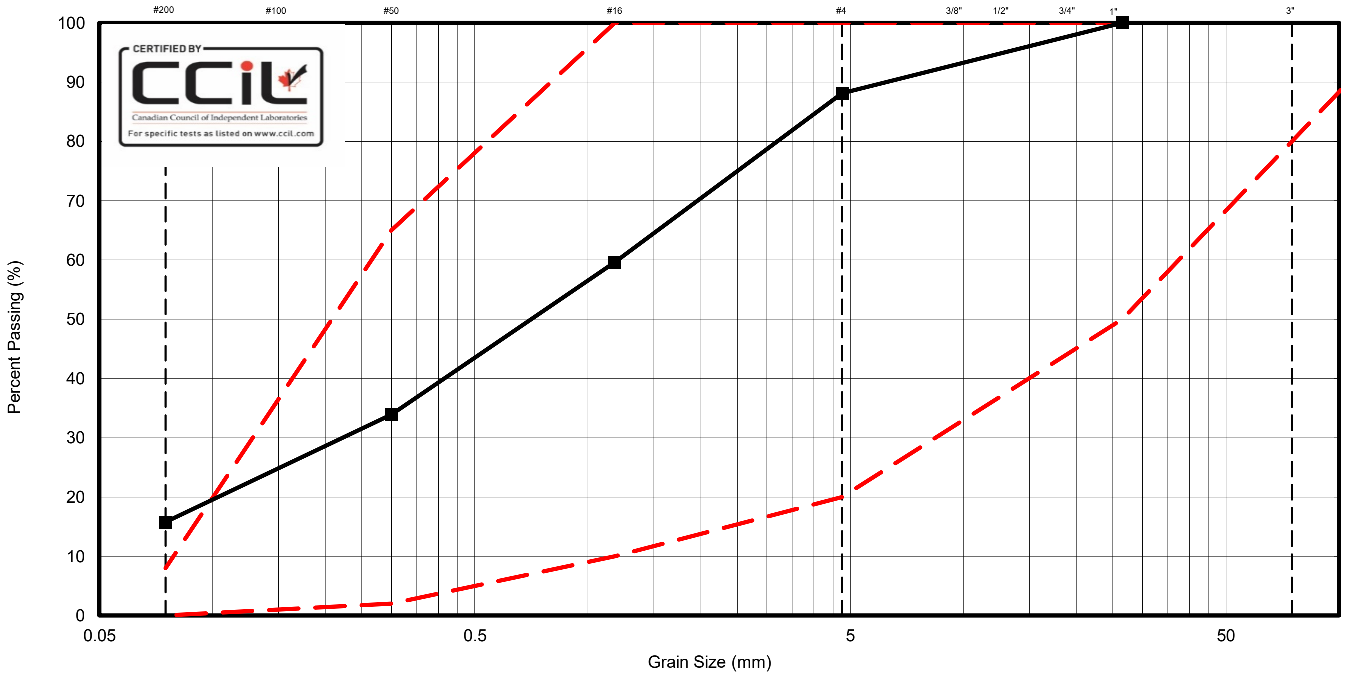
SAMPLE DATA

Total Mass of Sample (g):	3447.4	% Passing 75um by washing:	15.31
Total Mass retained on the 4.75mm sieve (g):	409.1	Total Losses (%): (Maximum 0.3%)	0.00
Total Mass passing the 4.75 mm sieve (g):	3038.3	Percent Crushed: (Min. 60% - Gran A)	N/A
Percent Coarse Aggregate:	11.87	Not Applicable - Gran. "B" Type 1	
Percent Fine Aggregate:	88.13	Asphalt Coated Particles (%) (Max. 30%)	-

TOTAL SAMPLE PERCENTAGES					COARSE AND FINE PORTION PERCENTAGES		
Sieve Size (mm)	Percent Passing	Min Spec. (%)	Max Spec. (%)	Pass?	Sieve Size	Percent Retained *	Percent Retained **
150	100.0	100	100	Y	150	0.0	-
26.5	100.0	50	100	Y	26.5	0.0	-
19.0	-	-	-	-	19.00	-	-
13.2	-	-	-	-	13.2	-	-
9.5	-	-	-	-	9.5	-	-
4.75	88.1	20	100	Y	4.75	100.0	-
1.18	59.6	10	100	Y	1.18	-	32.4
0.30	33.9	2	65	Y	0.30	-	61.5
0.15	-	-	-	-	0.15	-	-
0.075	15.8	0	8	N	0.075	-	82.1

* Based on Coarse Portion only ** Based on Fine Portion only

Material Does Not Meet OPSS.MUNI 1010 Specifications for Granular 'B' Type I



GRAIN SIZE DISTRIBUTION REPORT
GRANULAR A

GEI Consultants

Project Name: 9th Avenue East
Project No.: 2201530
Client: Tatham Engineering Limited
Supplier: -
Sampled From: BH22, AS1, 0-2'

Date Sampled: -
Date Tested: March 20, 2023
GEI Lab No. 5239
Figure No. B7

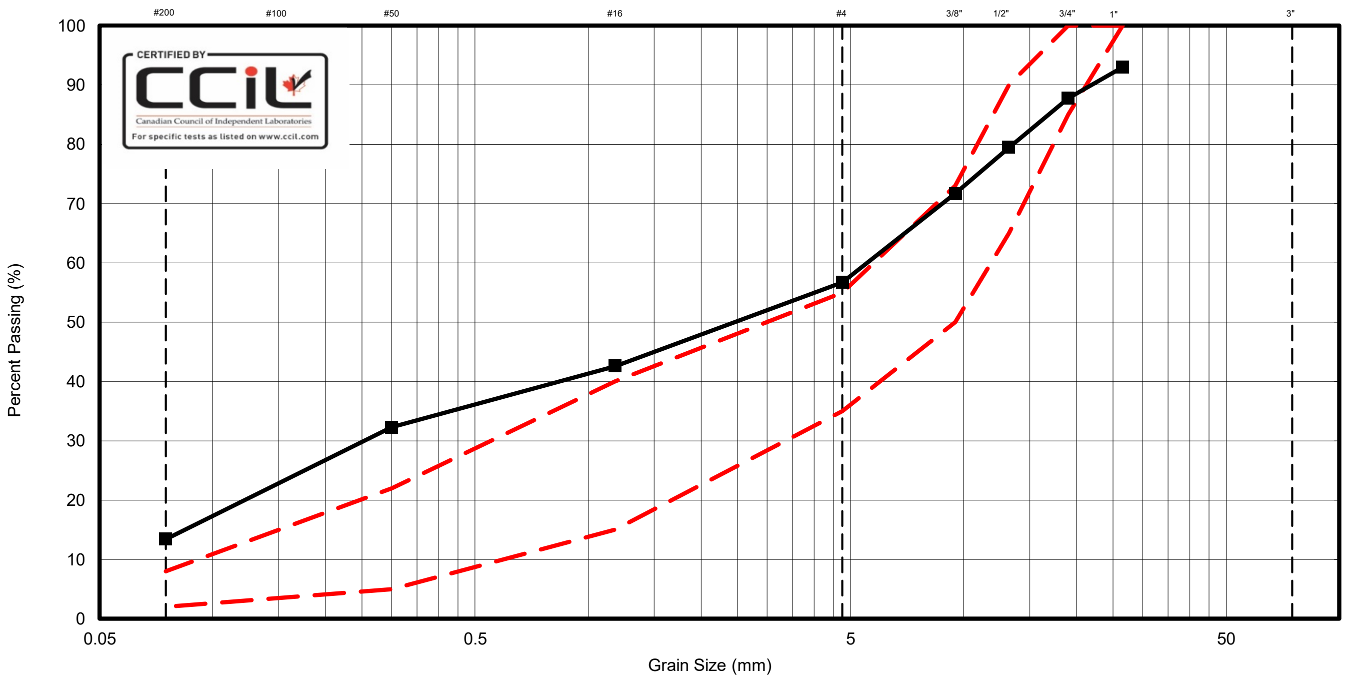
SAMPLE DATA

Total Mass of Sample (g):	2341	% Passing 75um by washing:	13.06
Total Mass retained on the 4.75mm sieve (g):	1013.6	Total Losses (%): (Maximum 0.3%)	0.00
Total Mass passing the 4.75 mm sieve (g):	1327.4	Percent Crushed: (Min. 60% - Gran A) Not Applicable - Gran. "B" Type 1	-
Percent Coarse Aggregate:	43.30		
Percent Fine Aggregate:	56.70	Asphalt Coated Particles (%) (Max. 30%)	-

TOTAL SAMPLE PERCENTAGES					COARSE AND FINE PORTION PERCENTAGES		
Sieve Size (mm)	Percent Passing	Min Spec. (%)	Max Spec. (%)	Pass?	Sieve Size	Percent Retained *	Percent Retained **
150	-	-	-	-	150	-	-
26.5	93.0	100	100	N	26.5	16.1	-
19.0	87.8	85	100	Y	19.00	28.2	-
13.2	79.5	65	90	Y	13.2	47.5	-
9.5	71.7	50	73	Y	9.5	65.4	-
4.75	56.7	35	55	N	4.75	100.0	-
1.18	42.6	15	40	N	1.18	-	24.9
0.30	32.3	5	22	N	0.30	-	43.1
0.15	-	-	-	-	0.15	-	-
0.075	13.4	2	8	N	0.075	-	76.3

* Based on Coarse Portion only ** Based on Fine Portion only

Material Does Not Meet OPSS.MUNI 1010 Specifications for Granular 'A'



GRAIN SIZE DISTRIBUTION REPORT
GRANULAR 'B' TYPE I

GEI Consultants

Project Name: 9th Avenue East
Project No.: 2201530
Client: Tatham Engineering Limited
Supplier: -
Sampled From: BH22, AS1, 0-2'

Date Sampled: -
Date Tested: March 20, 2023
GEI Lab No. 5239
Figure No. B8

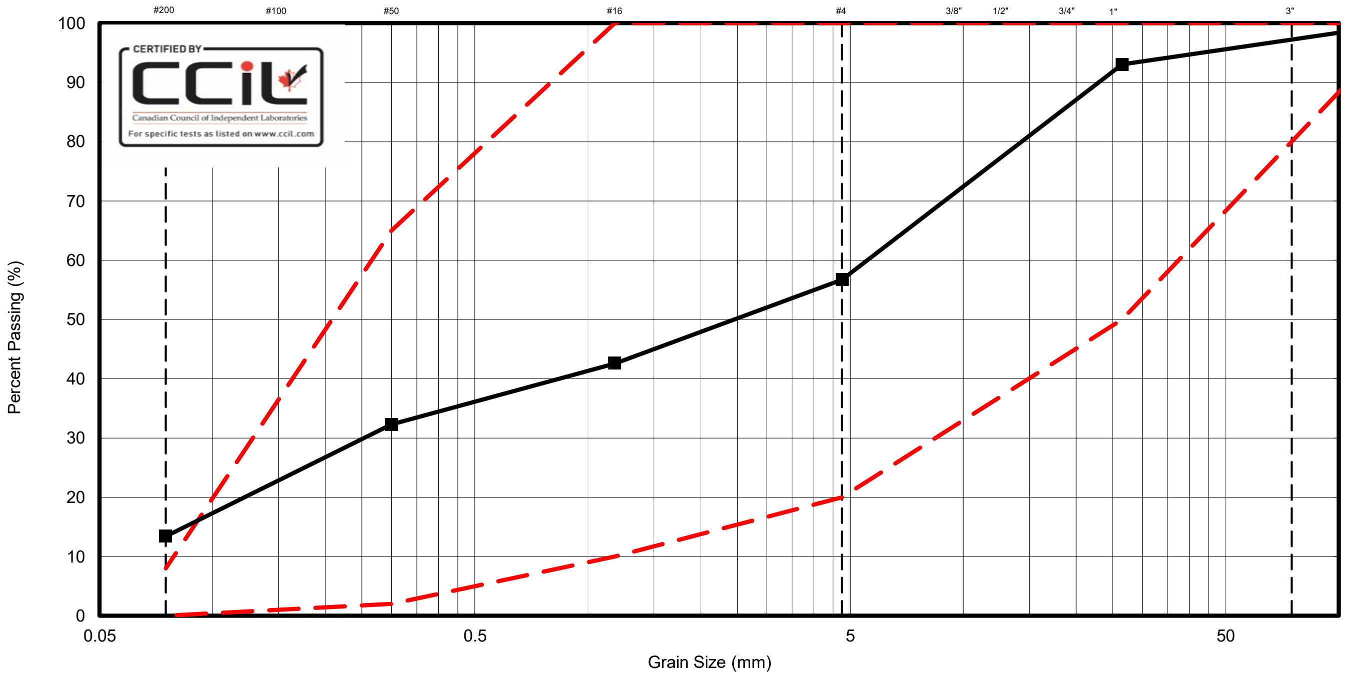
SAMPLE DATA

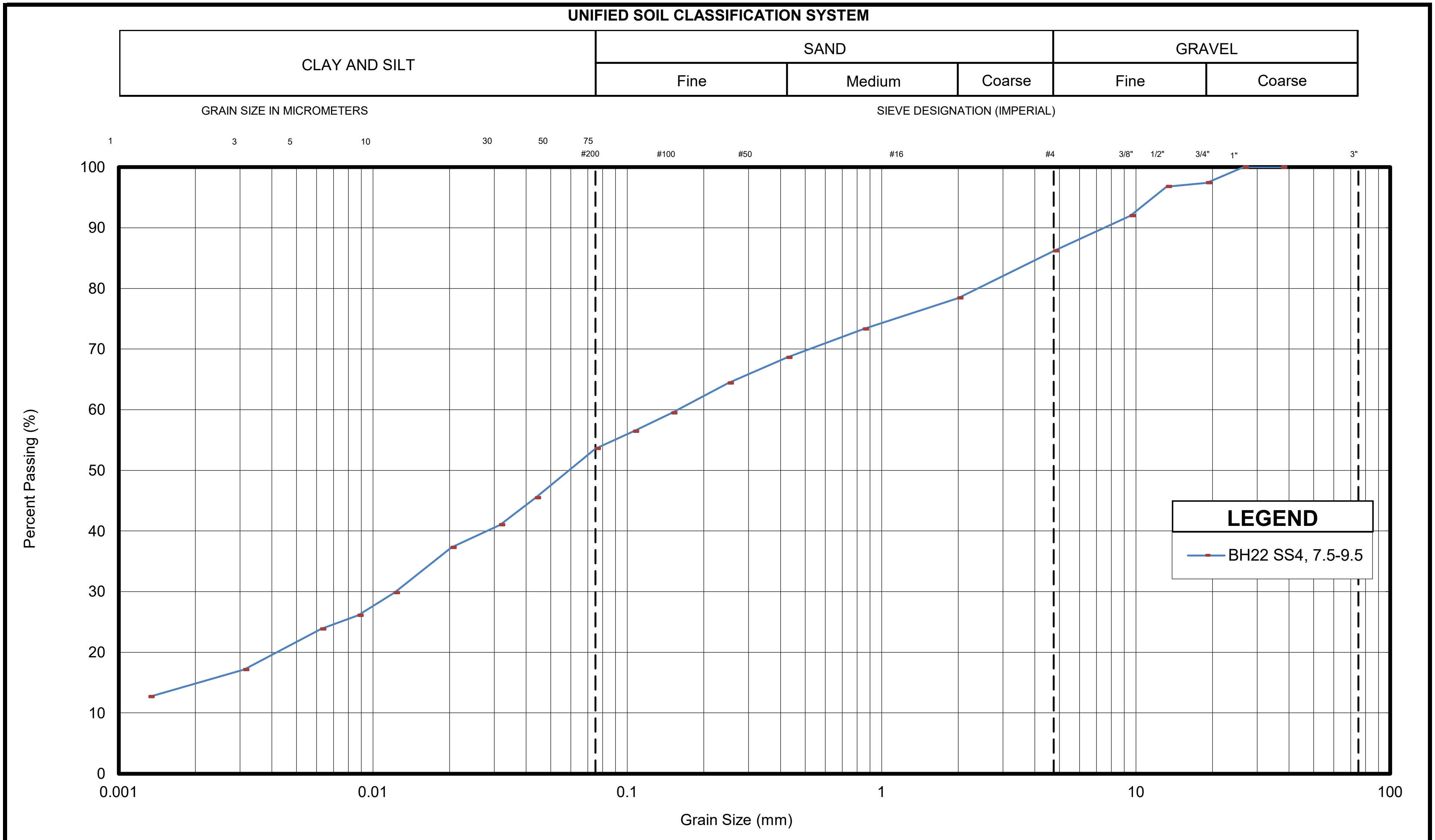
Total Mass of Sample (g):	2341	% Passing 75um by washing:	13.05
Total Mass retained on the 4.75mm sieve (g):	1013.6	Total Losses (%): (Maximum 0.3%)	0.00
Total Mass passing the 4.75 mm sieve (g):	1327.4	Percent Crushed: (Min. 60% - Gran A) Not Applicable - Gran. "B" Type 1	N/A
Percent Coarse Aggregate:	43.30		
Percent Fine Aggregate:	56.70	Asphalt Coated Particles (%) (Max. 30%)	-

TOTAL SAMPLE PERCENTAGES					**COARSE AND FINE PORTION PERCENTAGES**		
Sieve Size (mm)	Percent Passing	Min Spec. (%)	Max Spec. (%)	Pass?	Sieve Size	Percent Retained *	Percent Retained **
150	100.0	100	100	Y	150	0.0	-
26.5	93.0	50	100	Y	26.5	16.1	-
19.0	-	-	-	-	19.00	-	-
13.2	-	-	-	-	13.2	-	-
9.5	-	-	-	-	9.5	-	-
4.75	56.7	20	100	Y	4.75	100.0	-
1.18	42.6	10	100	Y	1.18	-	24.9
0.30	32.3	2	65	Y	0.30	-	43.1
0.15	-	-	-	-	0.15	-	-
0.075	13.4	0	8	N	0.075	-	76.3

* Based on Coarse Portion only ** Based on Fine Portion only

Material Does Not Meet OPSS.MUNI 1010 Specifications for Granular 'B' Type I





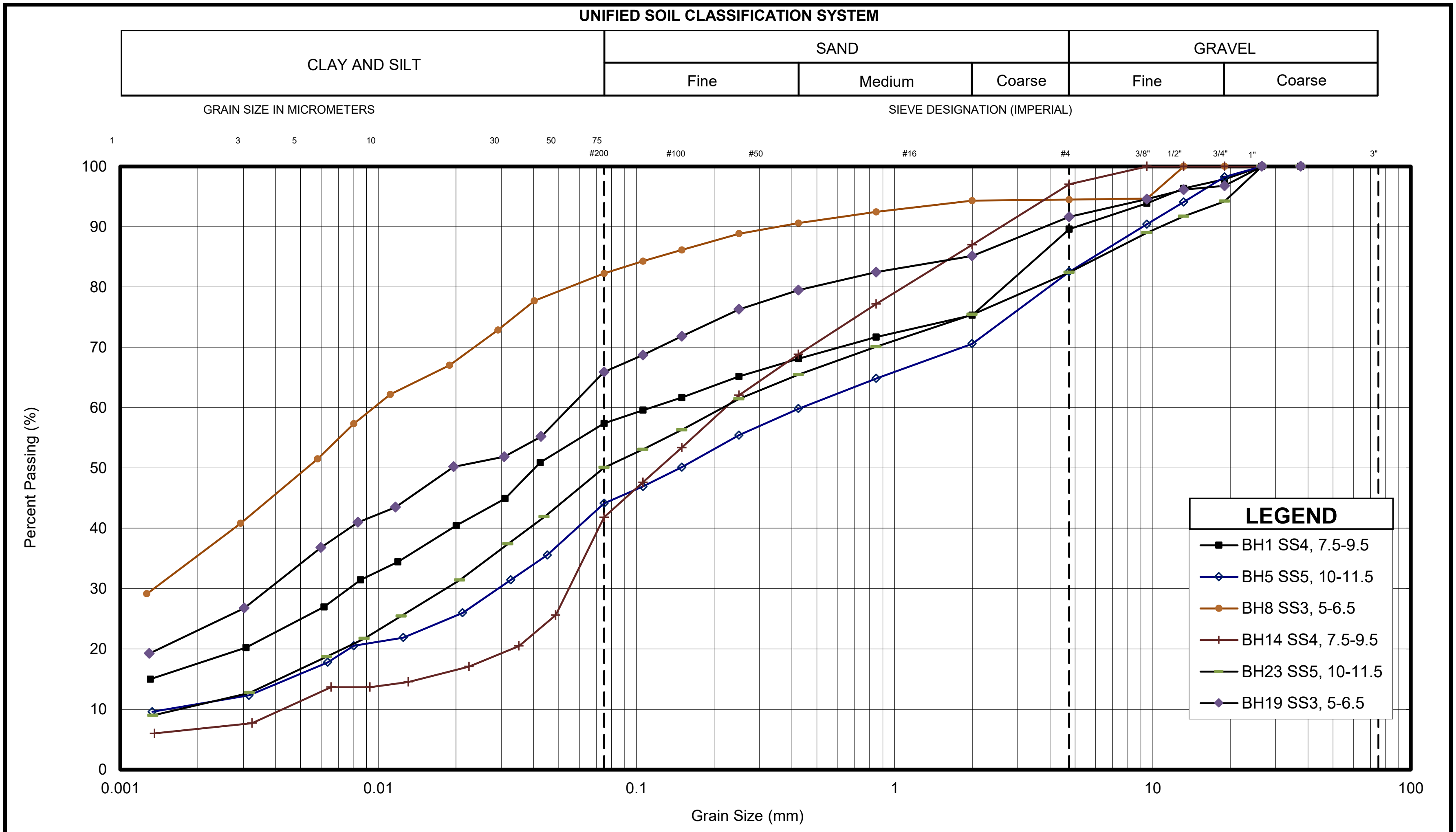
Sample	Description	Gr.	Sa.	Si.	Cl.	D_{10}	D_{30}	D_{60}	C_u	C_c
BH22 SS4	SANDY SILT, Some Clay, Some Gravel	14	33	38	15	-	0.012	0.158	-	-

GEI Consultants

GRAIN SIZE DISTRIBUTION - 9th Avenue East

FILL

FIGURE No. B9
REF. No. 2201530
DATE March 2023



Sample	Description	Gr.	Sa.	Si.	Cl.	D_{10}	D_{30}	D_{60}	C_u	C_c
BH1 SS4	SANDY SILT, Some Clay, Some Gravel	10	32	40	18	-	0.008	0.114	-	-
BH5 SS5	SILTY SAND, Some Gravel, Some Clay	17	38	33	12	0.002	0.029	0.435	285.7	1.28
BH8 SS3	CLAYEY SILT, Some Sand, Trace Gravel	6	12	47	35	-	0.001	0.01	-	-
BH14 SS4	SAND AND SILT, Trace Clay, Trace Gravel	3	55	35	7	0.004	0.055	0.221	52.03	3.18
BH19 SS3	SANDY CLAYEY SILT, Trace Gravel	8	26	39	27	-	0.004	0.055	-	-
BH23 SS5	SANDY SILT, Some Gravel, Some Clay	18	32	39	11	0.002	0.018	0.217	127.9	0.91

GRAIN SIZE DISTRIBUTION - 9th Avenue East

GLACIAL TILL

FIGURE No. B10
REF. No. 2201530
DATE March 2023

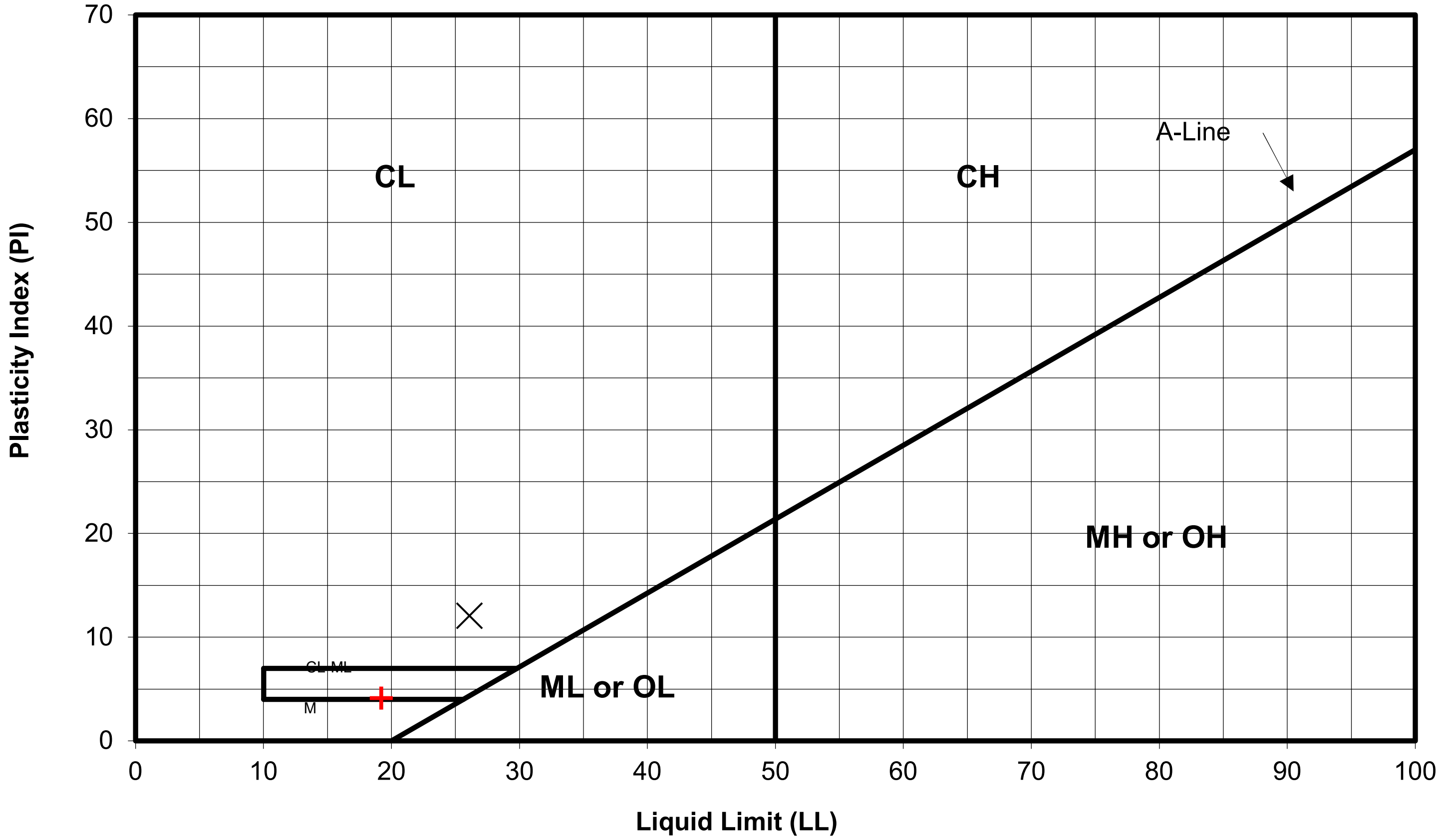
Atterberg Limits Report

Project Name: 9th Avenue East
Project No.: 2201530
Client: Tatham Engineering Limited

Figure No.: B11
Date Tested: March 20, 2023
Date Sampled: -

SAMPLE INFORMATION								
SAMPLE ID	BH8 SS3, 5-6.5	LIQUID LIMIT (LL):	26.1	PLASTIC LIMIT (PL)	14.1	PLASTIC INDEX (PI)	12.0	X
SAMPLE ID	BH22 SS4, 7.5-9.5	LIQUID LIMIT (LL):	19.2	PLASTIC LIMIT (PL)	15.1	PLASTIC INDEX (PI)	4.1	+

Plasticity Chart



DISTRIBUTION:	Prepared By: D. Gorry	Checked By:

Report No.

Appendix C

Corrosivity Laboratory Testing Results

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: ---

REPORT No. B23-01723

Rev. 2

Report To:

GEI Consultants
647 Welham Rd, Unit 14,
Barrie ON L4N 0B7 Canada
Attention: Matthew Hobson

Caduceon Environmental Laboratories
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 07-Feb-23
DATE REPORTED: 20-Mar-23
SAMPLE MATRIX: Soil

JOB/PROJECT NO.:
P.O. NUMBER: 2201530
WATERWORKS NO.

			Client I.D.		BH14-SS2	BH14-SS4	BH20-SS2	BH23-SS4
			Sample I.D.		B23-01723-16	B23-01723-17	B23-01723-20	B23-01723-23
			Date Collected		03-Feb-23	03-Feb-23	30-Jan-23	31-Jan-23
Parameter	**Units**	**R.L.**	**Reference Method**	**Date/Site Analyzed**				
pH @25°C	pH Units		MOEE3530	10-Feb-23/R	7.81	7.92	7.50	7.97
Conductivity @25°C	mS/cm	0.001	SM 2510B	14-Feb-23/O	0.201	0.293	0.198	0.131
Resistivity	ohms·cm		SM 2510B	20-Mar-23/O	4970	3420	5060	7620
Chloride	µg/g	5	SM4110C	13-Feb-23/O	55	50	9	12
Sulphate	µg/g	10	SM4110C	13-Feb-23/O	< 10	180	< 10	30
Sulfide	µg/g	0.3	In-House	16-Feb-23	< 0.3 [1]	< 0.3 [1]	< 0.3 [1]	< 0.3 [1]
REDOX potential	mV		In-House	14-Feb-23/R	413	203	264	256

1. Subcontracted to Testmark Labs
2. Revised report to include resistivity reuslts as per client request

CBurke

Christine Burke
Lab Manager

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: ---

REPORT No. B23-01723

Rev. 2

Report To:

GEI Consultants
647 Welham Rd, Unit 14,
Barrie ON L4N 0B7 Canada
Attention: Matthew Hobson

Caduceon Environmental Laboratories
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 07-Feb-23

DATE REPORTED: 20-Mar-23

SAMPLE MATRIX: Soil

JOB/PROJECT NO.:

P.O. NUMBER: 2201530

WATERWORKS NO.

			Client I.D.		BH25-SS2			
			Sample I.D.		B23-01723-25			
			Date Collected		31-Jan-23			
Parameter	**Units**	**R.L.**	**Reference Method**	**Date/Site Analyzed**				
pH @25°C	pH Units		MOEE3530	10-Feb-23/R	7.59			
Conductivity @25°C	mS/cm	0.001	SM 2510B	14-Feb-23/O	0.173			
Resistivity	ohms·cm		SM 2510B	20-Mar-23/O	5770			
Chloride	µg/g	5	SM4110C	13-Feb-23/O	9			
Sulphate	µg/g	10	SM4110C	13-Feb-23/O	10			
Sulfide	µg/g	0.3	In-House	16-Feb-23	< 0.3 [1]			
REDOX potential	mV		In-House	14-Feb-23/R	269			

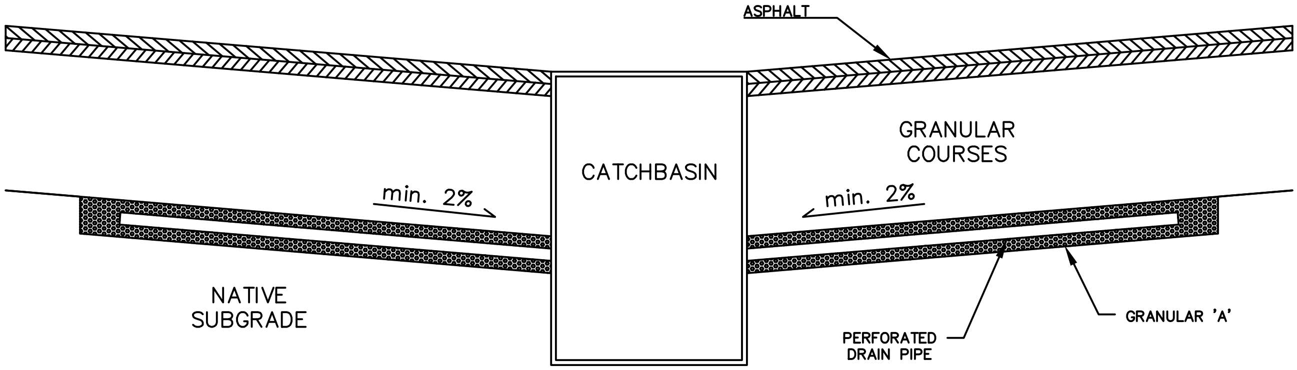
1. Subcontracted to Testmark Labs
2. Revised report to include resistivity reuslts as per client request

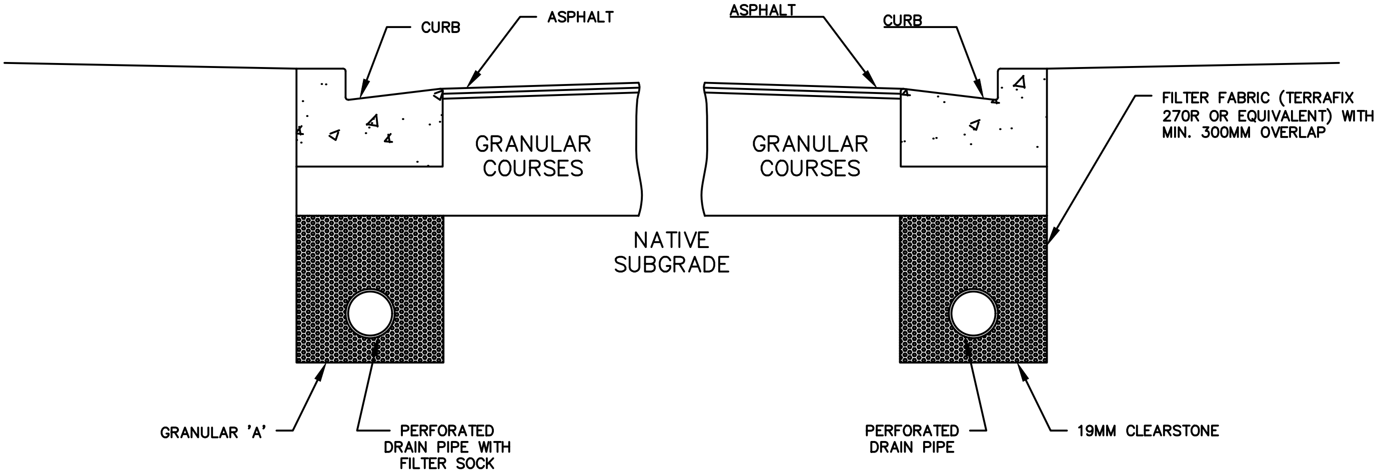
Christine Burke
Lab Manager

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

Appendix D

Typical Details

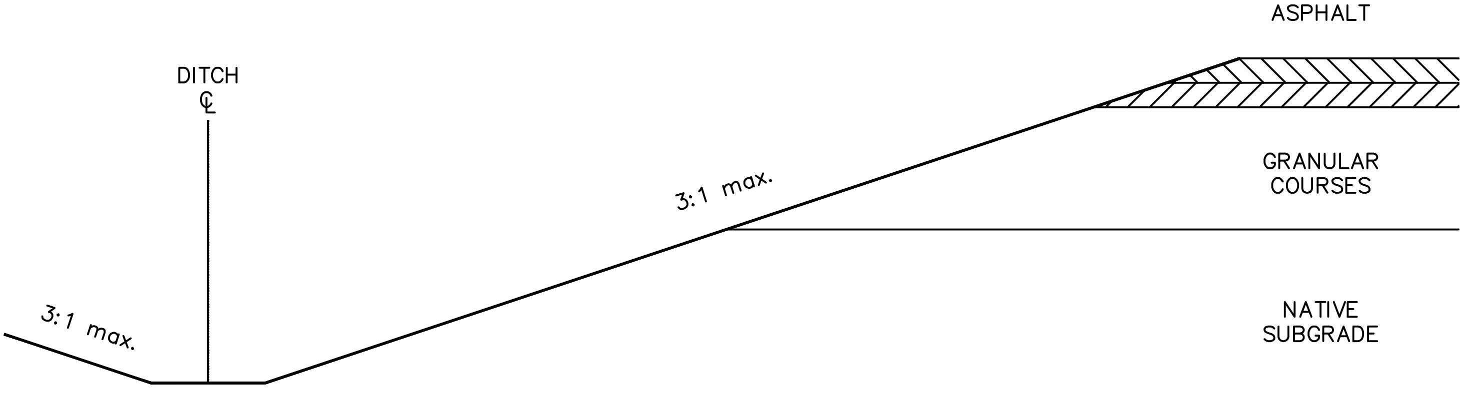




Unwrapped Trench

Wrapped Trench

Urban Cross Sections



Rural Cross Section

GEI Consultants

647 Welham Rd, Unit 14, Barrie, ON, L4N 0B7

PAVEMENT DRAINAGE ALTERNATIVES TYPICAL DETAILS

Appendix F:
Hydrogeological Assessment Report

Enhancing our communities

9th Avenue East Watermain Replacement and Road Reconstruction

HYDROGEOLOGICAL ASSESSMENT

City of Owen Sound

File 121387 | May 11, 2023

Document Control

File:	Prepared by:	Prepared for:
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Date: **May 11, 2023**	**T** 705-444-2565 **tathameng.com**	

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Issue	**Date**	**Description**
1	May 11, 2023	Final Report

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1 Introduction

Tatham Engineering Limited (Tatham) has been retained by the City of Owen Sound (City) to complete a Hydrogeological Investigation for the proposed watermain replacement and road reconstruction of 9th Avenue East, in Owen Sound, Ontario.

The proposed watermain replacement and road reconstruction program will be completed in three Phases of construction:

- Phase 1 consists of the replacement of approximately 650 m of existing watermain along 6th Street East, and within the utility corridor from 6th Street East to 8th Street East.
- Phase 2 consists of new watermain installation extending approximately 420 m through a utility corridor from 6th Street East to Superior Street, replacement and upsizing of approximately 280 m of watermain along Superior Street from the corridor to approximately 160 m west of 9th Avenue East.
- Phase 3 consists of the replacement of approximately 1,000 m of watermain along 9th Avenue East from Superior Street to just north of 9th Street East. Approximately 140 m of existing clay sanitary sewer will also be replaced during the proposed reconstruction along 9th Avenue East north of 7th Street East, and approximately 865 m of existing storm sewers may be replaced along 9th Avenue East between 9th Street East and Superior Street.

It is understood Phase 1 is to be carried out in 2023 and Phase 2 and 3 will be carried out at a later date. A site location plan and site layout illustrating the three Phases are enclosed as Figures 1 and 2, respectively.

The geotechnical investigation for the project has been completed by GEI (2023) and has been relied upon for the hydrogeological assessment.

1.1 PURPOSE AND SCOPE OF WORK

The main objectives of the Hydrogeological Investigation were to:

- Establish local and regional geology and hydrogeology.
- Determine potential construction dewatering requirements and provide an assessment of anticipated construction dewatering flow rates for a generic construction scenario.
- Assess groundwater quality and compare the results to the applicable City of Owen Sound Sewer Use By-Law Criteria, Provincial Water Quality Objectives (PWQO), and O.Reg.153/04, as amended, Table 1 Site Condition Standards.

- Qualitatively assess the potential impacts to the nearby structures, water bodies and water uses, if any, and comment on future regulatory agency involvement.
- Prepare a Hydrogeological Investigation report.

To achieve the above objectives, Tatham proposed the following scope of work:

- Complete a desktop review of pertinent geological and hydrogeological resources, Ministry of the Environment, Conservation and Parks (MECP) water well records, previous geotechnical reports completed by others, and proposed site plan drawings.
- Visit the site to note existing site conditions, topography, drainage, water features, neighboring land uses, and/or existing water supply or monitoring wells.
- Complete groundwater level monitoring of all accessible and functional wells installed on-site during the 2023 geotechnical investigation completed by GEI.
- Perform borehole permeability testing at selected monitoring wells to determine hydraulic conductivity of the screen soil deposits.
- Determine baseline groundwater quality by collecting and analysis of one representative groundwater sample.
- Evaluate the background information, field, and laboratory data to evaluate the construction dewatering requirements.
- Prepare a Hydrogeological Investigation report.

1.2 WATER TAKING – TEMPORARY

Temporary construction dewatering is governed by the Environmental Protection Act, and the following water taking limits and requirements are outlined in O.Reg.63/16:

- Construction dewatering less than 50,000 L/day: the taking of both groundwater and stormwater does not require a hydrogeological report nor a water taking permit.
- Construction dewatering greater than 50,000 L/day but less than 400,000 L/day: the taking of both groundwater and stormwater does require a hydrogeological report and registration on the Environmental Activity and Sector Registry (EASR).
- Construction dewatering greater than 400,000 L/day: the taking of groundwater and stormwater requires a hydrogeological report and an approved MECP Category 3 Permit-To-Take-Water (PTTW).

This hydrogeological assessment was carried out to assess the potential construction dewatering volumes to proceed in accordance with the applicable water taking regulatory requirements and to obtain the applicable water taking permit.

2 Site Setting

The site is comprised of municipal roadway including 9th Avenue East from Superior Street to just north of 9th Street East, the western portion of 6th Street East from the corridor to the western limit, and Superior Street from the utility corridor to about 160 m west of 9th Avenue East as well as two utility corridors. The site is located in a mixed residential, commercial and industrial setting, with primarily residential properties to the north, west and south, and commercial and industrial land uses to the east.

2.1 PHYSIOGRAPHY, SURFICIAL AND BEDROCK GEOLOGY

Most of the site lies within the physiographic region known as the Cape Rich Steps comprising of shale plains, and the southern portion of the site lies within the physiographic region known as the Bruce Peninsula comprising of limestone plains (Chapman and Putnam, 1984). Ontario Geological Survey (OGS) quaternary geology mapping indicates the site consists primarily of glaciolacustrine deposits comprised of sand, gravelly sand and gravel. OGS surficial geology mapping indicates the site consists primarily of Till comprised of stone-poor sandy silt to silty sand texture till on Paleozoic terrain; however, the southern portion is mapped as bedrock. These findings are generally consistent with the subsurface conditions encountered during GEI's 2023 geotechnical investigation where sandy silt/sand overburden soils were encountered and bedrock was encountered towards the southern portion of the site. Local clayey silt to silty clay till was also encountered

The bedrock at the site primarily consists of Cabot Head shale, Manitoulin/Cabot Head/Fossil Hill dolostone of the Clinton-Cataract Group, or Amabel Dolostone. Bedrock was encountered during the geotechnical investigation towards the southern portion of the site at depths of 1.5 to 3.5 m below existing grade.

2.2 TOPOGRAPHY AND DRAINAGE

The topography of the site includes rolling hills with elevations ranging from 230 meters above sea level (m asl) to 265 m asl. Drainage and runoff is expected to follow the local topography towards the existing storm sewers throughout the roadway and to lower lying areas grassed areas within the utility corridors. It is anticipated regional groundwater flow will be to the northwest towards Georgian Bay.

2.3 MECP WATER WELL RECORDS

To assess the nature of the groundwater resources as well as the history of the current well usage in the area, MECP water well records were reviewed for a 500 m radius surrounding the site. The approximate MECP water well locations are shown on Figure 3, and a summary of the MECP water well records are provided in Appendix A.

A total of 32 MECP well records were reviewed within a 500 m boundary of the site. Six of the water well records indicated domestic or commercial water supply use, 15 records indicated test hole and monitoring well use, two records indicated the wells were not in use, and the remaining water well records did not specify water well use.

In general, the well records indicated subsurface layers of sand, silt and clay overlying limestone or shale bedrock. Bedrock was noted at depths of 1.5 to 18.3 m below existing grade.

2.4 SOURCE WATER PROTECTION MAPPING

The site is located in the Grey Sauble Source Protection Area (SPA). The site does not lie within a Municipal Well Head Protection Area (WHPA); however, the northern portion of the site does lie within an Intake Protection Zone (IPZ), as shown on Figures 4 and 5. The southern boundary of the site borders a Significant Groundwater Recharge Area (SGRA) and the entire site lies within a Highly Vulnerable Aquifer (HVA), as shown on Figures 6 and 7, respectively.

2.5 SITE INSPECTION

A visual site inspection was completed on April 21, 2023. The site was primarily comprised of municipal roadways, and two grassed utility corridors. The topography was hilly throughout the site, and the site was surrounded by residential properties to the north, west and south, and industrial and commercial land uses to the east.

No water bodies were noted to cross the site. Georgian Bay is approximately 1.5 km north of the site and the Sydenham River lies approximately 1.3 km west of the site.

3 Procedures and Methodology

Boreholes (BH1 through BH25) were advanced during the geotechnical investigation (GEI, 2023). Monitoring wells were installed in 11 of the boreholes (BH/MWs 1, 3, 5, 7, 9, 14, 17, 19, 21, 23 and 25).

The geotechnical borehole logs and laboratory testing are discussed further in section 4.1 and are provided in Appendix B and C, respectively.

3.1 BOREHOLE PERMEABILITY TESTING

Borehole permeability testing was completed in three monitoring wells (BH/MWs 21, 23 and 25) on April 21, 2023. Water was purged from the well using low density polyethylene (LDPE) tubing and a foot valve. Following the removal of three well volumes of groundwater or the well going dry, and after 95% recovery, the test was initiated. The static water level was measured prior to the start of the testing and the change in water level was manually recorded following purging. The change in water level was recorded on regular intervals for a total of 30 minutes. The test was completed to estimate the hydraulic conductivity (K) of the soils at the well screen depth. The plot for drawdown versus time is presented in Appendix D.

3.2 GROUNDWATER SAMPLING

To establish baseline conditions and assess the suitability for discharge of pumped groundwater to surface during potential construction dewatering, a representative groundwater sample was collected from BH/MW25 on April 21, 2023.

The sample was collected using low-flow sampling methods to reduce sediment content within the sample. The sample was directly placed into pre-cleaned laboratory-supplied vials and/or bottles, with analytical test group specific preservatives. Dedicated nitrile gloves were used during sampling and non-dedicated equipment was sanitized between monitoring wells.

Samples were field filtered for select parameters and submitted for chemical analysis of the City of Owen Sound Sewer Use By-Law Criteria, PWQO metals, and O.Reg. 153/04, as amended, Petroleum Hydrocarbons (PHCs) and Volatile Organic Compounds (VOCs). Samples were analyzed by Caduceon Environmental Laboratories, a CALA accredited lab. Groundwater chemistry results are included in the laboratory Certificates of Analysis, provided in Appendix E.

4 Subsurface Conditions

The Geotechnical Investigation (GEI, 2023) was reviewed for this study. The borehole and monitoring well locations are shown on Figure 2, detailed subsurface borehole logs are presented in Appendix B, and the geotechnical laboratory results are included in Appendix C.

In general, the boreholes encountered pavement structure or topsoil, over a silty sand to clay silt/sandy clayey silt fill, over a glacial till comprising of sandy silt, sand and silt, silty sand and locally clayey silt to sandy clayey silt.

Towards the southern portion of the site borehole drilling refusal at depths of 1.5 to 3.5 m below existing grade was interpreted as probable bedrock.

4.1 GROUNDWATER

4.1.1 Groundwater Levels

Unstabilized groundwater level measurements and cave measurements were taken upon drilling completion of each borehole in 2023, as presented in the borehole logs in Appendix B. These measurements provide a rough estimate of the possible excavation and temporary groundwater control constructability considerations that may arise. Upon completion of the boreholes, all boreholes were open and almost all boreholes were dry upon completion; with the exception of BH/MW7 and BH10 where water was noted at 4.4 m and 0.8 m, respectively.

Monitoring wells were installed in 11 boreholes (BH/MWs 1, 3, 5, 7, 9, 14, 17, 19, 21, 23 and 25) to facilitate measurements of stabilized groundwater levels across the site. The monitoring wells were installed with 50-mm PVC riser pipe and slotted 1.5-meter-long screens. A summary of the monitoring well installations is presented in Table 1. Stabilized groundwater measurements are presented in Table 2.

Table 1: Monitoring Well Installation Details

MONITORING WELL ID	GROUND SURFACE	LOCATION OF SCREEN		STRATA SCREENED
		Depth (m)	Elevation (m asl)	
BH/MW1	234.4	3.1 – 4.6	229.8 – 231.3	Sandy Silt Glacial Till
BH/MW3	242.7	3.1 – 4.6	238.1 – 239.6	Silty Sand Fill to Sandy Silt Till
BH/MW5	237.1	3.1 – 4.6	232.5 – 234.0	Silty Sand Glacial Till

MONITORING WELL ID	GROUND SURFACE	LOCATION OF SCREEN		STRATA SCREENED
		Depth (m)	Elevation (m asl)	
BH/MW7	233.7	3.1 – 4.6	229.1 – 230.6	Sandy Clayey Silt Glacial Till
BH/MW9	237.3	3.1 – 4.6	232.7 – 234.2	Sandy Silt Glacial Till
BH/MW14	248.8	1.6 – 3.1	245.7 – 247.2	Sandy Silt to Sand and Silt Glacial Till
BH/MW17	262.7	0.9 – 2.4	260.3 – 261.8	Clayey Silt Fill to Sandy Silt Glacial Till
BH/MW19	249.2	1.6 – 3.1	246.1 – 247.6	Sandy Clayey Silt Glacial Till
BH/MW21	245.2	0.8 – 2.3	242.9 – 244.4	Clayey Silt Fill to Sandy Silt
BH/MW23	247.3	1.6 – 3.1	244.2 – 245.7	Sandy Silt Glacial Till
BH/MW25	248.3	1 – 2.5	245.8 – 247.3	Sandy Silt Glacial Till

Table 2: Groundwater Levels

MONITORING WELL ID	GROUNDWATER DEPTH (M) / ELEVATION (m asl)	
	FEBRUARY 13, 2023	APRIL 21, 2023
BH/MW1	Dry	-*
BH/MW3	Dry	-*
BH/MW5	3.2 / 233.9	-*
BH/MW7	1.4 / 232.3	-*
BH/MW9	1.8 / 235.5	-*
BH/MW14	0.6 / 248.2	-*

MONITORING WELL ID	GROUNDWATER DEPTH (M) / ELEVATION (m asl)	
	FEBRUARY 13, 2023	APRIL 21, 2023
BH/MW17	Dry	Dry
BH/MW19	1.7 / 247.5	1.76 / 247.4
BH/MW21	1.3 / 243.9	1.22 / 244.0
BH/MW23	0.1 / 247.2	-0.07** / 247.4
BH/MW25	0.2 / 248.1	0.21 / 248.1

Note:
* Monitoring well could not be safely accessed and groundwater level was unable to be collected.
**value indicates water level measured above the ground surface.

Stabilized groundwater levels on February 13, 2023 ranged from 0.1 to 3.2 m below exiting grade (elevation 232.2 to 248.2 m asl). Local groundwater flow is anticipated to flow to the northwest/west towards Georgian Bay and/or Syndenham River as shown on Figure 8.

4.2 IN-SITU PERMEABILITY

Borehole permeability testing was conducted at BH/MWs 21, 23 and 25 and the hydraulic conductivities were calculated using Dagan (1978) solution which accounts for the groundwater table straddling the well screen. The semi-log plot for drawdown versus time is provided in Appendix D and summarized in Table 3, below.

Table 3: Hydraulic Conductivity

MONITORING WELL ID	WELL DEPTH (m)	STRATA SCREENED	HYDRAULIC CONDUCTIVITY (m/s)
BH/MW21	2.3	Clayey Silt Fill to Sandy Silt	$1.5x10^{-6}$
BH/MW23	3.1	Sandy Silt Glacial Till	$2.2x10^{-7}$
BH/MW25	2.5	Sandy Silt Glacial Till	$4.3x10^{-7}$

According to Freeze and Cherry (1979), the typical hydraulic conductivity of the strata investigated are:

- Glacial Till: 10^{-6} m/s to 10^{-12} m/s
- Silt: 10^{-6} m/s to 10^{-9} m/s
- Silty Sand: 10^{-3} m/s to 10^{-7} m/s

The actual measured hydraulic conductivity of the deposits generally, were within the expected range; however, for design purposes the hydraulic conductivity was assumed to be $1.5x10^{-6}$ m/sec.

4.3 BASELINE GROUNDWATER CHEMISTRY

To establish baseline conditions and assess the suitability for discharge of pumped groundwater to surface during potential future construction dewatering, a groundwater sample was collected and analyzed for select parameters.

The groundwater sample met the Owen Sound Storm Sewer ByLaw Criteria for the parameters tested with the exception of Total Suspended Solids with a measured concentration of 32 mg/L compared to a Sewer Use Bylaw Criteria of 15 mg/L. Similarly, the groundwater sample met the PWQO and O.Reg. 153/04 (as amended) Table 1 Site Condition Standards for the parameters tested with the exception of Iron with a measured concentration of 1,160 µg/L compared to a PWQO of 300 µg/L. It is noted the E.Coli and pesticides were not tested for as part of the Owen Sound Sewer ByLaw testing.

The above chemical results suggest the dewatering discharge may not meet the applicable Owen Sound Storm Sewer Use By-Law Criteria and PWQO during construction dewatering without first being discharged to a silt bag and/or sediment tank before being discharged to the land surface. Treatment of dewatering discharge water by filtration or sedimentation to reduce the concentration of TSS will likely reduce the concentration of non-dissolved metals to achieve compliance with the PWQO; however, other treatment methods may be required still to reduce the concentration of dissolved analytes.

It is expected during dewatering pumped, water will first be discharged to a silt bag and/or sediment tank at minimum before being discharged to land and/or storm sewer.

5 Discussion and Analysis

It is understood the proposed watermain replacement and road construction will occur in three Phases of construction:

- Phase 1 consists of the replacement of approximately 650 m of existing watermain along 6th Street East, and within the utility corridor from 6th Street East to 8th Street East.
- Phase 2 consists of new watermain installation extending approximately 420 m through a utility corridor from 6th Street East to Superior Street, replacement and upsizing of approximately 280 m of watermain along Superior Street from the corridor to approximately 160 m west of 9th Avenue East.
- Phase 3 consists of the replacement of approximately 1,000 m of watermain along 9th Avenue East from Superior Street to just north of 9th Street East. Approximately 140 m of existing clay sanitary sewer will also be replaced during the proposed reconstruction along 9th Avenue East north of 7th Street East, and approximately 865 m of existing storm sewers may be replaced along 9th Avenue East between 9th Street East and Superior Street.

Based on the current design details it is assumed watermain inverts will be approximately 2.5 m bgs and the proposed storm and sanitary sewers inverts will be approximately 3.5 m bgs.

It is anticipated construction dewatering will be required during the construction works.

5.1 TEMPORARY CONSTRUCTION DEWATERING

To calculate the estimated dewatering rate for the proposed on-site construction works, the following assumptions have been made:

- Groundwater is to be drawn down 1.0 m below the anticipated excavation depths.
- The water-bearing soils that may be exposed during construction primarily consist of sandy silt glacial till with variable clay contents, with an assumed K-value of 1.5×10^{-6} m/s for calculation purposes.
- Saturated soils will be encountered from depths ranging from surface to 2.8 m below existing grade (Elevation 232.2 to 248.2m asl).
- The excavation depths for the Phase 1 construction zone are inferred from the 9th Avenue East Looping Watermain Phase 1 Tender Design drawings dated March 2023 prepared by Tatham and are expected to range between 2.0 to 2.5 m below the existing ground surface. At the time of this report the design details for Phase 2 and 3 were not available and for

design purposes watermain inverts were assumed to be similar to those proposed within Phase 1, and up to 3.5 m for the proposed sanitary and/or storm sewer inverts.

- For calculation purposes the site has been separated into three zones based on the proposed phasing; however, the dewatering contractor may use smaller dewatering zones to limit the dewatering discharge rates.
- It is assumed all measures will be implemented to ensure the 400,000 L/day EASR threshold will not be exceeded. This includes completing the work in smaller sections.

5.1.1 Radius of Influence

The Radius of Influence (ROI) for construction dewatering refers to the distance at which the drawdown resulting from pumping becomes negligible. The ROI is calculated using the empirical Sichardt Equation. The equation is empirical and provides representative flow rates using the steady state flow dewatering equations. The Sichardt Equation is used to provide representative flow calculations; however, it is not precise in determining the actual radius influence by pumping since during steady state conditions, the ROI of pumping will extend until boundary flow conditions are reached and provide sufficient water inputs to the aquifer, such as recharge and surface water bodies.

The Sichardt equation is expressed as the following equation:

$$R_o = 3000(H - h)\sqrt{K}$$

Where:

K = hydraulic conductivity (m/s)

H = Static Saturated Head (m)

h = Dynamic Saturated Head (m)

R_o= Radius of Influence (m)

Based on the Sichardt equation and the design K value, the ROI from the centre of the excavation for radial flow for each zone is tabulated below. Calculation details are provided in Appendix F and the locations of the Zones 1, 2 and 3 are shown on Figure 2.

Table 4: Radius of Influence

ZONE	DESCRIPTION	ROI (m)
1	Phase 1	13
2	Phase 2	11

ZONE	DESCRIPTION	ROI (m)
3	Phase 3	8

The ROI calculation is a conservative methodology. It should be noted most of the water will be pumped during the first stage of construction or when a rain event occurs.

Although the ROI is calculated as 8 to 13 m from the centre of the excavation, over a period of time, the amount of settlement will decrease exponentially to zero towards the ROI limit. The likelihood for impacts to the nearby structures are negligible given the distance of the neighbouring dwellings and the anticipated excavations; however, a settlement analysis should be completed by the geotechnical engineer prior to construction dewatering activities.

5.1.2 Temporary Dewatering Flow Rate Equation

The Dupuit method for linear flow in an unconfined aquifer for a fully penetrating excavation was used within Zone 1, 2 and 3 and is expressed as:

$$Q = Kx\frac{H^2 - h^2}{L_o}$$

Where:

Q = rate of pumping (m^3/s)

x = length of excavation (m)

L = length of excavation (m)

K = hydraulic conductivity (m/s)

H = head beyond the influence of pumping (static groundwater elevation) (m)

h = head above base of aquifer at the excavation (m)

It is anticipated the initial dewatering rate will be higher to remove groundwater from within the overburden formation. As the water level reaches its target elevation, dewatering rates are expected to decrease as the local groundwater storage will have been removed and lessen seepage rates into the excavation.

Using the assumptions and equations outlined above, the estimated dewatering rates were determined and summarized below. Calculation details are provided in Appendix F.

Table 5: Construction Dewatering Estimated Daily Flow Rate

ZONE	DESCRIPTION	CONSTRUCTION DEWATERING FLOW RATE (L/day)	CONSTRUCTION DEWATERING FLOW RATE INLCUDING SAFETY FACTOR OF 2 AND A 10 mm RAIN EVENT (L/day)	CONSTRUCTION DEWATERING FLOW RATE INCLUDING SAFETY FACTOR OF 2 AND A 10 mm RAIN EVENT PER 100 m LENGTH TRENCH (L/day/100 m)
1	Phase 1	165,100	356,200	54,800
2	Phase 2	175,900	386,200	44,900
3	Phase 3	162,300	364,600	36,460

To account for seasonal fluctuations of the groundwater table and variation in the hydrogeological properties beyond those encountered during this study, a safety factor of 2.0 was applied. Further to account for surface water infiltration within the excavation footprint, a 10 mm rain event was applied. This rate can be considered a contingency volume subject to the timing and season of construction.

The estimates provided in this report are based on proposed reconstruction information available at the time of the investigation. If design changes are implemented, additional dewatering estimation will be required to reflect the design changes.

The estimated dewatering volumes range between 356,200 and 386,200 L/day; however, it is anticipated construction will be completed in smaller sections. Considering typical construction practices dewatering volumes are anticipated to range between 36,460 and 54,800 L/day per 100 m length of trench. As the estimated dewatering rates are over 50,000 L/day but remain below 400,000 L/day it is recommended the anticipated water taking be registered on the MECP EASR.

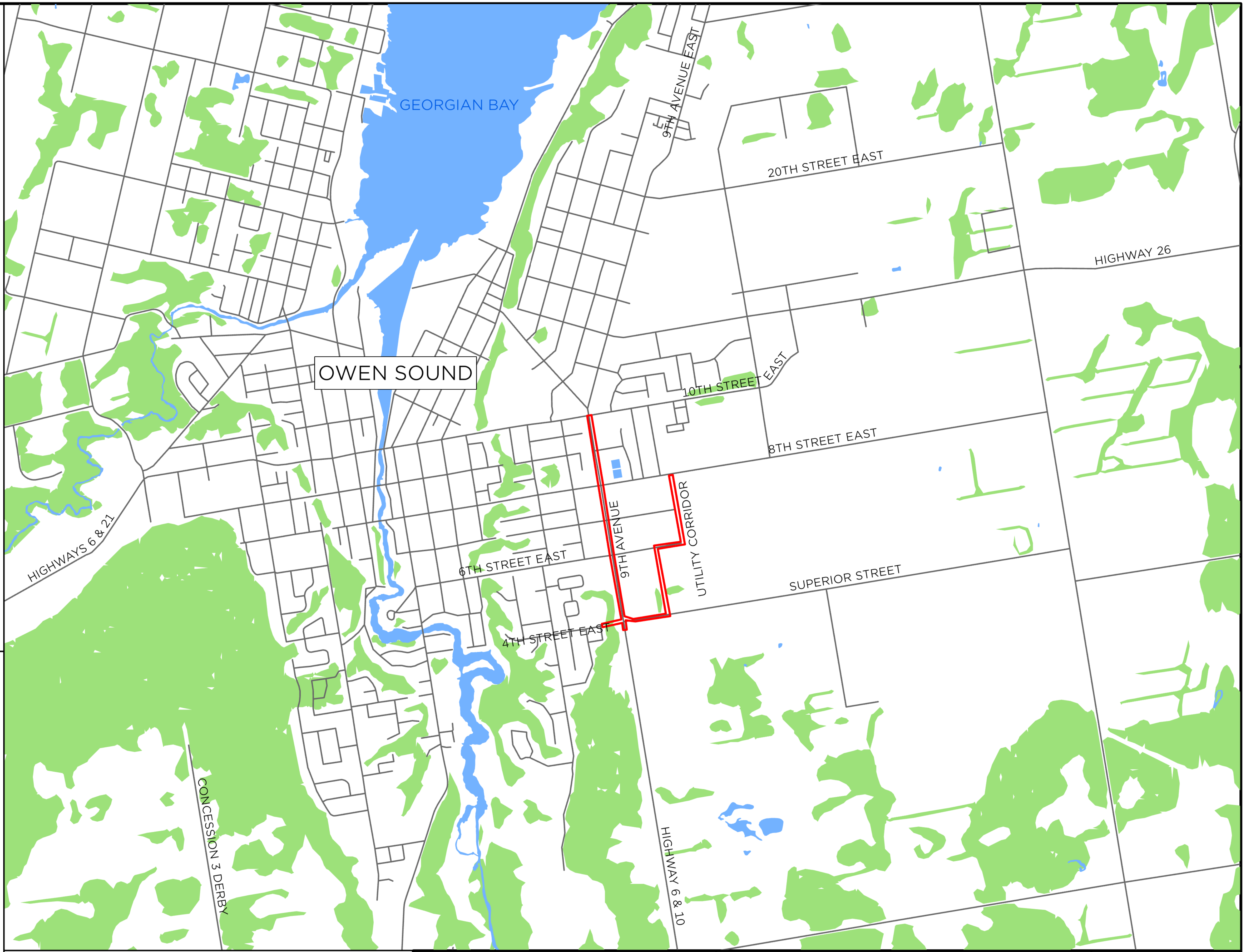
In accordance with O.Reg. 63/19 a water taking and discharge plan have been prepared for the site and are provided in Appendix G and H, respectively.

It is the responsibility of the contractor to ensure dry conditions are maintained within excavations at all times. If dewatering does exceed the 400,000 L/day volume during construction, a PTTW with the MECP will be required. Dewatering volumes should be closely monitored during construction in order to stay below the threshold of 400,000 L/day which may require construction being carried out in smaller sections.

6 References

Chapman, L.J. and Putnam, D.F. 2007. The Physiography of Southern Ontario; Ontario Geological Survey, Miscellaneous Release – Data 228.

GEI Consulting Engineers and Scientists. March 24, 2023. Proposed Watermain Replacement and Road Reconstruction, 9th Avenue East, Owen Sound, Ontario.



NOTES:
1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N
2.CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE – ONTARIO.

LEGEND

🟥 SITE
🟩 WOODED AREA
🟦 WATERBODY
— WATERCOURSE
— ROAD

0 0.38 0.75 1.5
KILOMETERS

TATHAM
ENGINEERING

9TH AVENUE EAST, OWEN SOUND
HYDROGEOLOGICAL ASSESSMENT
SITE LOCATION PLAN

DWG. No.
FIG-1

SCALE: 1:24,000
DRAWN: CW
DATE: MAY. 2023
JOB NO. 121387

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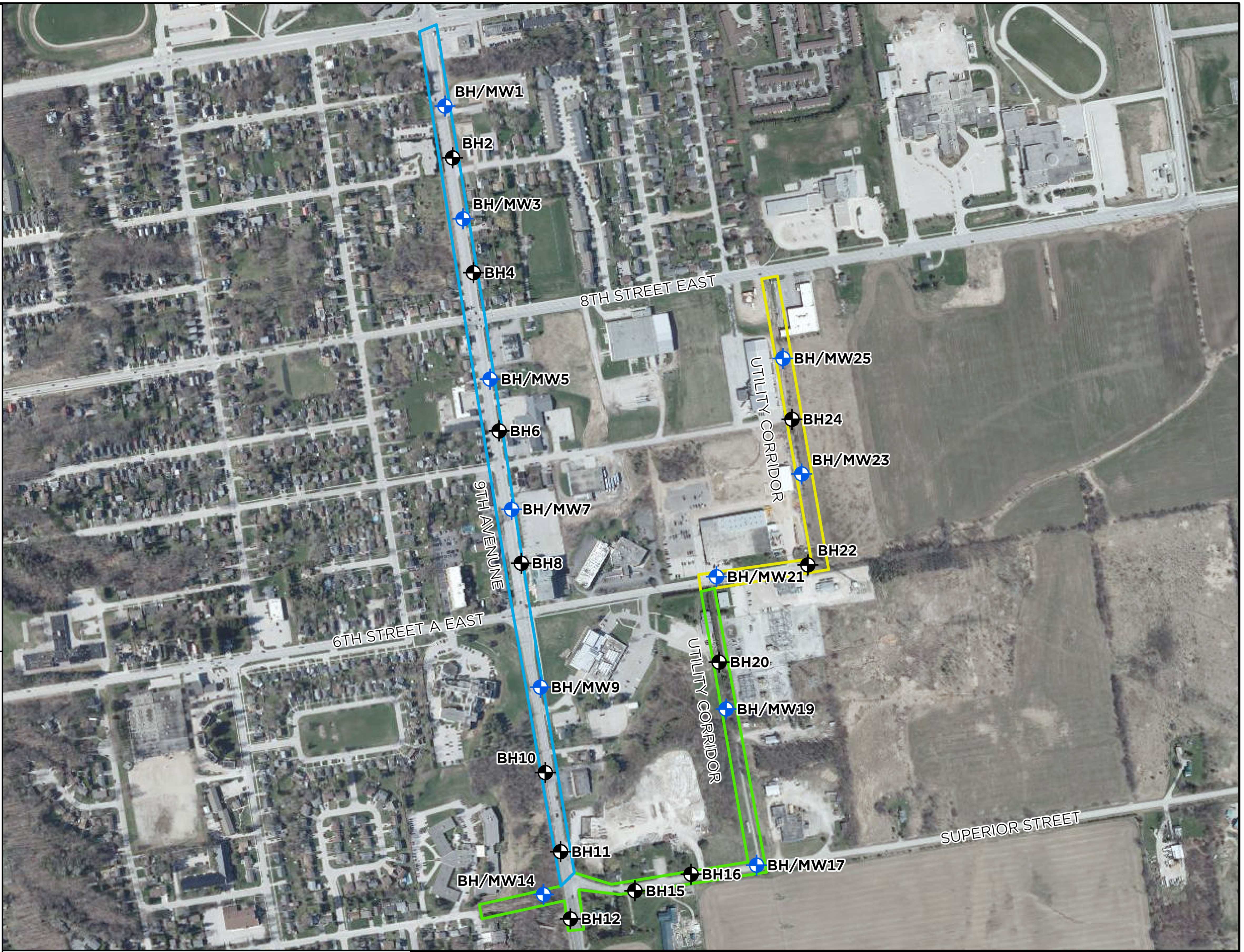

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NOTES:

1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N
2. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE – ONTARIO.

LEGEND

⊕ MONITORING WELL, 2023

⊕ BOREHOLE, 2023

DEWATERING ZONES

🟨 PHASE 1 - 6TH STREET & UTILITY CORRIDOR

🟩 PHASE 2 - UTILITY CORRIDOR & SUPERIOR STREET

🟦 PHASE 3 - 9TH AVENUE

0 50 100 200 300 400 500
METERS

TATHAM
ENGINEERING

9^TH^ AVENUE EAST, OWEN SOUND
HYDROGEOLOGICAL ASSESSMENT
BOREHOLE/MONITORING WELL
LOCATION PLAN

DWG. No.
FIG-2

SCALE: 1:8,000 | DRAWN: CW | DATE: MAY. 2023 | JOB NO. 121387

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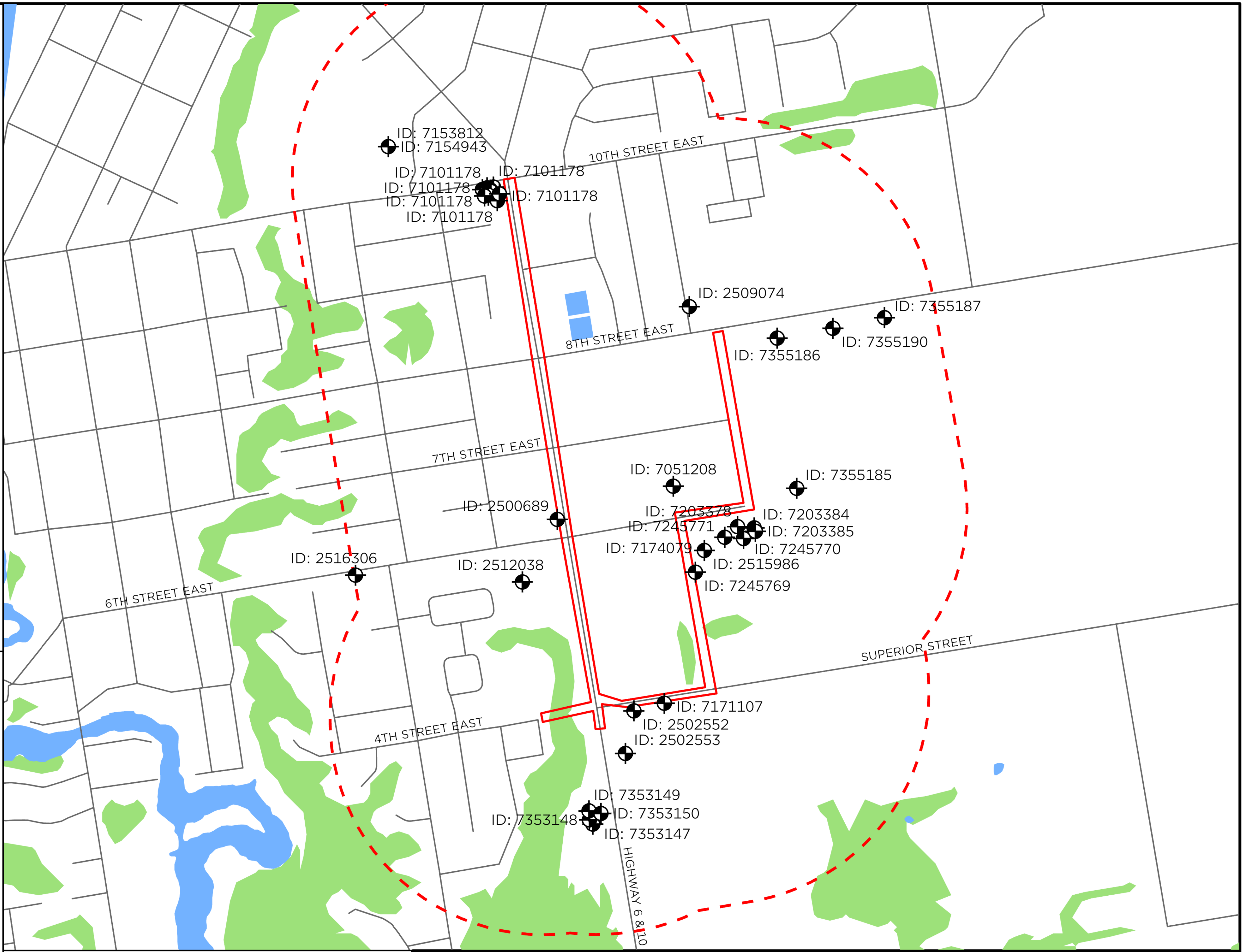
N

NOTES:

1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N
2. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE – ONTARIO.

LEGEND

- 🟥 SITE
- ▭ BUFFER AREA (500m)
- 🟩 WOODED AREA
- 🟦 WATERBODY
- — WATERCOURSE
- — ROAD
- ⌖ MECP WATER WELL



0 0.13 0.25 0.5
KILOMETERS

TATHAM
ENGINEERING

9TH AVENUE EAST, OWEN SOUND HYDROGEOLOGICAL ASSESSMENT MECP WELLS

DWG. No.

FIG-3

SCALE: 1:9,356	DRAWN: CW	DATE: MAY. 2023	JOB NO. 121387

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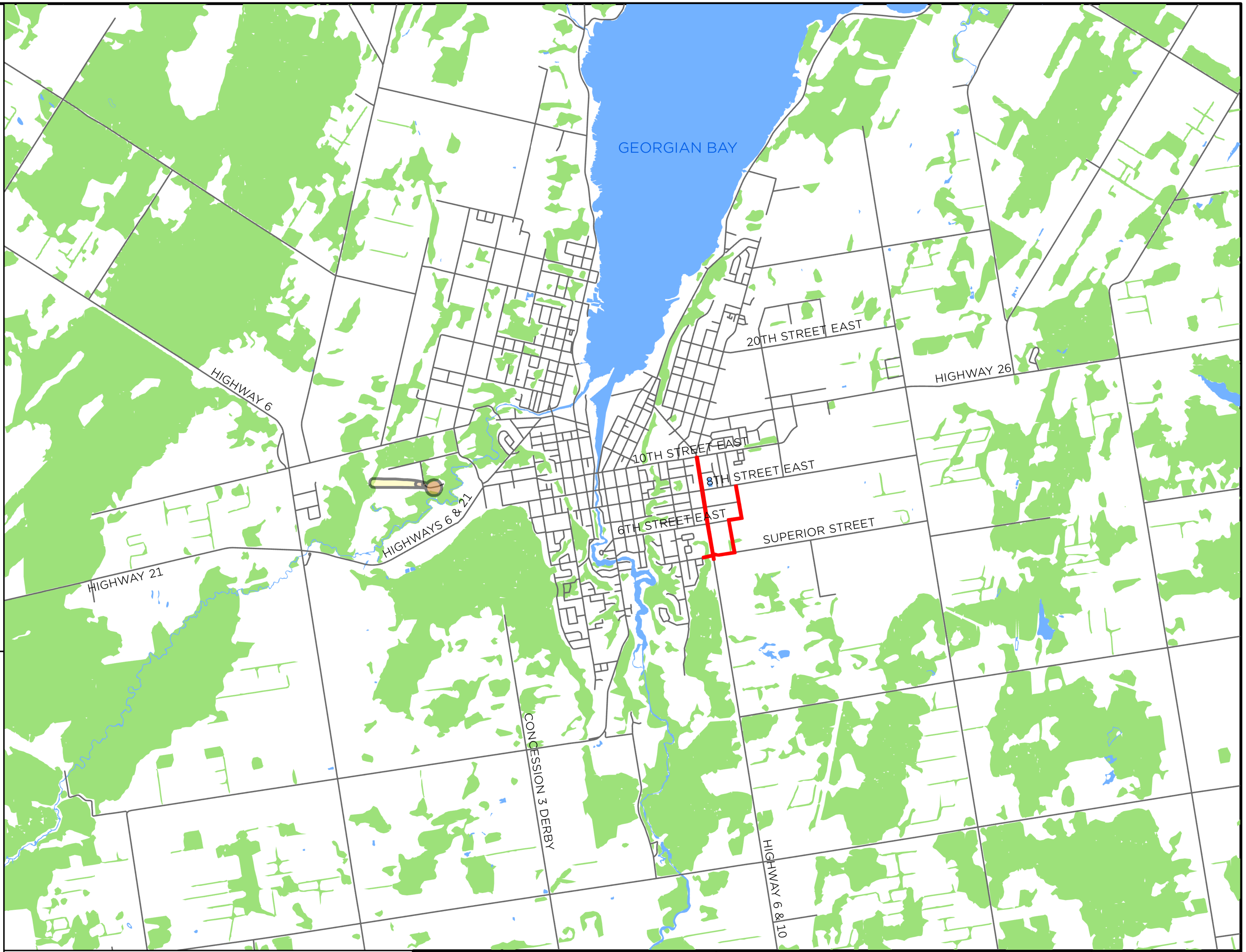

NOTES:

1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N
2. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE – ONTARIO.
3. CONTAINS INFORMATION MADE AVAILABLE UNDER LAKE SIMCOE REGION CONSERVATION AUTHORITY OPEN DATA LICENSE V1.0.
4. SITE IS NOT IN A WELLHEAD PROTECTION AREA

LEGEND

- 🟥 SITE
- 🟩 WOODED AREA
- 🟦 WATERBODY
- — WATERCOURSE
- — ROAD

WELLHEAD PROTECTION AREA

- ▨ A
- ▨ B
- ▨ C
- ▨ C1
- ▨ D
- ▨ F

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9TH AVENUE EAST, OWEN SOUND
HYDROGEOLOGICAL ASSESSMENT
WELLHEAD PROTECTION AREA

DWG. No.
FIG-4

SCALE: 1:50,000	DRAWN: CW	DATE: MAY. 2023	JOB NO. 121387

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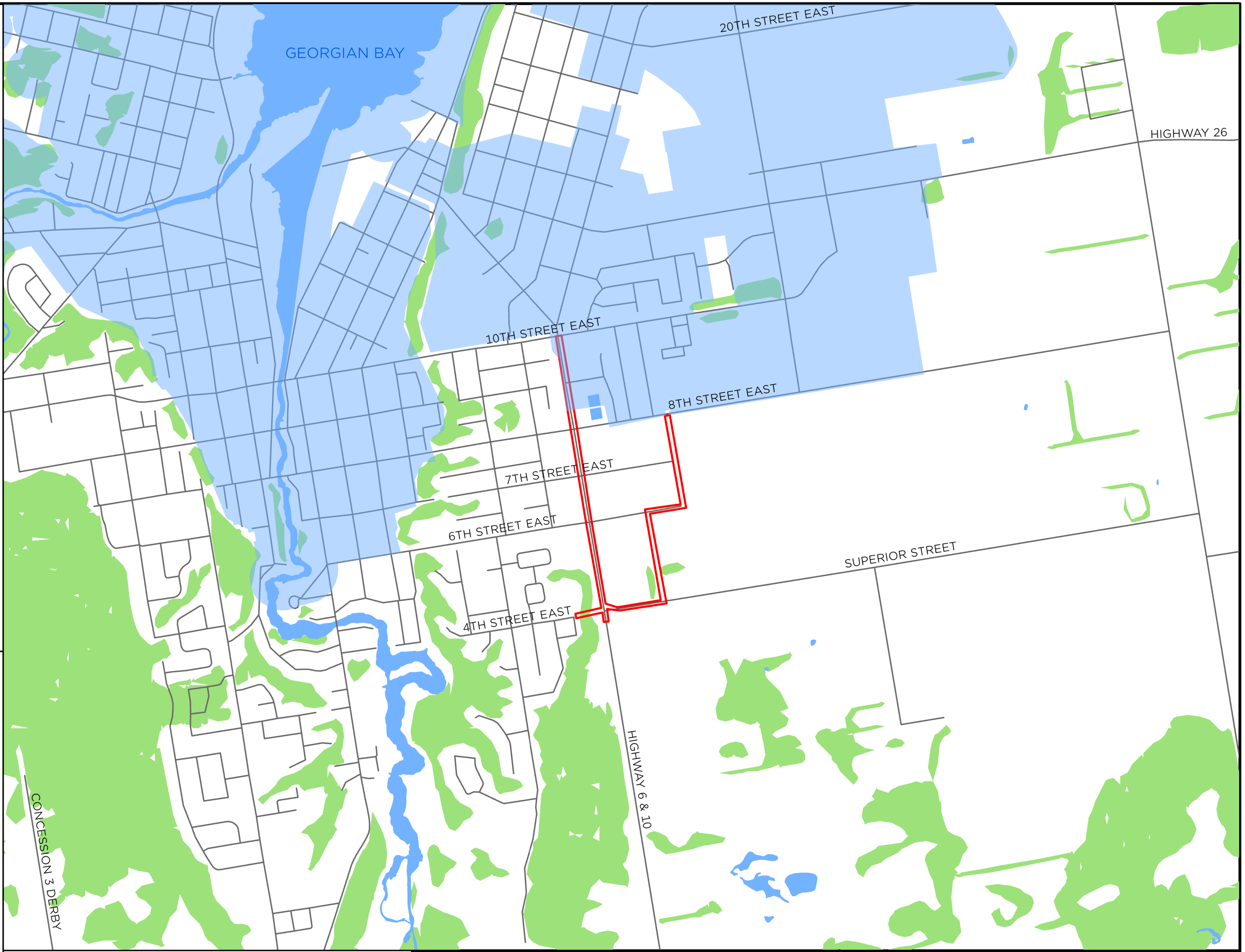
N

NOTES:
1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N
2.CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE – ONTARIO
3. CONTAINS INFORMATION MADE AVAILABLE UNDER LAKE SIMCOE REGION CONSERVATION AUTHORITY OPEN DATA LICENSE V1.0.
4. SITE IS WITHIN A INTAKE PROTECTION ZONE.

LEGEND

INTAKE PROTECTION ZONES (LSRCA 2022)
🟦 1
▭ 2
🟨 3
🟥 SITE
🟩 WOODED AREA
🟦 WATERBODY
― WATERCOURSE
― ROAD
▭ INTAKE PROTECTION ZONE 2



0 0.25 0.5 1
KILOMETERS

TATHAM
ENGINEERING

9TH AVENUE EAST, OWEN SOUND
HYDROGEOLOGICAL ASSESSMENT
INTAKE PROTECTION ZONE

DWG. No.
FIG-5

SCALE: 1:18,000	DRAWN: CW	DATE: MAY. 2023	JOB NO. 121387

O:\Collingwood\2021 Projects\121387 - 9th Avenue East Reconstruction, Owen Sound\GIS\121387 - 9th Avenue East, HydroG Figures.aprx

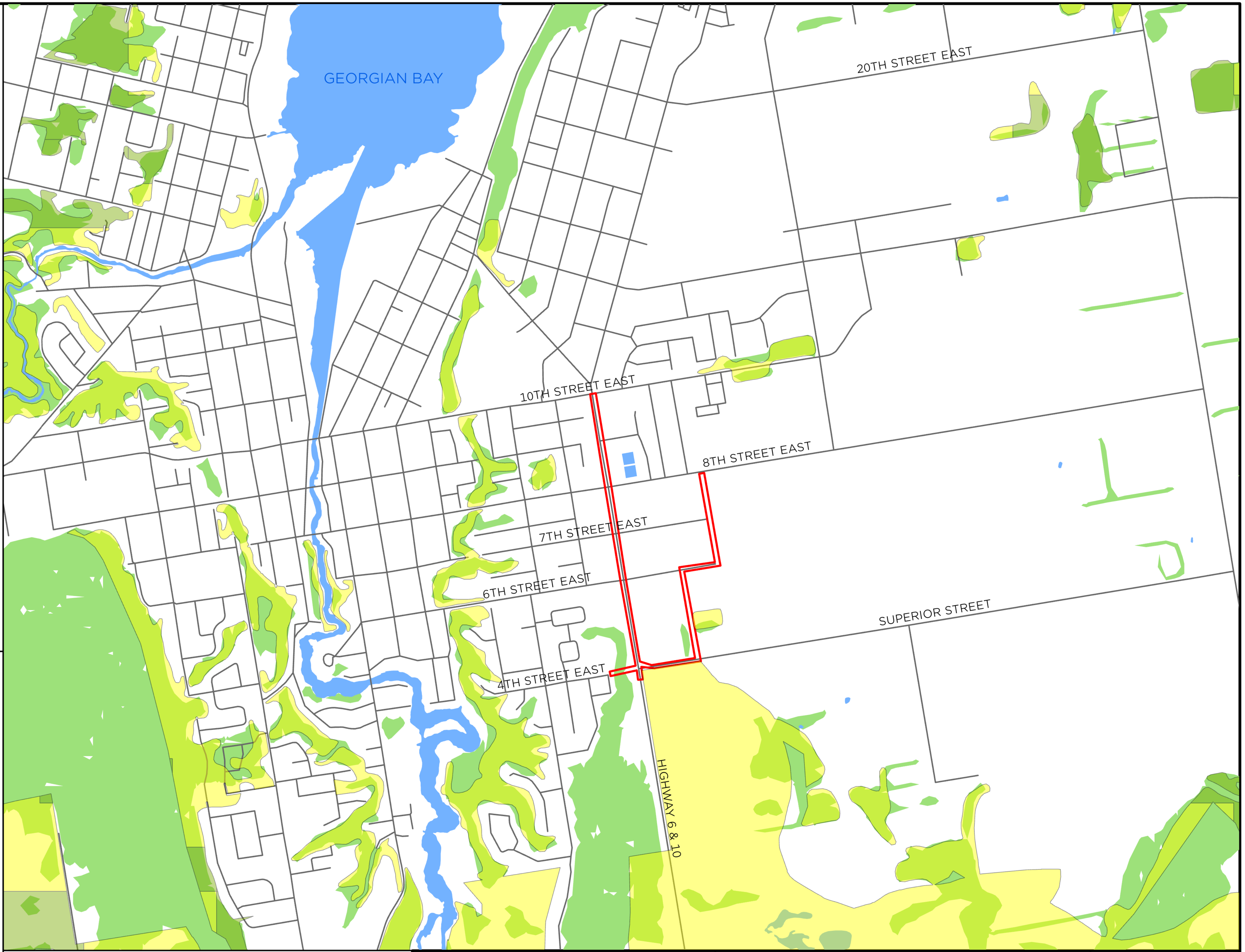
N

NOTES:
1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N
2.CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE – ONTARIO
3. CONTAINS INFORMATION MADE AVAILABLE UNDER LAKE SIMCOE REGION CONSERVATION AUTHORITY OPEN DATA LICENSE V1.0.
4. SITE IS WITHIN A SIGNIFICANT GROUNDWATER RECHARGE AREA

LEGEND

□ SITE
🟩 WOODED AREA
🟦 WATERBODY
— WATERCOURSE
— ROAD

SIGNIFICANT GROUNDWATER RECHARGE AREA
🟧 N/A
🟩 0
🟩 2
🟩 4
🟨 6



0 0.28 0.55 1.1
KILOMETERS

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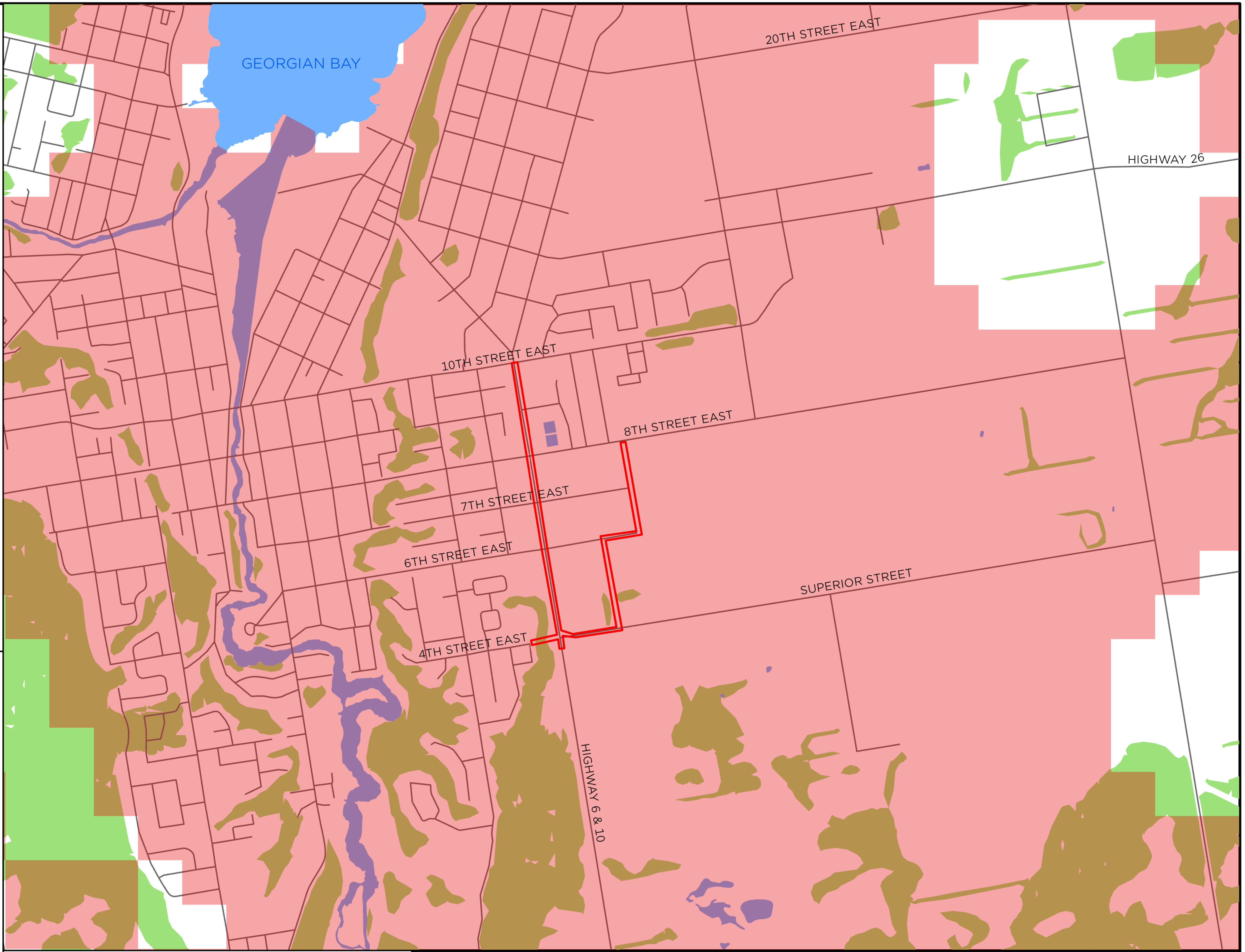
ENGINEERING

9TH AVENUE EAST, OWEN SOUND
HYDROGEOLOGICAL ASSESSMENT
SIGNIFICANT GROUNDWATER
RECHARGE AREA

DWG. No.
FIG-6

SCALE: 1:18,000
DRAWN: CW
DATE: MAY. 2023
JOB NO. 121387

O:\Collingwood\2021 Projects\121387 - 9th Avenue East Reconstruction, Owen Sound\GIS\121387 - 9th Avenue East, HydroG Figures.aprx



NOTES:

1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N
2. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE – ONTARIO
3. CONTAINS INFORMATION MADE AVAILABLE UNDER LAKE SIMCOE REGION CONSERVATION AUTHORITY OPEN DATA LICENSE V1.0.
4. SITE IS WITHIN A HIGHLY VULNERABLE AQUIFER.

LEGEND

□ SITE
🟩 WOODED AREA
🟦 WATERBODY
— WATERCOURSE
— ROAD
🟥 HIGHLY VULNERABLE AQUIFERS

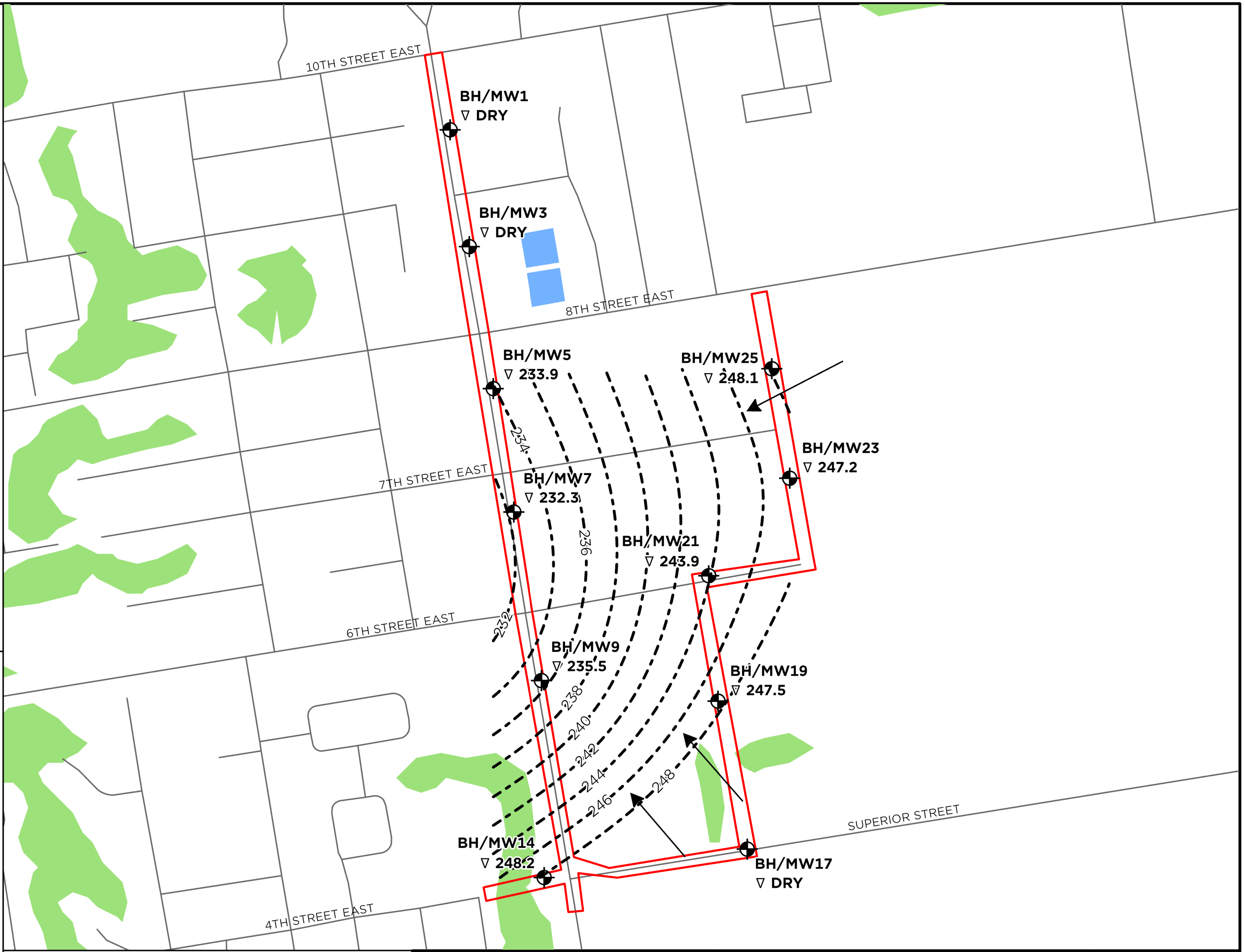
TATHAM
ENGINEERING

9TH AVENUE EAST, OWEN SOUND
HYDROGEOLOGICAL ASSESSMENT
HIGHLY VULNERABLE AQUIFER

DWG. No.
FIG-7

SCALE: 1:18,000
DRAWN: CW
DATE: MAY. 2023
JOB NO. 121387

O:\Collingwood\2021 Projects\121387 - 9th Avenue East Reconstruction, Owen Sound\GIS\121387 - 9th Avenue East, HydroG Figures.aprx



N

NOTES:
1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N
2.CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE – ONTARIO.

LEGEND

▭ SITE

⌖ MONITORING WELL, 2023

- - - GROUNDWATER CONTOURS - FEB, 2023

🟩 WOODED AREA

🟦 WATERBODY

— WATERCOURSE

— ROAD

0 100 200 400 METERS

TATHAM
ENGINEERING

9TH AVENUE EAST, OWEN SOUND
HYDROGEOLOGICAL ASSESSMENT
GROUNDWATER CONTOUR

DWG. No.
FIG-8

SCALE: 1:6,000 | DRAWN: CW | DATE: MAY. 2023 | JOB NO. 121387

O:\Collingwood\2021 Projects\121387 - 9th Avenue East Reconstruction, Owen Sound\GIS\121387 - 9th Avenue East, HydroG Figures.aprx

Appendix A:
MECP Water Well Records

Township Con Lot	UTM	Date Centr	Casing Dia	Water	Pump Test	Well Use	Screen Depth	Well	Formation
ARTEMESIA TOWNSHIP	17 505660 4935080 W	2004/02 6607	19.6	FR 0013			0016 10	2515913 (Z07616) A007477	BRWN FILL 0003 BRWN SILT STNS CLAY 0013 GREY SHLE LMSN SILT 0026
OWEN SOUND CITY	17 505722 4934176 W	1992/05 5507	6	FR 0042 FR 0112	20/123/4/1:	DO		2512038 (106144)	RED SHLE 0027 BLUE SHLE 0042 RED SHLE 0123
OWEN SOUND CITY	17 506129 4934199 W	2015/07 7148						7245769 (Z209684) A	
OWEN SOUND CITY	17 505660 4935080 W	2006/09 6607	2	FR 0005		NU	0005 12	2516956 (Z54927) A046463	RED SAND SLTY 0005 GREY SHLE LMSN 0017
OWEN SOUND CITY	17 506242 4934278 W	2015/07 7148						7245770 (Z209683) A	
OWEN SOUND CITY	17 506198 4934281 W	2015/07 7148						7245771 (Z209682) A	
OWEN SOUND CITY	17 505330 4934192 W	2005/01 6607	1.97	FR 0010			0008 5	2516306 (Z21657) A019250	BRWN SILT SAND 0010 BRWN SILT CLAY 0011 BRWN CLAY SILT 0013
OWEN SOUND CITY	17 506150 4934250 W	2004/04 7201	2			NU	0003 10	2515986 (Z09757) A008823	GREY CSND DRY 0002 BLUE UNKN 0006 BRWN SAND SILT WBRG 0013
OWEN SOUND CITY	17 506150 4934250 W	7303				MO		7174079 (Z132409) A	
OWEN SOUND CITY	17 505240 4933801 W	2010/10 6809	0.5 0.5 0.5			TH	0070 1 0022 1 0052 1	7173660 (Z121108) A100816	BLCK LOAM 0001 BRWN SAND 0020 BRWN CLAY 0040 GREY CLAY 0060 RED SHLE 0070
OWEN SOUND CITY	17 506228 4934306 W	2012/04 7201		3		MO		7203378 (Z141623) A125032 A	BRWN SAND GRVL 0005 GREY SILT WBRG SAND 0012

Township Con Lot	UTM	Date Centr	Casing Dia	Water	Pump Test	Well Use	Screen Depth	Well	Formation
OWEN SOUND CITY	17 506267 4934303 W	7201	1.5			MO	0002 10	7203384 (Z141592) A125032	BRWN SAND CLAY FILL 0001 BRWN CLAY SILT TILL 0009 GREY CLAY SILT TILL 0015
OWEN SOUND CITY	17 506270 4934295 W	2012/01 7201						7203385 (M08327) A125035 P	
OWEN SOUND CITY	17 505306 4934077 W	2010/03 7215				TH	0026 10	7144746 (Z112595) A097586	BRWN FILL WBRG ---- 0006 BRWN CLAY SLTY ---- 0020 GREY CLAY SLTY WBRG 0036
OWEN SOUND CITY	17 505307 4934075 W	2010/03 7215						7144745 (Z112534) A	
OWEN SOUND CITY	17 505299 4934031 W	2010/05 7215				TH	0017 10	7146075 (Z112571) A095340	BRWN FILL WBRG 0002 BRWN CLAY WBRG 0020 BRWN SAND WBRG 0026 GREY CLAY WBRG 0027
OWEN SOUND CITY	17 505660 4935080 W	2006/07 6607		FR 0015				2516864 (Z49099) A007977 A	
OWEN SOUND CITY	17 506367 4934396 W	2018/10 7644	2			TH MO	0015 10	7355185 (Z301298) A260228	
OWEN SOUND CITY	17 505907 4933632 W	2019/10 7190	6 1.25			MO	0033 10	7353150 (4SLGP6LK) A281484	BRWN CLAY SAND 0010 GREY LMSN 0043
OWEN SOUND CITY	17 505879 4933638 W	2019/10 7190	6 1.25			MO	0028 10	7353149 (NXNA9Q A9) A281483	BRWN CLAY SAND 0010 GREY LMSN 0038
OWEN SOUND CITY	17 506321 4934749 W	2018/10 7644	2			TH MO	0005 10	7355186 (Z301285) A249645	

Township Con Lot	UTM	Date Centr	Casing Dia	Water	Pump Test	Well Use	Screen Depth	Well	Formation
OWEN SOUND CITY	17 506573 4934797 W	2018/10 7644	2			TH MO	0005 10	7355187 (Z301284) A249744	
OWEN SOUND CITY	17 506452 4934772 W	2018/10 7644	2			TH MO	0010 10	7355190 (Z301286) A249768	
OWEN SOUND CITY	17 505888 4933607 W	2019/10 7190	6 1.25			MO	0026 10	7353147 (IZMSOOO6) A281481	BRWN CLAY SAND 0008 GREY LMSN 0036
OWEN SOUND CITY	17 505880 4933617 W	2019/10 7190	6 1.25			MO	0028 10	7353148 (O99VQYA2) A281482	BRWN CLAY SAND 0010 GREY LMSN 0038
OWEN SOUND CITY	17 505805 4934323 W	1947/06 5514	4 4	FR 0040 FR 0070	40//1/1:0	DO CO		2500689 ()	LOAM CLAY 0008 ROCK 0058 SHLE 0142
OWEN SOUND CITY	17 506077 4934401 W	2007/09 7241	1.5			MO		7051208 (Z63648) A063679	BRWN LOAM LOOS 0001 BRWN CLAY SILT DNSE 0012 GREY CLAY SILT WBRG 0023
OWEN SOUND CITY	17 505165 4933870 W	1952/06 1319	4	FR 0060 UK 0091	52/55/5/1:0	DO		2501937 ()	LOAM 0006 ROCK 0046 BLUE CLAY 0061 RED CLAY 0091
SYDENHAM TOWNSHIP	17 506056 4933891 W	7303						7171107 (Z132388) A	
SYDENHAM TOWNSHIP RANGE 02 003	17 506115 4934823 W	1987/08 5507	5	FR 0158	24/168/5/2:0	DO		2509074 (14857)	HPAN STNS 0058 LMSN 0158 BLUE SHLE 0163 RED SHLE 0168
SYDENHAM TOWNSHIP RANGE A 004	17 505965 4933773 W	1957/02 5502	6 6	FR 0125 FR 0180	71/170/5/3:0	CO		2502553 ()	CLAY 0005 LMSN 0070 BLUE SHLE 0080 RED SHLE 0150 ROCK 0180 BLUE SHLE 0206
SYDENHAM TOWNSHIP RANGE A 004	17 505985 4933873 W	1954/10 5506	4 4	FR 0075 FR 0080	40/115/10/1:0	DO		2502552 ()	LOAM 0010 LMSN 0085 BLUE SHLE 0115

UTM: UTM in Zone, Easting, Northing and Datum is NAD83; L: UTM estimated from Centroid of Lot; W: UTM not from Lot Centroid
DATE CNTR: Date Work Completed and Well Contractor Licence Number
CASING DIA: Casing diameter in inches
WATER: Unit of Depth in Feet. See Table 4 for meanign of code.
PUMP TEST: Static Water Level in Feet / Water Level After Pumping in Feet / Pump Test Rate in GPM / Pump Test Duration in Hr : Min
WELL USE: See Table 3 for Meaning of Code
SCREEN: Screen Depth and Length in feet
WELL: WEL (AUDIT #) Well Tag. A: Abandonment; P: Partial Data Entry Only
FORMATION: See Table 1 and 2 for Meaning of Code

Table 1: Core Material and Descriptive Terms

BLDR BOULDERS
BSLT BASALT
CGRD COARSE-GRAINED
CGVL COARSE GRAVEL
CHRT CHERT
CLAY CLAY
CLN CLEAN
CLYY CLAYEY
CMTD CEMENTED
CONG CONGLOMERATE
CRYS CRYSTALLINE
CSND COARSE SAND
DKCL DARK-COLOURED
DLMT DOLOMITE
DNSE DENSE
DRTY DIRTY
DRY DRY
FCRD FRACTURED
FGRD FINE-GRAINED
FGVL FINE GRAVEL
FILL FILL
FLDS FELDSPAR
FLNT FLINT
FOSS FOSILIFEROUS
FSND FINE SAND
GNIS GNEISS
GRNT GRANITE
GRSN GREENSTONE
GRVL GRAVEL
GRWK GREYWACKE
GVLY GRAVELLY
GYPS GYPSUM
HARD HARD
HPAN HARDPAN
IRFM IRON FORMATION
LIMY LIMY
LMSN LIMESTONE
LOAM TOPSOIL
LOOS LOOSE
LTCL LIGHT-COLOURED
LYRD LAYERED
MARL MARL
MGRD MEDIUM-GRAINED
MGVL MEDIUM GRAVEL
MRBL MARBLE
MSND MEDIUM SAND
MUCK MUCK
OBDN OVERBURDEN
PCKD PACKED
PEAT PEAT
PGVL PEA GRAVEL
PORS POROUS
PRDG PREVIOUSLY DUG
PRDR PREV. DRILLED
QRTZ QUARTZITE
QSND QUICKSAND
QTZ QUARTZ
ROCK ROCK
SAND SAND
SHLE SHALE
SHLY SHALY
SHRP SHARP
SHST SCHIST
SILT SILT
SLTE SLATE
SLTY SILTY
SNDS SANDSTONE
SNDY SANDYOAPSTONE
SOFT SOFT
SPST SOAPSTONE
STKY STICKY
STNS STONES
STNY STONEY
THIK THICK
THIN THIN
TILL TILL
UNKN UNKNOWN TYPE
VERY VERY
WBRG WATER-BEARING
WDFR WOOD FRAGMENTS
WTHD WEATHERED

Table 2: Core Color

WHIT WHITE
GREY GREY
BLUE BLUE
GREN GREEN
YLLW YELLOW
BRWN BROWN
RED RED
BLCK BLACK
BLGY BLUE-GREY

Table 3: Well Use

DO Domestic
ST Livestock
IR Irrigation
IN Industrial
CO Commercial
MN Municipal
PS Public
AC Cooling And A/C
NU Not Used
OT Other
TH Test Hole
DE Dewatering
MO Monitoring
MT Monitoring TestHole

Table 4:Water Detail

FR Fresh
SA Salty
SU Sulphur
MN Mineral
UK Unknown
GS Gas
IR Iron

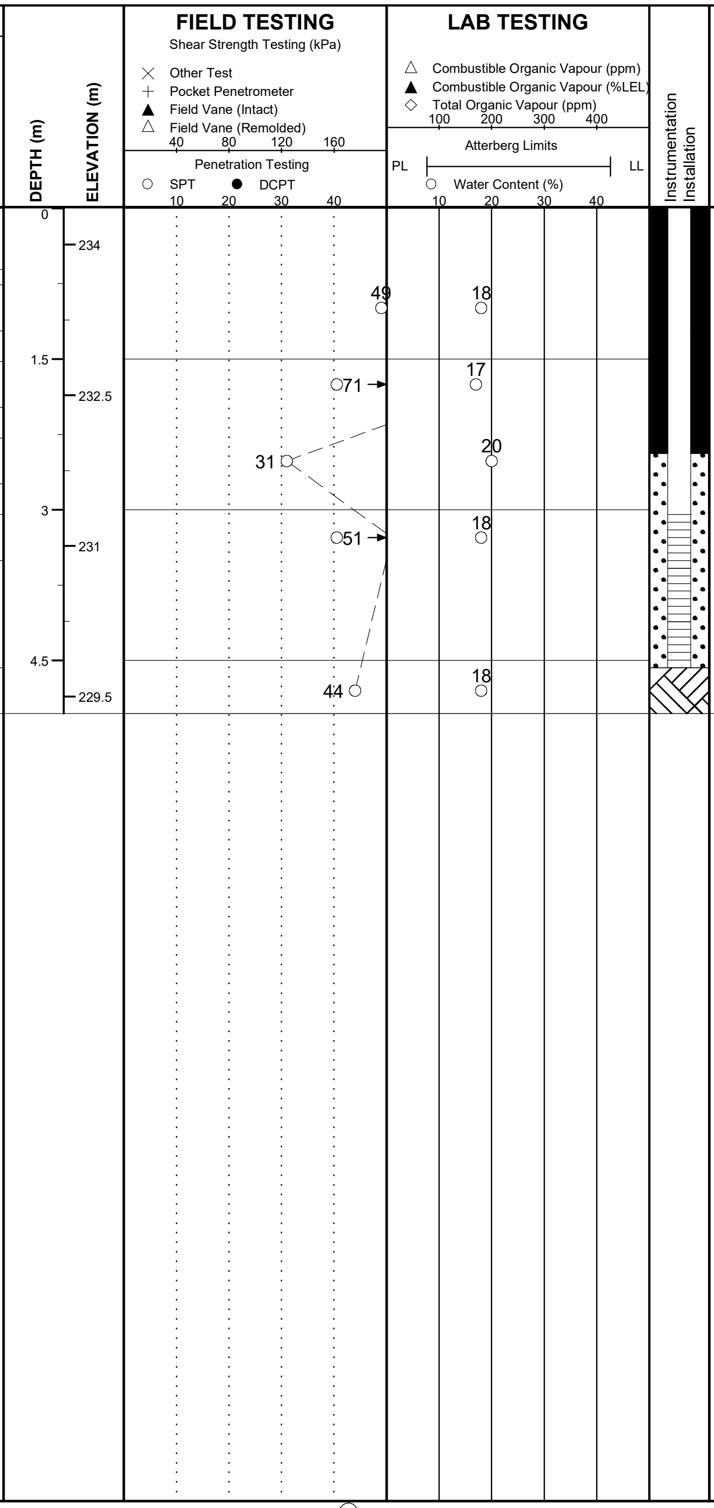
Appendix B: Borehole Logs

RECORD OF BOREHOLE No. 1

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing: **4935009**
Easting: **505716**
Date Started: **Feb 1/23**
Date Completed: **Feb 3/23**

LITHOLOGY PROFILE		SOIL SAMPLING				LAB TESTING	COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Depth (m)	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	Water Content (%)	GR	SA	SI	CL
0.0 234.4										
	ASPHALT: 220 mm									
0.3 234.0	GRANULAR FILL: 120 mm	AS	1							
	FILL: Silty sand, trace gravel, dense, brown, moist	SS	2	100	49	18				
1.5 232.8	SANDY SILT GLACIAL TILL: Some clay, trace to some gravel, trace shale fragments, very dense, greyish brown, moist	SS	3	75	71	17				
	- - - Dense, brownish red - - -	SS	4	100	31	20	10	32	40	18
	- - - Very Dense - - -	SS	5	100	51	18				
	- - - Dense, grey - - -	SS	6	100	44	18				
5.0 229.3	Borehole Terminated at 5.0 m									



GEI CONSULTANTS
647 Welham Road, Unit 14
Barrie, Ontario L4N 0B7
T : (705) 719-7994
www.geiconsultants.com

Groundwater depth encountered on completion of drilling: Dry
Groundwater depth observed on: Feb 13/23 at depth of: Dry
Cave depth after auger removal: Open
Groundwater Elevation:

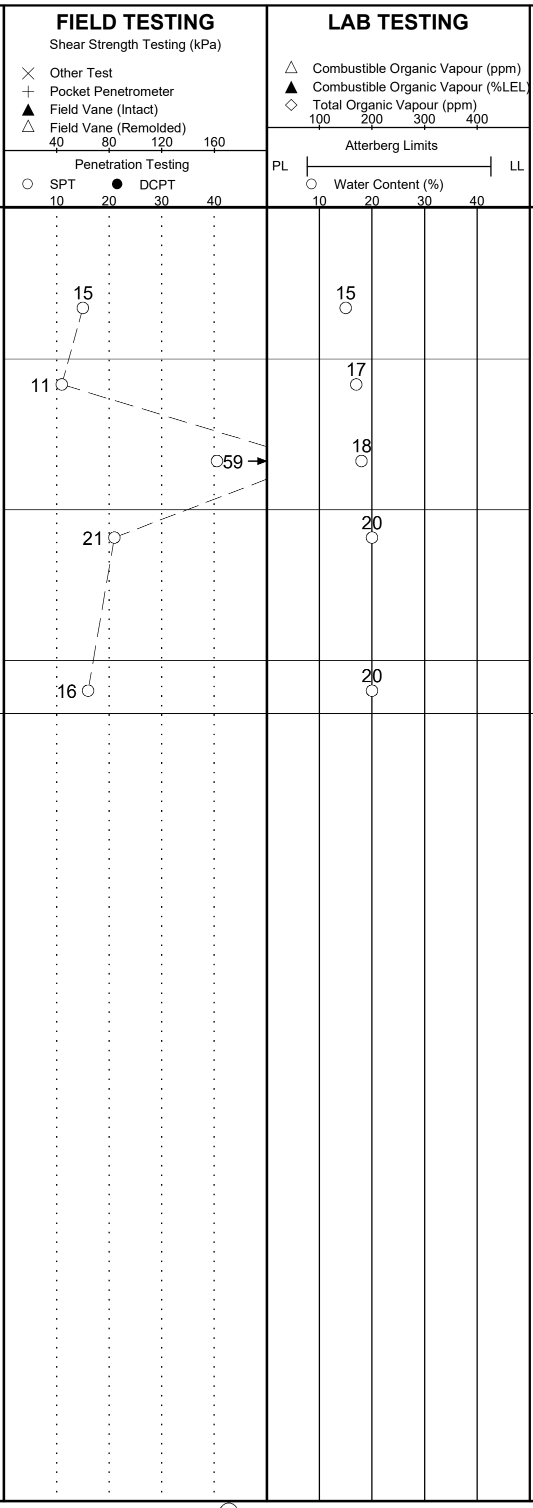
Scale: **1 :75**

RECORD OF BOREHOLE No. 2

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing: **4934935**
Easting: **505727**
Date Started: **Feb 1/23**
Date Completed: **Feb 3/23**

LITHOLOGY PROFILE		SOIL SAMPLING							COMMENTS & GRAIN SIZE DISTRIBUTION (%)
Depth / Elevation	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	Water Content (%)	GR / SA / SI / CL
0.0 / 237.3	ASPHALT: 220 mm GRANULAR FILL: 580 mm	AS	1			0	237		
0.8 / 236.6	SANDY SILT TILL: Trace to some clay, trace gravel, compact, brownish red, moist	SS	2	100	15			15	
		SS	3	100	11	1.5	235.5	17	
	- - - Shale fragments, very dense - - -	SS	4	100	59			18	First Water Strike SS4
	- - - Compact - - -	SS	5	100	21	3	234	20	
	- - - Brown to grey - - -	SS	6	100	16	4.5	232.5	20	
5.0 / 232.3	Borehole Terminated at 5.0 m								



Instrumentation Installation

GEI CONSULTANTS
647 Welham Road, Unit 14
Barrie, Ontario L4N 0B7
T : (705) 719-7994
www.geiconsultants.com

Groundwater depth encountered on completion of drilling: Dry
Groundwater depth observed on:
Cave depth after auger removal: Open
Groundwater Elevation:

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

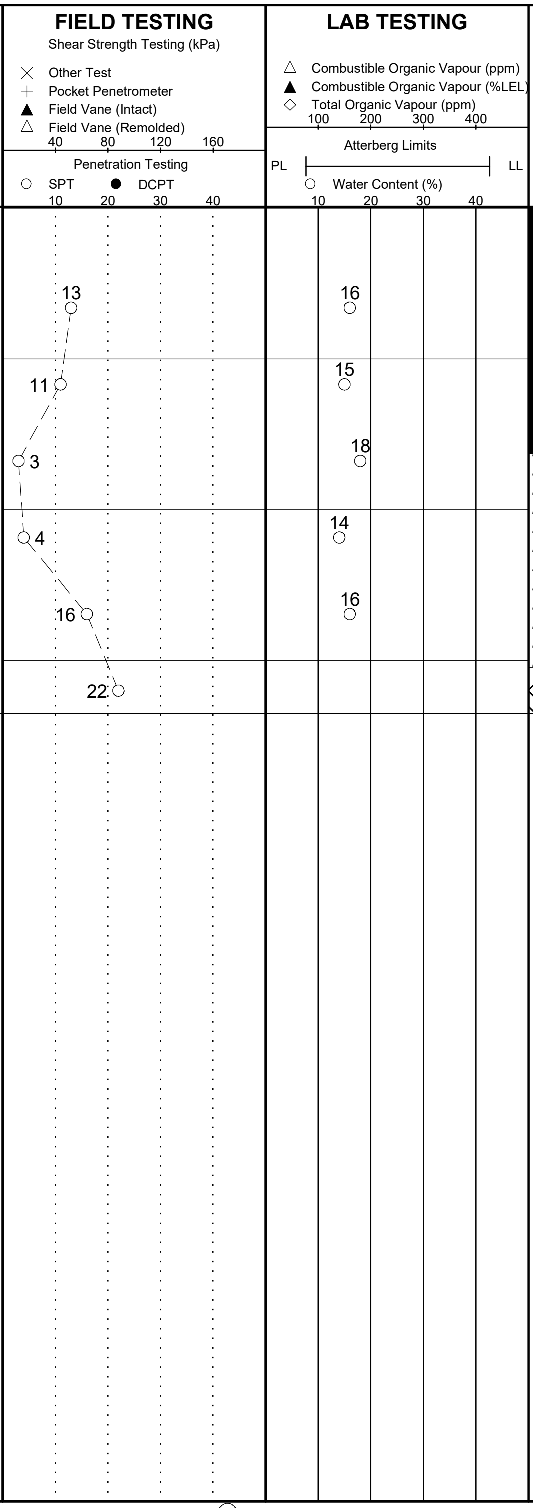
Scale: **1 :75**

RECORD OF BOREHOLE No. 3

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing: **4934850**
Easting: **505793**
Date Started: **Feb 1/23**
Date Completed: **Feb 3/23**

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Depth (m)	DESCRIPTION (Elevation 242.7 at 0.0)	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	SPT	Water Content (%)	Instrumentation Installation	GR	SA	SI	CL
0.0	ASPHALT: 260 mm GRANULAR FILL: 500 mm	AS	1			0								
0.8 (242.0)	FILL: Silty sand, trace gravel, compact, brown, moist	SS	2	75	13		241.5	13	16					
		SS	3	45	11	1.5		11	15					
	- - - Clayey silt, some sand, trace gravel, soft - - -	SS	4	10	3		240	3	18					
		SS	5	25	4	3		4	14					
3.8 (238.9)	SANDY SILT TILL: Some clay, trace gravel, compact, brownish red, moist	SS	6	75	16		238.5	16	16					
	- - - Grey - - -	SS	7	100	22	4.5		22						
5.0 (237.7)	Borehole Terminated at 5.0 m													



GEI CONSULTANTS
647 Welham Road, Unit 14
Barrie, Ontario L4N 0B7
T : (705) 719-7994
www.geiconsultants.com

Groundwater depth encountered on completion of drilling: Dry
Groundwater depth observed on: Feb 13/23 at depth of: Dry
Cave depth after auger removal: Open
Groundwater Elevation:

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

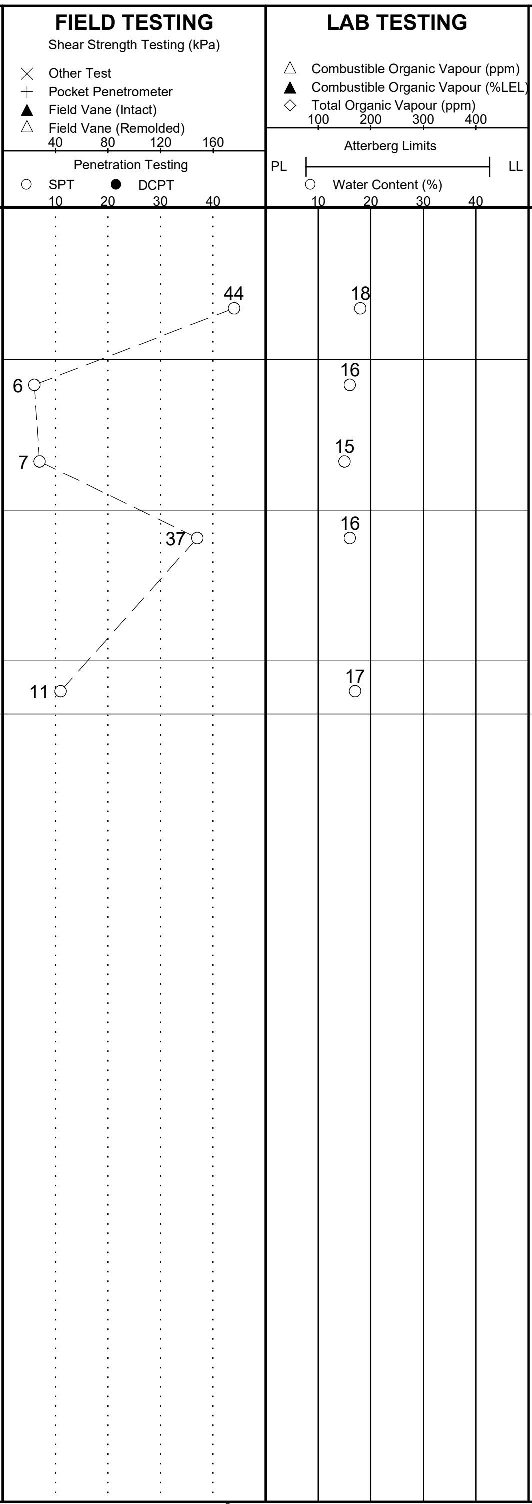
Scale: **1 :75**
Page: **1 of 1**

RECORD OF BOREHOLE No. 4

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing: **4934771**
Easting: **505757**
Date Started: **Feb 1/23**
Date Completed: **Feb 3/23**

LITHOLOGY PROFILE			SOIL SAMPLING						LAB TESTING	COMMENTS & GRAIN SIZE DISTRIBUTION (%)
Depth (m)	DESCRIPTION	Elevation (m)	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	Penetration Testing (SPT)		Water Content (%)	GR / SA / SI / CL
0.0		244.4								
0.2	ASPHALT: 150 mm	244.2	AS	1						
	GRANULAR FILL: 650 mm									
0.8	FILL: Silty sand, trace gravel, brownish red, dense, brown, moist	243.6	SS	2	35	44	44		18	
	--- Clayey silt, trace sand, trace gravel, brownish red, firm ---		SS	3	75	6	6		16	
			SS	4	35	7	7		15	
3.0	SANDY SILT TILL: Some clay, trace gravel, dense, brownish red, moist	241.3	SS	5	100	37	37		16	
	--- Compact ---		SS	6	75	11	11		17	
5.0	Borehole Terminated at 5.0 m	239.3								



GEI CONSULTANTS
647 Welham Road, Unit 14
Barrie, Ontario L4N 0B7
T : (705) 719-7994
www.geiconsultants.com

Groundwater depth encountered on completion of drilling: Dry
Cave depth after auger removal: Open
Groundwater depth observed on:
Groundwater Elevation:

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

Scale: **1 :75**
Page: **1 of 1**

RECORD OF BOREHOLE No. 5

GEI Consultants

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:
Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing: **4934619**
Easting: **505781**
Date Started: **Jan 31/23**
Date Completed: **Feb 3/23**

FIELD TESTING – Shear Strength Testing (kPa): × Other Test; + Pocket Penetrometer; ▲ Field Vane (Intact); △ Field Vane (Remolded); 40 80 120 160. Penetration Testing: ○ SPT ● DCPT; 10 20 30 40

LAB TESTING – △ Combustible Organic Vapour (ppm); ▲ Combustible Organic Vapour (%LEL); ◇ Total Organic Vapour (ppm); 100 200 300 400. Atterberg Limits: PL ├──┤ LL; ○ Water Content (%); 10 20 30 40

Depth (m) / Elevation (m)	LITHOLOGY PROFILE – DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	Penetration Testing (SPT)	Water Content (%)	GR	SA	SI	CL
0.0 / 237.1	ASPHALT: 300 mm GRANULAR FILL: 360 mm	AS	1								
0.6 / 236.4	SANDY SILT GLACIAL TILL: Trace to some clay, trace to some gravel, cobbles and boulders, compact, brown, moist	SS	2	100	16	16	15				
		SS	3	100	18	18	17				
2.3 / 234.8	SILTY SAND GLACIAL TILL: Some gravel, some clay, cobbles and boulders, dense, brown, moist	SS	4	100	30	30	17				
		SS	5	100	32	32	14	17	38	33	12
		SS	6	100	33	33	14				
5.0 / 232.0	Borehole Terminated at 5.0 m										

Depth scale: 0 – 237; 1.5 – 235.5; 3 – 234; 4.5 – 232.5

Instrumentation Installation

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

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Groundwater depth encountered on completion of drilling: Dry
Cave depth after auger removal: Open
Groundwater depth observed on: Feb 13/23 at depth of: 3.2 m.
Groundwater Elevation: 233.9 m

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

Scale: **1 :75**
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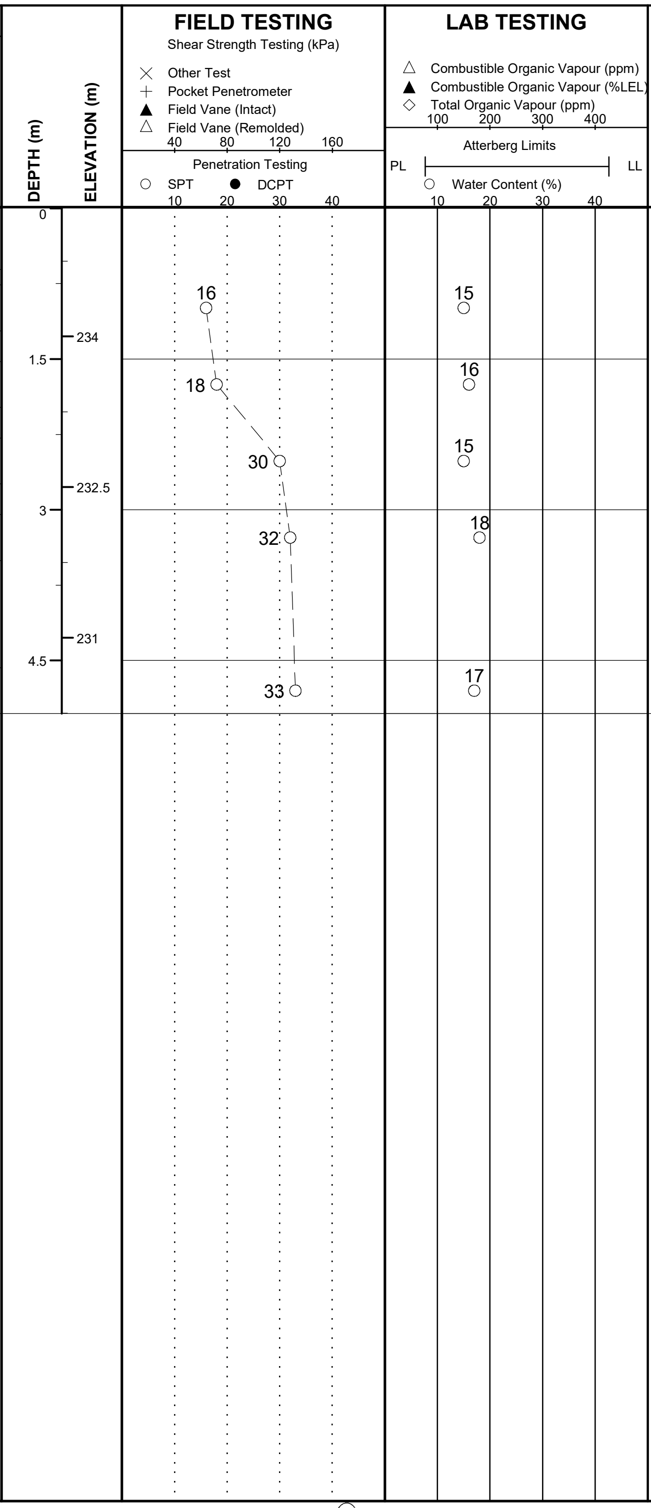
RECORD OF BOREHOLE No. 6

GEI Consultants

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:
Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing: **4934545**
Easting: **505794**
Date Started: **Jan 31/23**
Date Completed: **Feb 3/23**

LITHOLOGY PROFILE		SOIL SAMPLING			
Depth / Elevation	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value
0.0 / 235.3	ASPHALT: 130 mm				
0.4 / 234.8	GRANULAR FILL: 290 mm	AS	1		
	FILL: Silty sand, some clay, trace gravel, compact, brown, moist	SS	2	100	16
1.5 / 233.8	SANDY SILT GLACIAL TILL: Trace to some clay, trace gravel, cobbles and boulders, compact, brown, moist	SS	3	100	18
	- - - Dense - - -	SS	4	100	30
		SS	5	100	32
		SS	6	100	33
5.0 / 230.2	Borehole Terminated at 5.0 m				



Instrumentation Installation

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL

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Groundwater depth encountered on completion of drilling: Dry
Cave depth after auger removal: Open
Groundwater depth observed on:
Groundwater Elevation:

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

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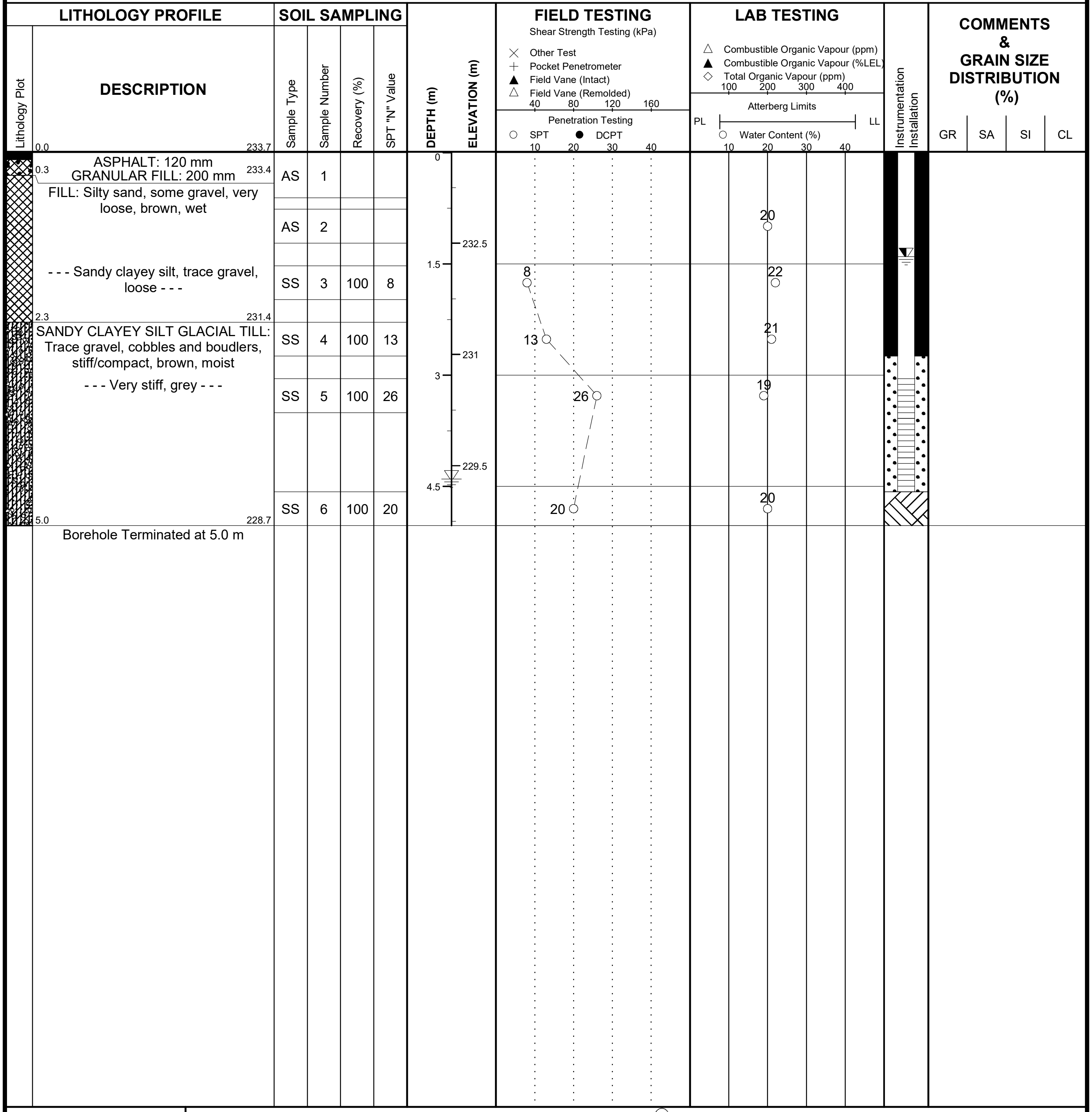
RECORD OF BOREHOLE No. 7

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing: **4934433**
Easting: **505812**
Date Started: **Jan 31/23**
Date Completed: **Feb 3/23**



Depth (m)	DESCRIPTION	Elevation (m)	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	Water Content (%)
0.0		233.7					
0.3	ASPHALT: 120 mm GRANULAR FILL: 200 mm	233.4	AS	1			
	FILL: Silty sand, some gravel, very loose, brown, wet		AS	2			20
	- - - Sandy clayey silt, trace gravel, loose - - -		SS	3	100	8	22
2.3	SANDY CLAYEY SILT GLACIAL TILL: Trace gravel, cobbles and boudlers, stiff/compact, brown, moist	231.4	SS	4	100	13	21
	- - - Very stiff, grey - - -		SS	5	100	26	19
5.0		228.7	SS	6	100	20	20
	Borehole Terminated at 5.0 m						

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▽ Groundwater depth encountered on completion of drilling: 4.4 m.

Cave depth after auger removal: Open

▼ Groundwater depth observed on: Feb 13/23 at depth of: 1.4 m.

Groundwater Elevation: 232.3 m

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

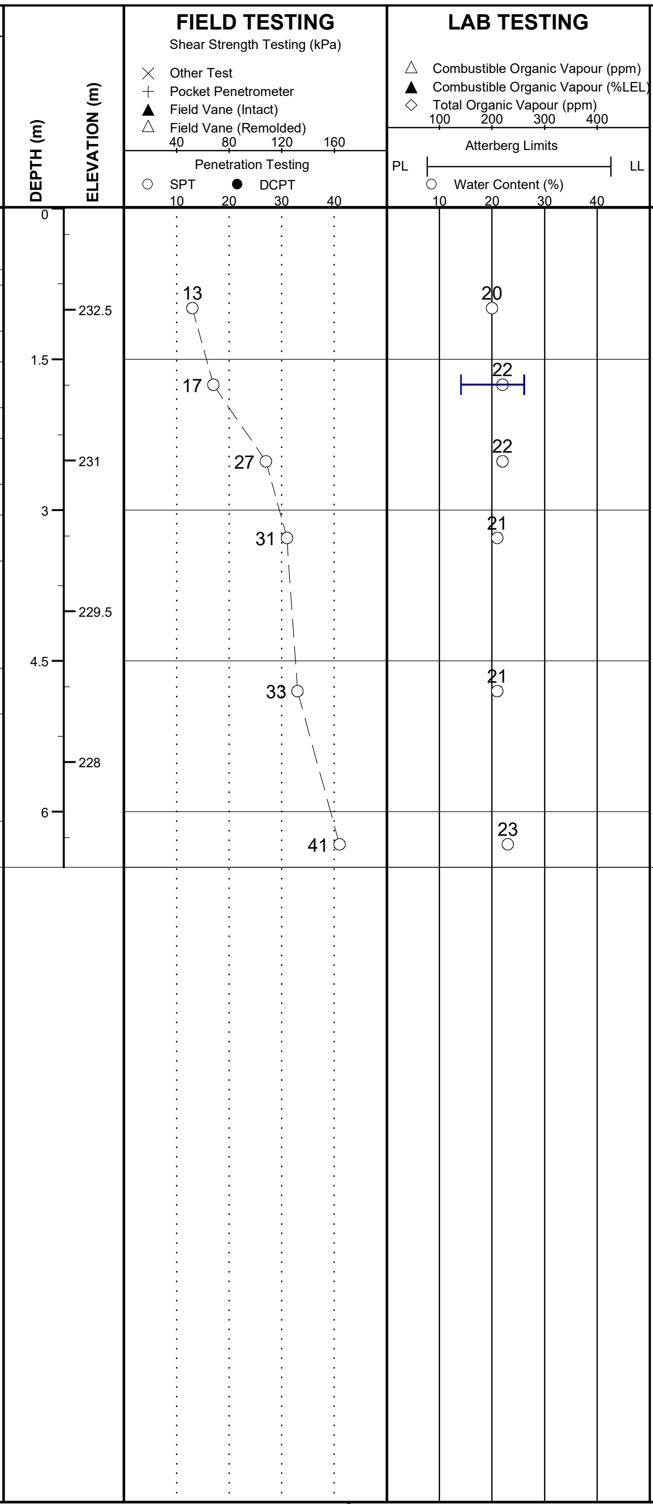
Scale: **1 :75**

RECORD OF BOREHOLE No. 8

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing: **4934356**
Easting: **505826**
Date Started: **Jan 31/23**
Date Completed: **Feb 3/23**

Depth (m) / Elevation (m)	LITHOLOGY PROFILE – DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	Water Content (%)	GR	SA	SI	CL
0.0 / 233.5	ASPHALT: 150 mm GRANULAR FILL: 450 mm	AS	1							
0.6 / 232.9	CLAYEY SILT GLACIAL TILL: Trace to Some sand, trace gravel, cobbles and boulders, stiff, brown, wet	SS	2	100	13	20				
	- - - Very stiff - - -	SS	3	100	17	22	6	12	47	35
		SS	4	100	27	22				
	- - - Hard - - -	SS	5	100	31	21				
		SS	6	100	33	21				
6.1 / 227.4	CLAYEY SANDY SILT GLACIAL TILL: Trace gravel, cobbles and boulders, hard/very dense, brown, moist	SS	7	100	41	23				
6.6 / 227.0	Borehole Terminated at 6.6 m									



Instrumentation Installation

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

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Groundwater depth encountered on completion of drilling: Dry
Groundwater depth observed on:
Cave depth after auger removal: Open
Groundwater Elevation:

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

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RECORD OF BOREHOLE No. 9

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Project Number: **2201530**

Project Client: **Tatham Engineering Ltd.**

Project Name: **Watermain Replacement and Road**

Project Location: **9th Ave E, Owen Sound, ON**

Drilling Location: **See Borehole Location Plan**

Local Benchmark:

Drilling Method: **Truck Mount**

Drilling Machine: **Solid Stem Augers**

Logged By: **MH**

Reviewed By: **GW**

Northing: **4934179**

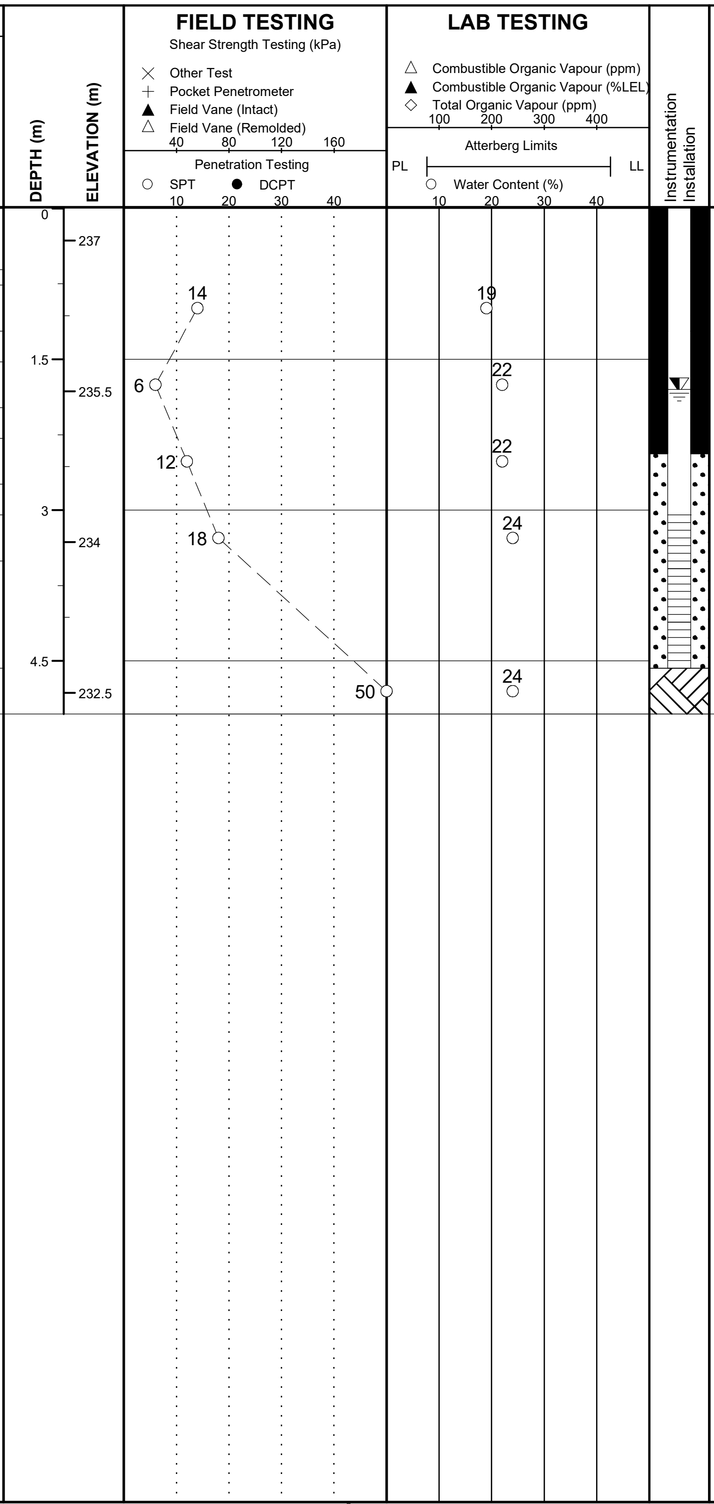
Easting: **505854**

Date Started: **Feb 2/23**

Date Completed: **Feb 3/23**

LITHOLOGY PROFILE / SOIL SAMPLING

DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value
0.0 237.3 ASPHALT: 170 mm GRANULAR FILL: 590 mm	AS	1		
0.8 236.6 FILL: Sand and silt, trace gravel, compact, dark color, moist	SS	2	100	14
- - - Loose - - -	SS	3	100	6
2.3 235.0 SANDY SILT GLACIAL TILL: Trace to some clay, trace gravel, cobbles and boulders, compact, brown, wet	SS	4	100	12
	SS	5	100	18
- - - Very dense - - - 5.0 232.3	SS	6	100	50
Borehole Terminated at 5.0 m				



COMMENTS & GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL

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Groundwater depth encountered on completion of drilling: Dry

Cave depth after auger removal: Open

Groundwater depth observed on: Feb 13/23 at depth of: 1.8 m.

Groundwater Elevation: 235.5 m

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

Scale: **1 :75**

RECORD OF BOREHOLE No. 10

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing: **4934057**
Easting: **505861**
Date Started: **Feb 2/23**
Date Completed: **Feb 3/23**

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Lithology Plot	DESCRIPTION 0.0 245.5	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	Shear Strength Testing (kPa) × Other Test + Pocket Penetrometer ▲ Field Vane (Intact) △ Field Vane (Remolded) 40 80 120 160 Penetration Testing ○ SPT ● DCPT 10 20 30 40	△ Combustible Organic Vapour (ppm) ▲ Combustible Organic Vapour (%LEL) ◇ Total Organic Vapour (ppm) 100 200 300 400 Atterberg Limits PL ├──┤ LL ○ Water Content (%) 10 20 30 40	Instrumentation Installation	GR	SA	SI	CL
	ASPHALT: 100 mm GRANULAR FILL: 660 mm 0.8 244.8	AS	1			0								
	FILL: Silty sand, some rock fragments, compact, brown, moist 1.5 244.0	SS	2	35	13	1.5	244.5	13 ○	15 ○					
	Borehole Terminated at 1.5 m Upon Auger Refusal													

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Groundwater depth encountered on completion of drilling: 0.8 m.
Cave depth after auger removal: Open
Groundwater depth observed on:
Groundwater Elevation:

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

Scale: **1 :75**

RECORD OF BOREHOLE No. 11

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing: **4933944**
Easting: **505883**
Date Started: **Feb 2/23**
Date Completed: **Feb 3/23**

FIELD TESTING: Shear Strength Testing (kPa)
- × Other Test
- + Pocket Penetrometer
- ▲ Field Vane (Intact)
- △ Field Vane (Remolded)

Scale: 40 80 120 160

Penetration Testing
- ○ SPT
- ● DCPT

Scale: 10 20 30 40

LAB TESTING
- △ Combustible Organic Vapour (ppm)
- ▲ Combustible Organic Vapour (%LEL)
- ◇ Total Organic Vapour (ppm)

Scale: 100 200 300 400

Atterberg Limits: PL ├──┤ LL
- ○ Water Content (%)

Scale: 10 20 30 40

LITHOLOGY PROFILE: Depth (m)	LITHOLOGY PROFILE: Elevation (m)	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	Instrumentation Installation	GR	SA	SI	CL
0.0	254.2						0								
		ASPHALT: 120 mm GRANULAR FILL: 650 mm	AS	1											
0.8	253.4							253.5							
		FILL: Silty sand, dense, brown, moist	SS	2	75	30			○ 30	○ 14					
1.5	252.7						1.5								
		Borehole Terminated at 1.5 m Upon Auger Refusal													

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

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Groundwater depth encountered on completion of drilling: Dry
Groundwater depth observed on:
Cave depth after auger removal: Open
Groundwater Elevation:

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

Scale: **1 :75**
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RECORD OF BOREHOLE No. 12

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing: **4933848**
Easting: **505897**
Date Started: **Feb 2/23**
Date Completed: **Feb 3/23**

FIELD TESTING
Shear Strength Testing (kPa)
× Other Test
+ Pocket Penetrometer
▲ Field Vane (Intact)
△ Field Vane (Remolded)
40 80 120 160
Penetration Testing
○ SPT ● DCPT
10 20 30 40

LAB TESTING
△ Combustible Organic Vapour (ppm)
▲ Combustible Organic Vapour (%LEL)
◇ Total Organic Vapour (ppm)
100 200 300 400
Atterberg Limits
PL ├──┤ LL
○ Water Content (%)
10 20 30 40

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Lithology Plot	DESCRIPTION 0.0 262.5	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)			Instrumentation Installation	GR	SA	SI	CL
▨	ASPHALT: 160 mm GRANULAR FILL: 600 mm 0.8 261.8	AS	1			0	262.5							
▨	FILL: Silty sand, some gravel, dense, brown, mosit 1.5 261.0	SS	2	55	30	1.5		30 ○	12 ○					
	Borehole Terminated at 1.5 m Upon Auger Refusal													

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Groundwater depth encountered on completion of drilling: Dry
Cave depth after auger removal: Open
Groundwater depth observed on:
Groundwater Elevation:

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

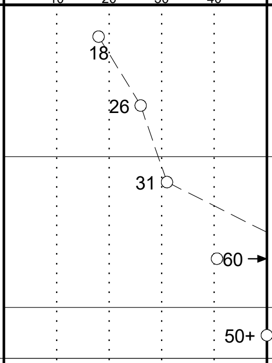
Scale: **1 :75**

RECORD OF BOREHOLE No. 14

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing: **-**
Easting: **-**
Date Started: **Feb 2/23**
Date Completed: **Feb 3/23**

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Depth (m)	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	SPT (Penetration Testing)	Water Content (%)	Instrumentation Installation	GR	SA	SI	CL
0.0 / 248.8 0.1 / 248.7	TOPSOIL: 75 mm					0								
0.8 / 248.0	FILL: Sandy silt, trace gravel, trace organics and rootlets, compact, brown, moist	SS	1	85	18			18						
	SANDY SILT: Trace gravel, trace clay, compact, brown, moist	SS	2	100	26		247.5	26	12					
2.3 / 246.5	- - - Dense - - -	SS	3	100	31	1.5		31	13					
	SAND AND SILT GLACIAL TILL: Trace clay, trace gravel and clay, cobbles and boulders, very dense, grey	SS	4	100	60		246	60	14		3	55	35	7
3.5 / 245.3	- - - Trace rock fragments - - -	SS	5	40	50+	3		50+	15					
	Borehole Terminated at 3.5 m													



FIELD TESTING
Shear Strength Testing (kPa)
× Other Test
+ Pocket Penetrometer
▲ Field Vane (Intact)
△ Field Vane (Remolded)
40 80 120 160
Penetration Testing
○ SPT ● DCPT
10 20 30 40

LAB TESTING
△ Combustible Organic Vapour (ppm)
▲ Combustible Organic Vapour (%LEL)
◇ Total Organic Vapour (ppm)
100 200 300 400
Atterberg Limits
PL ├──┤ LL
○ Water Content (%)
10 20 30 40

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Groundwater depth encountered on completion of drilling: Dry
Cave depth after auger removal: Open
Groundwater depth observed on: Feb 13/23 at depth of: 0.6 m.
Groundwater Elevation: 248.2 m

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

Scale: **1 :75**

RECORD OF BOREHOLE No. 15

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing:
Easting:
Date Started: **Feb 2/23**
Date Completed: **Feb 3/23**

FIELD TESTING
Shear Strength Testing (kPa)
× Other Test
+ Pocket Penetrometer
▲ Field Vane (Intact)
△ Field Vane (Remolded)
40 80 120 160
Penetration Testing
○ SPT ● DCPT
10 20 30 40

LAB TESTING
△ Combustible Organic Vapour (ppm)
▲ Combustible Organic Vapour (%LEL)
◇ Total Organic Vapour (ppm)
100 200 300 400
Atterberg Limits
PL ⊢—⊣ LL
○ Water Content (%)
10 20 30 40

LITHOLOGY PROFILE: Depth (m) / Elevation (m)	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	Instrumentation Installation	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
0.0 / 265.0	ASPHALT: 90 mm GRANULAR FILL: 520 mm	AS	1			0								
0.6 / 264.4	SANDY SILT GLACIAL TILL: Some clay, trace gravel, very dense, brown, moist	SS	2	100	50+		264	50+	14					
1.5 / 263.5	Borehole Terminated at 1.5 m Upon Auger Refusal					1.5								

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Groundwater depth encountered on completion of drilling: Dry
Cave depth after auger removal: Open
Groundwater depth observed on:
Groundwater Elevation:

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

Scale: **1 :75**

RECORD OF BOREHOLE No. 16

GEI Consultants

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing: **4933912**
Easting: **506070**
Date Started: **Feb 2/23**
Date Completed: **Feb 3/23**

FIELD TESTING
Shear Strength Testing (kPa)
× Other Test
+ Pocket Penetrometer
▲ Field Vane (Intact)
△ Field Vane (Remolded)
40 80 120 160
Penetration Testing
○ SPT ● DCPT
10 20 30 40

LAB TESTING
△ Combustible Organic Vapour (ppm)
▲ Combustible Organic Vapour (%LEL)
◇ Total Organic Vapour (ppm)
100 200 300 400
Atterberg Limits
PL ├──┤ LL
○ Water Content (%)
10 20 30 40

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Depth (m) / Elevation	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	SPT	Water Content (%)	Instrumentation Installation	GR	SA	SI	CL
0.0 / 266.0	ASPHALT: 210 mm GRANULAR FILL: 400 mm	AS	1			0	265.5							
0.6 / 265.4	SANDY SILT GLACIAL TILL: Some clay, trace gravel, cobbles and boulders, compact, brownish red, moist	SS	2	100	12			12	16					
1.8 / 264.2		SS	3	35	11	1.5		11	15					
	Borehole Terminated at 1.8 m Upon Auger Refusal													

Groundwater depth encountered on completion of drilling: Dry
Groundwater depth observed on:
Cave depth after auger removal: Open
Groundwater Elevation:

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Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

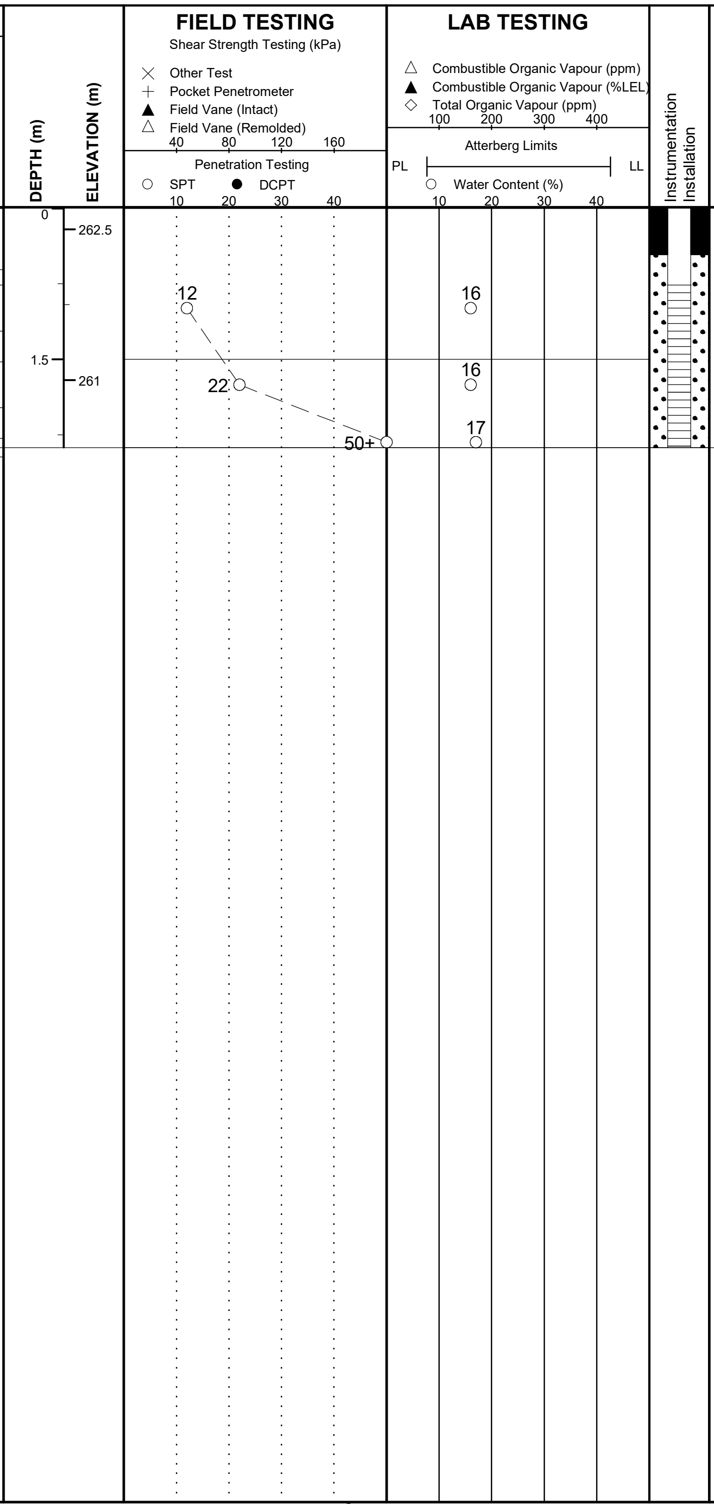
Scale: **1 :75**

RECORD OF BOREHOLE No. 17

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing: **4933925**
Easting: **506164**
Date Started: **Feb 2/23**
Date Completed: **Feb 3/23**

LITHOLOGY PROFILE		SOIL SAMPLING						COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Depth (m)	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	Elevation	Water Content (%)	GR	SA	SI	CL
0.0						262.7					
	ASPHALT: 100 mm GRANULAR FILL: 660 mm	AS	1								
0.8	FILL: Clayey silt, some sand, trace gravel, cobbles and boulbers, stiff, brown, moist	SS	2	100	12	261.9	16				
1.5	SANDY SILT GLACIAL TILL: Some clay, trace gravel, cobbles and boulders, compact to very dense, brown, moist	SS	3	0	22	261.2	16				
2.4		SS	4	100	50+	260.3	17				
	Borehole Terminated at 2.4 m Upon Auger Refusal										



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Barrie, Ontario L4N 0B7
T : (705) 719-7994
www.geiconsultants.com

Groundwater depth encountered on completion of drilling: Dry
Cave depth after auger removal: Open
Groundwater depth observed on: Feb 13/23 at depth of: Dry
Groundwater Elevation:

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

Scale: **1 :75**
Page: **1 of 1**

RECORD OF BOREHOLE No. 19

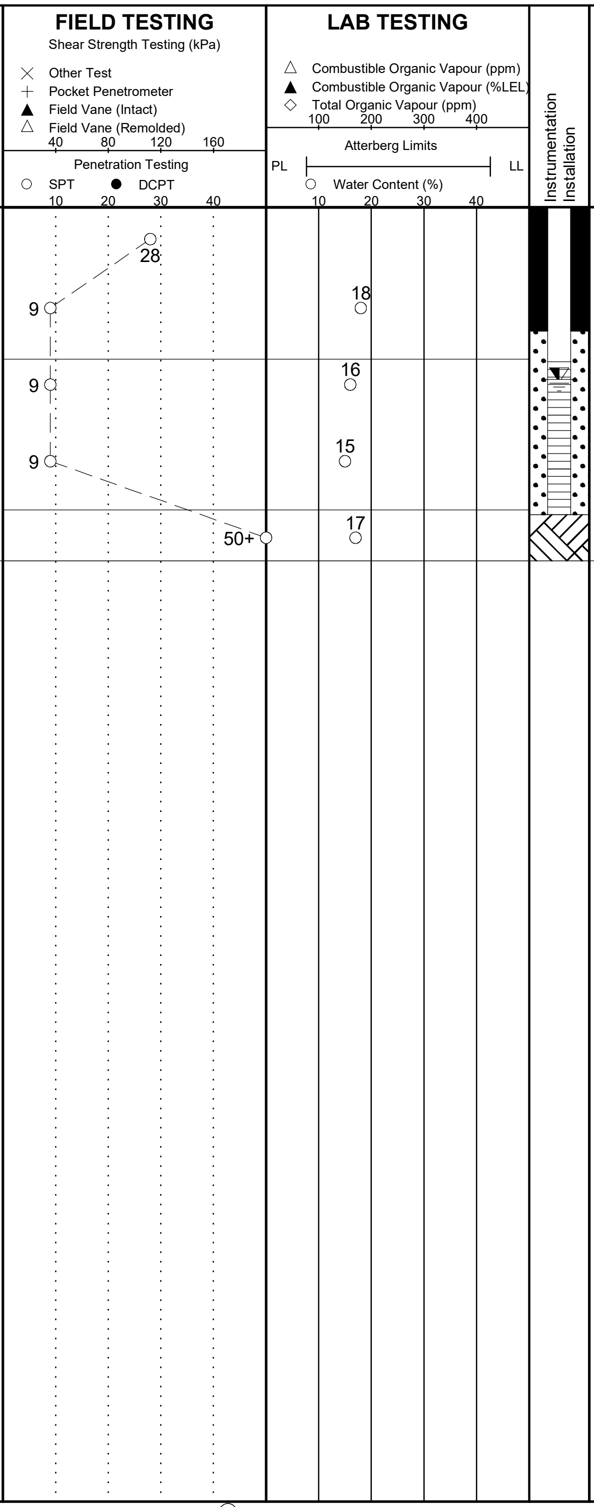
GEI Consultants

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing: **4934148**
Easting: **506120**
Date Started: **Feb 2/23**
Date Completed: **Feb 3/23**

Depth (m)	Elevation (m)	Description	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	Water Content (%)	GR	SA	SI	CL
0.0 0.1	249.2 249.1	TOPSOIL: 100 mm									
		FILL: Clayey silt, trace sand, some rock fragments, very stiff to stiff, brown, moist	SS	1	100	28					
1.2	248.0		SS	2	100	9	18				
		SANDY CLAYEY SILT GLACIAL TILL: trace gravel, cobbles and boulders, stiff/loose, brown	SS	3	100	9	16	8	26	39	27
			SS	4	45	9	15				
3.5	245.7	- - - Trace rock fragments, hard/very dense - - -	SS	5	55	50+	17				

Borehole Terminated at 3.5 m
Upon Auger Refusal



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Groundwater depth encountered on completion of drilling: Dry
Cave depth after auger removal: Open
Groundwater depth observed on: Feb 13/23 at depth of: 1.7 m.
Groundwater Elevation: 247.5 m

Scale: **1 :75**
Page: **1 of 1**

RECORD OF BOREHOLE No. 20

Project Number: **2201530**

Project Client: **Tatham Engineering Ltd.**

Project Name: **Watermain Replacement and Road**

Project Location: **9th Ave E, Owen Sound, ON**

Drilling Location: **See Borehole Location Plan**

Local Benchmark:

Drilling Method: **Truck Mount**

Drilling Machine: **Solid Stem Augers**

Logged By: **MH**

Reviewed By: **GW**

Northing: **4934215**

Easting: **506110**

Date Started: **Feb 2/23**

Date Completed: **Feb 3/23**

FIELD TESTING Shear Strength Testing (kPa): × Other Test; + Pocket Penetrometer; ▲ Field Vane (Intact); △ Field Vane (Remolded); 40 80 120 160. Penetration Testing: ○ SPT; ● DCPT; 10 20 30 40

LAB TESTING: △ Combustible Organic Vapour (ppm); ▲ Combustible Organic Vapour (%LEL); ◇ Total Organic Vapour (ppm); 100 200 300 400. Atterberg Limits: PL |——| LL. ○ Water Content (%); 10 20 30 40

LITHOLOGY PROFILE DESCRIPTION	Depth (m)	Elevation (m)	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	SPT (plotted)	Water Content (%)	Instrumentation Installation	GR	SA	SI	CL
	0.0	248.0											
TOPSOIL: 150 mm	0.2	247.9											
FILL: Clayey silt, trace to some sand, trace organics, stiff, brown, moist			SS	1	100	6	6	24					
			SS	2	100	7	7	17					
SANDY CLAYEY SILT GLACIAL TILL: Trace gravel, cobbles and boulders, stiff/ compact to loose, brown, moist	1.5	246.5	SS	3	100	12	12	19					
			SS	4	100	9	9	17					
			SS	5	100	7	7	19					
Borehole Terminated at 3.5 m	3.5	244.5											

Depth scale: 0, 1.5, 3. Elevation scale: 247.5, 246.

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

Groundwater depth encountered on completion of drilling: Dry

Cave depth after auger removal: Open

Groundwater depth observed on:

Groundwater Elevation:

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Scale: **1 :75**

RECORD OF BOREHOLE No. 21

GEI Consultants

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing: **4934337**
Easting: **506106**
Date Started: **Jan 30/23**
Date Completed: **Feb 3/23**

FIELD TESTING – Shear Strength Testing (kPa): ✕ Other Test; + Pocket Penetrometer; ▲ Field Vane (Intact); △ Field Vane (Remolded); scale 40, 80, 120, 160. Penetration Testing: ○ SPT; ● DCPT; scale 10, 20, 30, 40

LAB TESTING: △ Combustible Organic Vapour (ppm); ▲ Combustible Organic Vapour (%LEL); ◇ Total Organic Vapour (ppm); scale 100, 200, 300, 400. Atterberg Limits: PL ├──┤ LL; ○ Water Content (%); scale 10, 20, 30, 40

COMMENTS & GRAIN SIZE DISTRIBUTION (%): GR, SA, SI, CL

Depth / Elev.	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	SPT	Water Content (%)	GR	SA	SI	CL
0.0 / 245.2	ASPHALT: 125 mm GRANULAR FILL: 625 mm	AS	1			0							
0.8 / 244.5	FILL: Clayey silt, trace gravel, stiff, brownish red, moist	SS	2	100	8		244.5	8	17				
1.5 / 243.7	SANDY SILT: Some clay, loose, brown, wet	SS	3	100	7	1.5		7	16				
2.3 / 243.0	Borehole Terminated at 2.3 m Upon Refusal to Aguer						243						

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▽ Groundwater depth encountered on completion of drilling: Dry
Cave depth after auger removal: Open
▼ Groundwater depth observed on: Feb 13/23 at depth of: 1.2 m.
Groundwater Elevation: 244.0 m

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

Scale: **1 :75**
Page: **1 of 1**

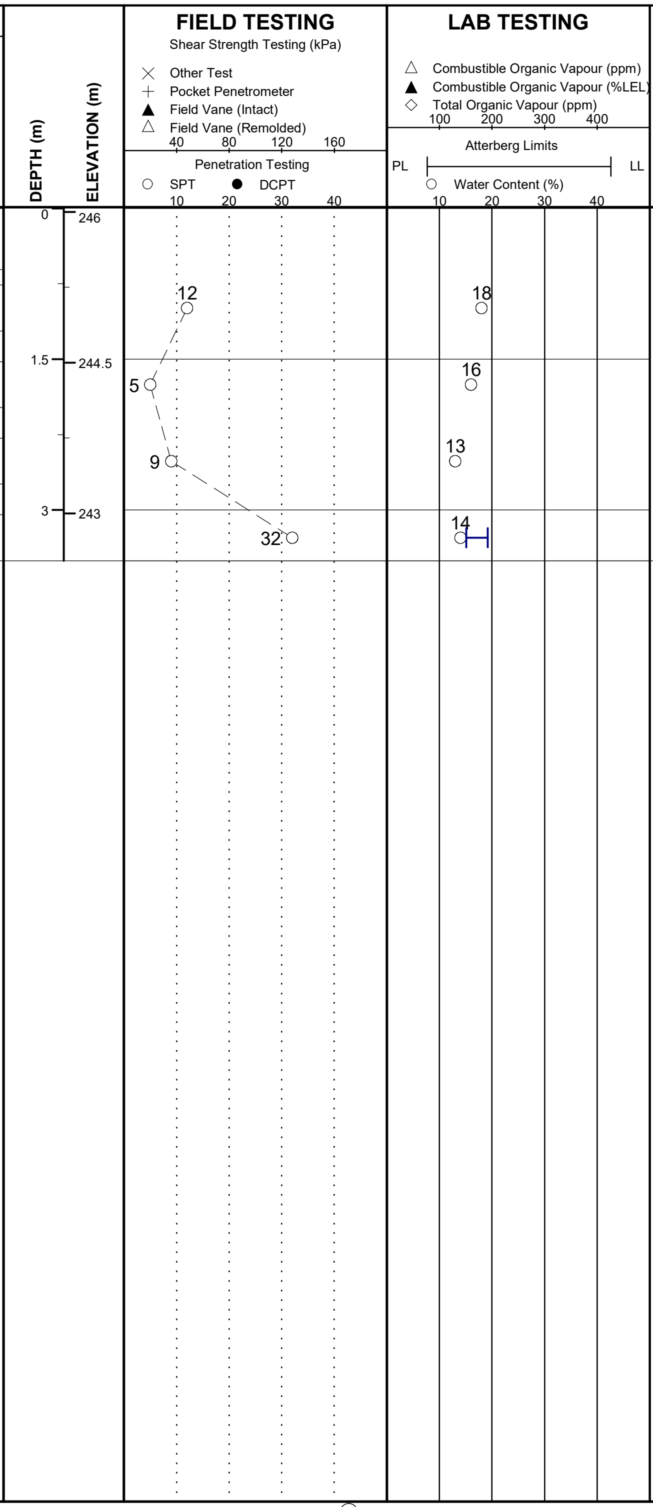
RECORD OF BOREHOLE No. 22

GEI Consultants

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing: **4934354**
Easting: **506237**
Date Started: **Jan 30/23**
Date Completed: **Feb 3/23**

LITHOLOGY PROFILE		SOIL SAMPLING				LAB TESTING	COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Depth (m) / Elevation (m)	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	Water Content (%)	GR	SA	SI	CL
0.0 / 246.0	ASPHALT: 100 mm GRANULAR FILL: 660 mm	AS	1							
0.8 / 245.3	FILL: Sandy silt, some clay, trace to some gravel, compact, brown, moist	SS	2	20	12	18				
	- - - Loose - - -	SS	3	75	5	16				
		SS	4	55	9	13	14	33	38	15
3.0 / 243.0	SANDY SILT GLACIAL TILL: Some clay, trace gravel, dense, brown, moist	SS	5	100	32	14				
3.5 / 242.5	Borehole Terminated at 3.5 m									



Instrumentation Installation

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647 Welham Road, Unit 14
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T : (705) 719-7994
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Groundwater depth encountered on completion of drilling: Dry
Groundwater depth observed on:
Cave depth after auger removal: Open
Groundwater Elevation:

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

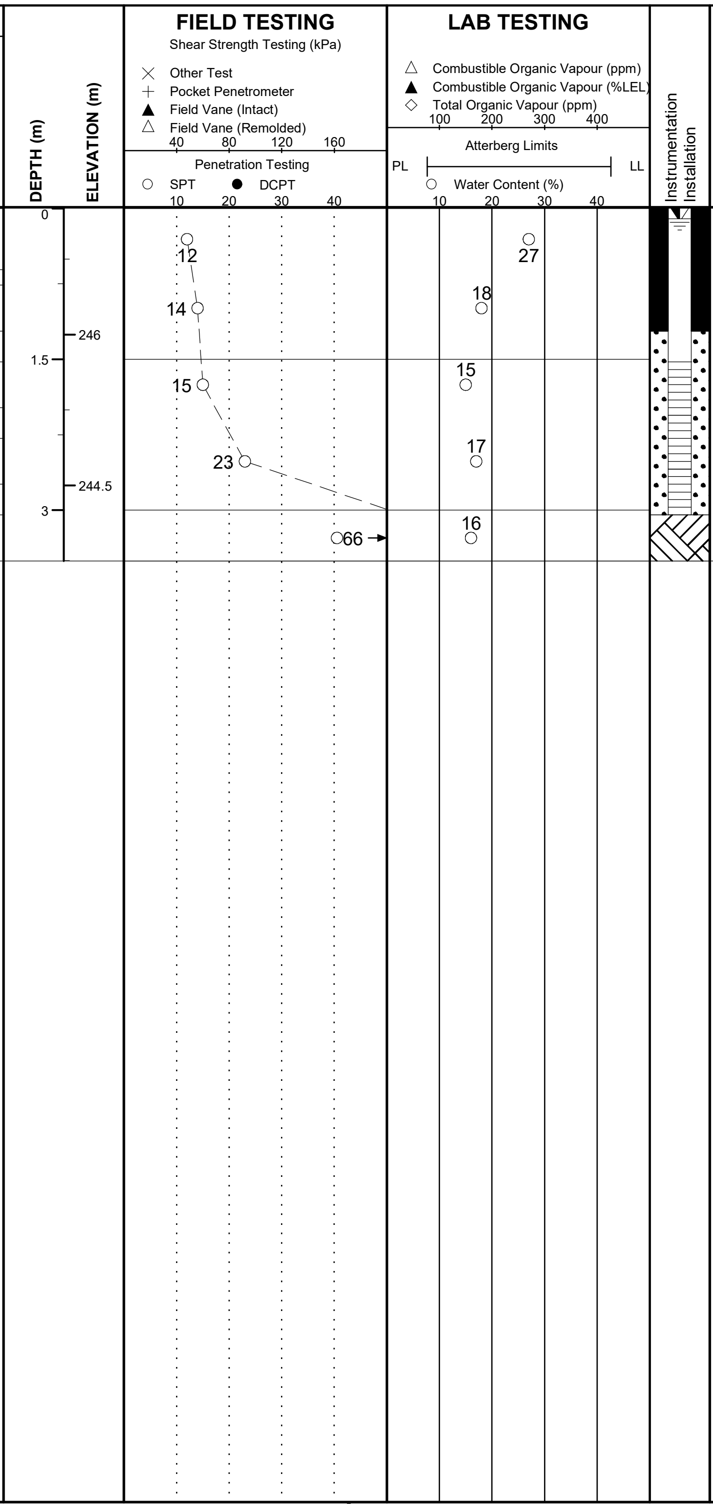
Scale: **1 :75**
Page: **1 of 1**

RECORD OF BOREHOLE No. 23

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing: **4934484**
Easting: **506228**
Date Started: **Jan 30/23**
Date Completed: **Feb 3/23**

LITHOLOGY PROFILE		SOIL SAMPLING				LAB TESTING	COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Depth / Elevation	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	Water Content (%)	GR	SA	SI	CL
0.0 247.3 0.1 247.1	ASPHALT: 125 mm									
	FILL: Sandy Silt, some clay, trace organics, trace gravel, compact, brown, moist	SS	1	100	12	27				
0.8 246.5	SANDY SILT GLACIAL TILL: Trace to Some clay, trace to some gravel, cobbles and boulders, compact, brown, moist	SS	2	100	14	18				
		SS	3	100	15	15				
		SS	4	100	23	17				
	- - - Very dense - - -	SS	5	100	66	16	18	32	39	11
3.5 243.7	Borehole Terminated at 3.5 m									



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Groundwater depth encountered on completion of drilling: Dry
Cave depth after auger removal: Open
Groundwater depth observed on: Feb 13/23 at depth of: 0.1 m.
Groundwater Elevation: 247.2 m

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

Scale: **1 :75**
Page: **1 of 1**

RECORD OF BOREHOLE No. 24

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Reviewed By: **GW**
Northing: **4934562**
Easting: **506214**
Date Started: **Jan 30/23**
Date Completed: **Feb 3/23**

LITHOLOGY PROFILE		SOIL SAMPLING					
Depth (m) / Elevation (m)	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)
0.0 / 247.4 0.2 / 247.3	TOPSOIL: 150 mm					0	
0.2 / 247.3 0.8 / 246.6	FILL: Clayey silt, trace organics, soft, brown, moist	SS	1	100	6		
0.8 / 246.6 3.5 / 243.9	SANDY SILT TILL: Some clay, trace gravel, cobbles and boulders, compact, brown, moist	SS	2	100	19		
		SS	3	100	25	1.5	246
		SS	4	100	23		
	- - - Dense - - -	SS	5	100	44	3	244.5
	Borehole Terminated at 3.5 m						

FIELD TESTING

Shear Strength Testing (kPa)

- ╳ Other Test
- ┼ Pocket Penetrometer
- ▲ Field Vane (Intact)
- △ Field Vane (Remolded)

Penetration Testing

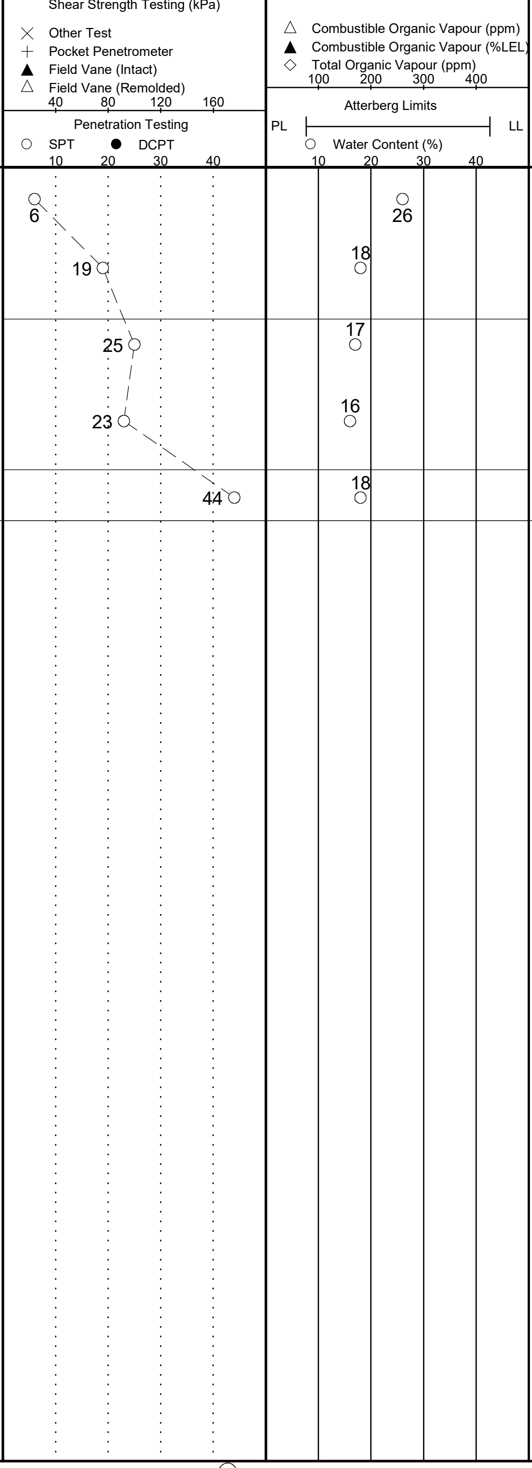
○ SPT ● DCPT

LAB TESTING

- △ Combustible Organic Vapour (ppm)
- ▲ Combustible Organic Vapour (%LEL)
- ◇ Total Organic Vapour (ppm)

Atterberg Limits PL ├──┤ LL

○ Water Content (%)



Instrumentation Installation

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

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Groundwater depth encountered on completion of drilling: Dry

Groundwater depth observed on:

Cave depth after auger removal: Open

Groundwater Elevation:

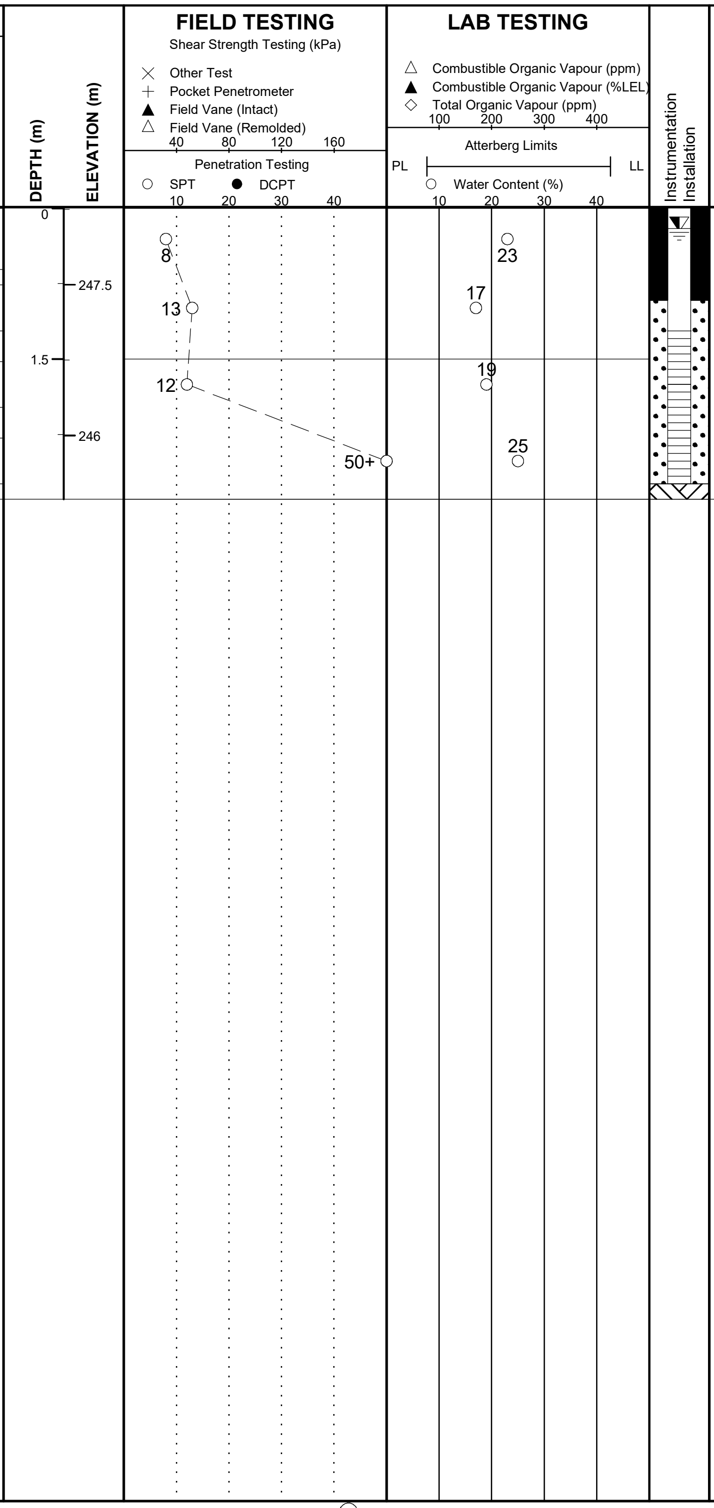
Scale: **1 :75**

RECORD OF BOREHOLE No. 25

Project Number: **2201530**
Project Client: **Tatham Engineering Ltd.**
Project Name: **Watermain Replacement and Road**
Project Location: **9th Ave E, Owen Sound, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Truck Mount**
Drilling Machine: **Solid Stem Augers**
Logged By: **MH**
Northing: **4934649**
Date Started: **Jan 31/23**
Reviewed By: **GW**
Easting: **506201**
Date Completed: **Feb 3/23**

LITHOLOGY PROFILE				SOIL SAMPLING				COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Depth (m)	DESCRIPTION	Elevation (m)		Sample Type	Sample Number	Recovery (%)	SPT "N" Value	GR	SA	SI	CL
0.0		248.3									
0.1	TOPSOIL: 150 mm	248.2									
	FILL: Clayey silt, some organics, trace rootlets, stiff, dark color, moist			SS	1	100	8				
0.8	SANDY SILT GLACIAL TILL: Trace to some clay, trace gravel, cobbles and boulders, compact, brown, moist	247.5		SS	2	100	13				
				SS	3	100	12				
	- - - Very dense - - -			SS	4	65	50+				
2.9	Borehole Terminated at 2.9 m Upon Auger Refusal	245.4									



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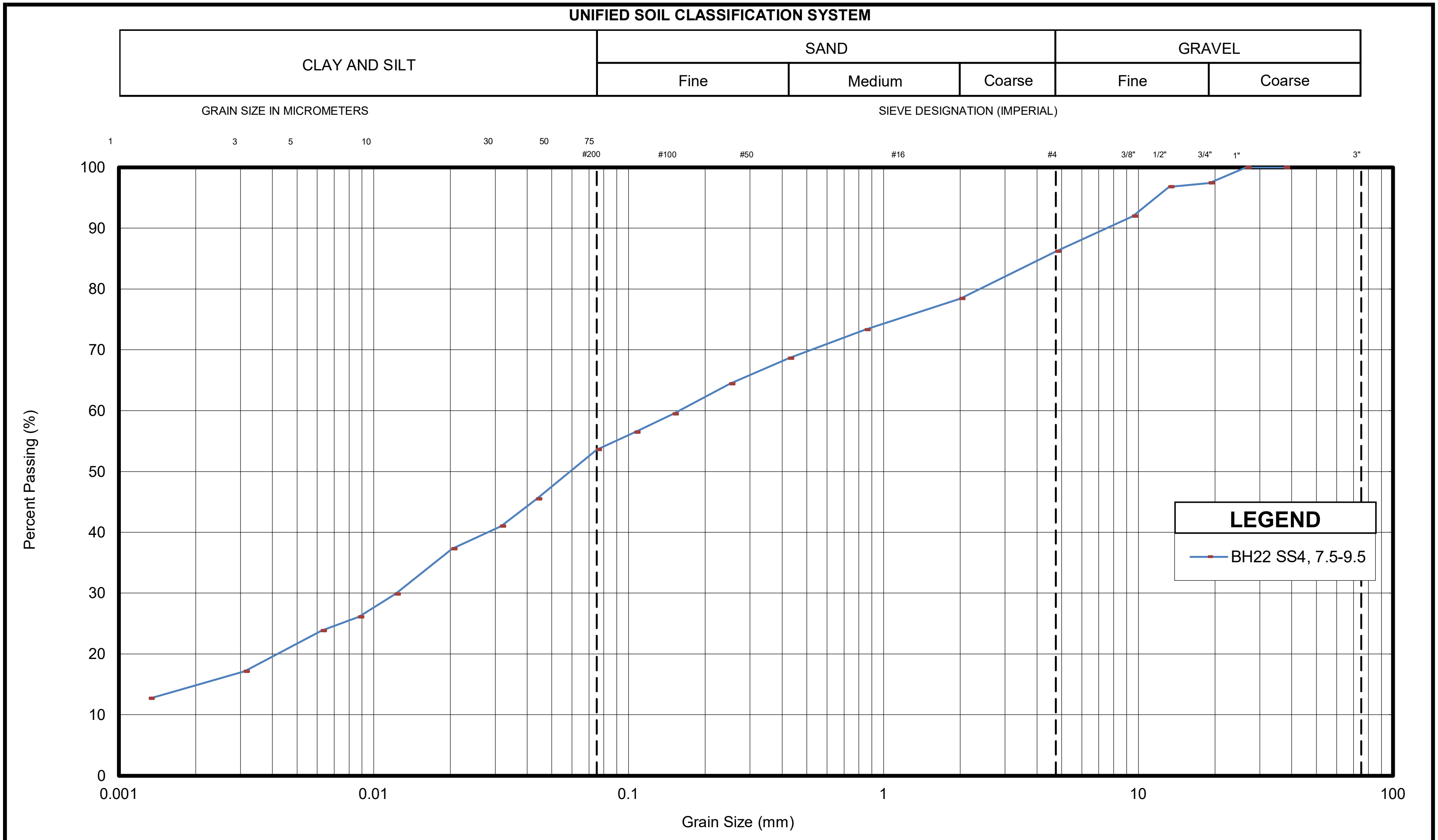
Groundwater depth encountered on completion of drilling: Dry
Cave depth after auger removal: Open
Groundwater depth observed on: Feb 13/23 at depth of: 0.2 m.
Groundwater Elevation: 248.1 m

Scale: **1 :75**

Appendix C:
Geotechnical Laboratory Data



Sample	Description	Gr.	Sa.	Si.	Cl.	D_{10}	D_{30}	D_{60}	C_u	C_c
BH22 SS4	SANDY SILT, Some Clay, Some Gravel	14	33	38	15	-	0.012	0.158	-	-

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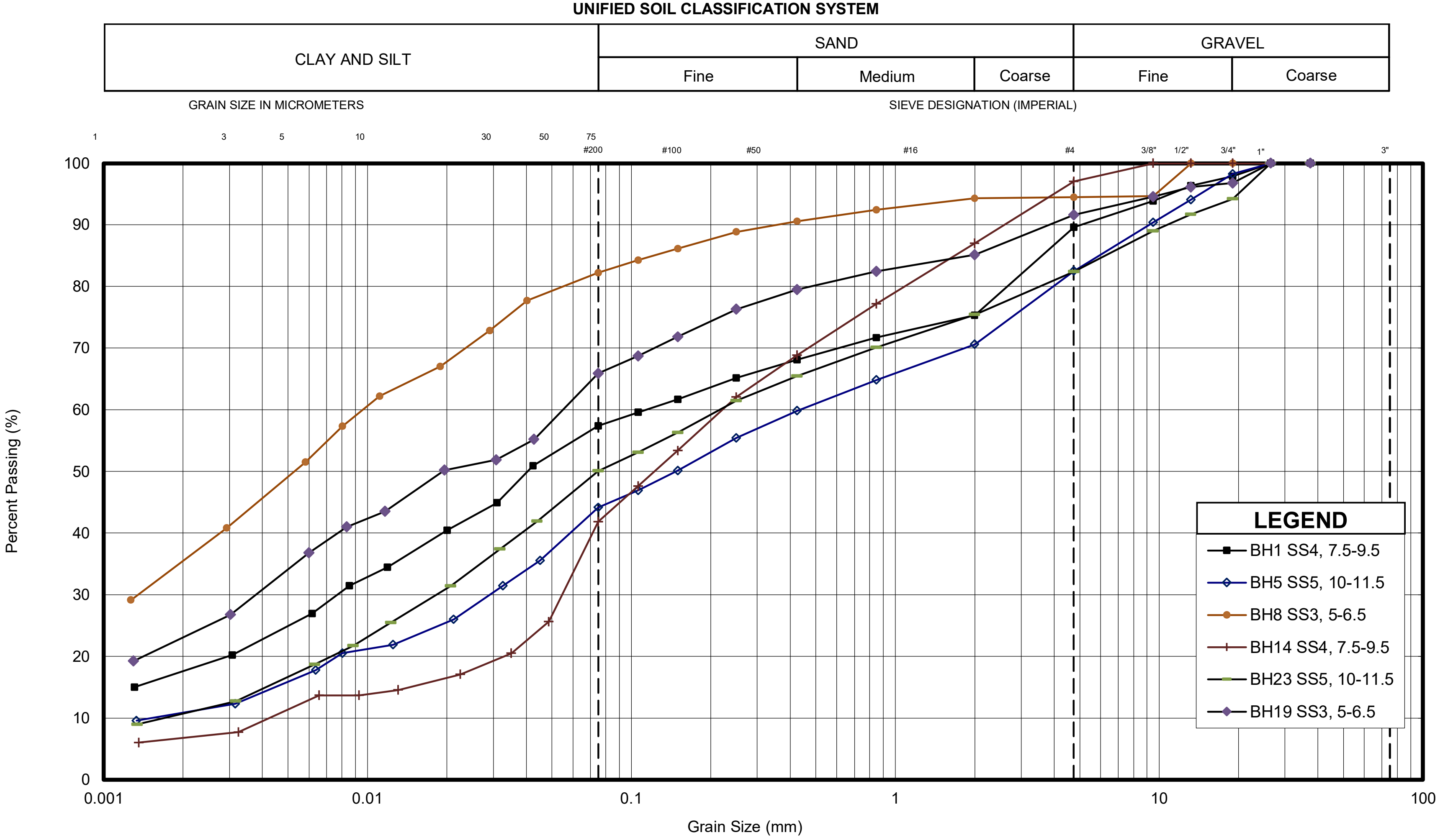
GRAIN SIZE DISTRIBUTION - 9th Avenue East

FILL

FIGURE No. B9
REF. No. 2201530
DATE March 2023



Sample	Description	Gr.	Sa.	Si.	Cl.	D_{10}	D_{30}	D_{60}	C_u	C_c
BH1 SS4	SANDY SILT, Some Clay, Some Gravel	10	32	40	18	-	0.008	0.114	-	-
BH5 SS5	SILTY SAND, Some Gravel, Some Clay	17	38	33	12	0.002	0.029	0.435	285.7	1.28
BH8 SS3	CLAYEY SILT, Some Sand, Trace Gravel	6	12	47	35	-	0.001	0.01	-	-
BH14 SS4	SAND AND SILT, Trace Clay, Trace Gravel	3	55	35	7	0.004	0.055	0.221	52.03	3.18
BH19 SS3	SANDY CLAYEY SILT, Trace Gravel	8	26	39	27	-	0.004	0.055	-	-
BH23 SS5	SANDY SILT, Some Gravel, Some Clay	18	32	39	11	0.002	0.018	0.217	127.9	0.91

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GRAIN SIZE DISTRIBUTION - 9th Avenue East

GLACIAL TILL

FIGURE No. B10
REF. No. 2201530
DATE March 2023

GEI Consultants

Atterberg Limits Report

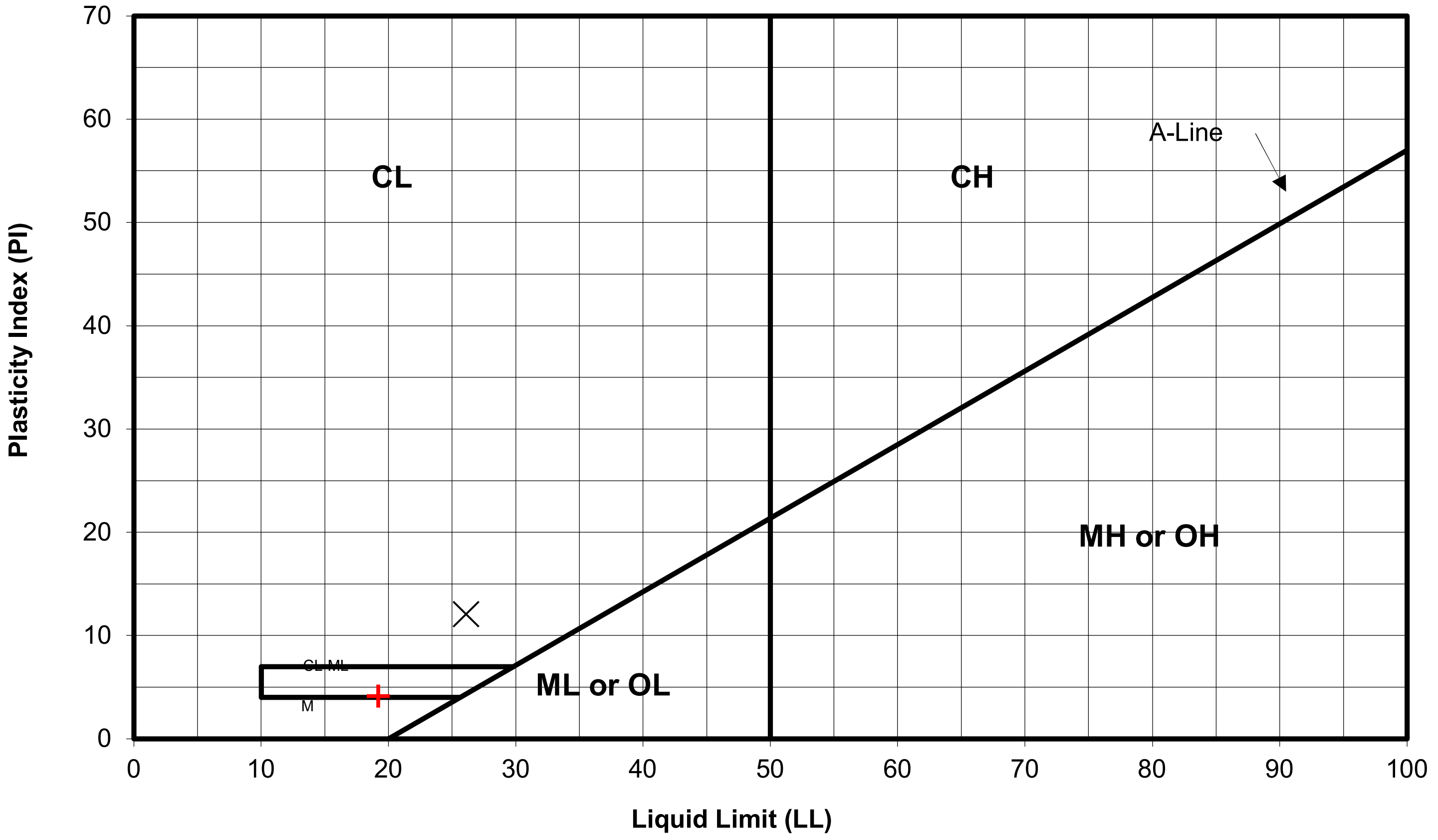
Project Name: 9th Avenue East
Project No.: 2201530
Client: Tatham Engineering Limited

Figure No.: B11
Date Tested: March 20, 2023
Date Sampled: -

SAMPLE INFORMATION

SAMPLE ID	BH8 SS3, 5-6.5	LIQUID LIMIT (LL):	26.1	PLASTIC LIMIT (PL)	14.1	PLASTIC INDEX (PI)	12.0	X
SAMPLE ID	BH22 SS4, 7.5-9.5	LIQUID LIMIT (LL):	19.2	PLASTIC LIMIT (PL)	15.1	PLASTIC INDEX (PI)	4.1	+

Plasticity Chart



DISTRIBUTION:	**Prepared By: D. Gorry**	**Checked By:**

Report No. ____________________

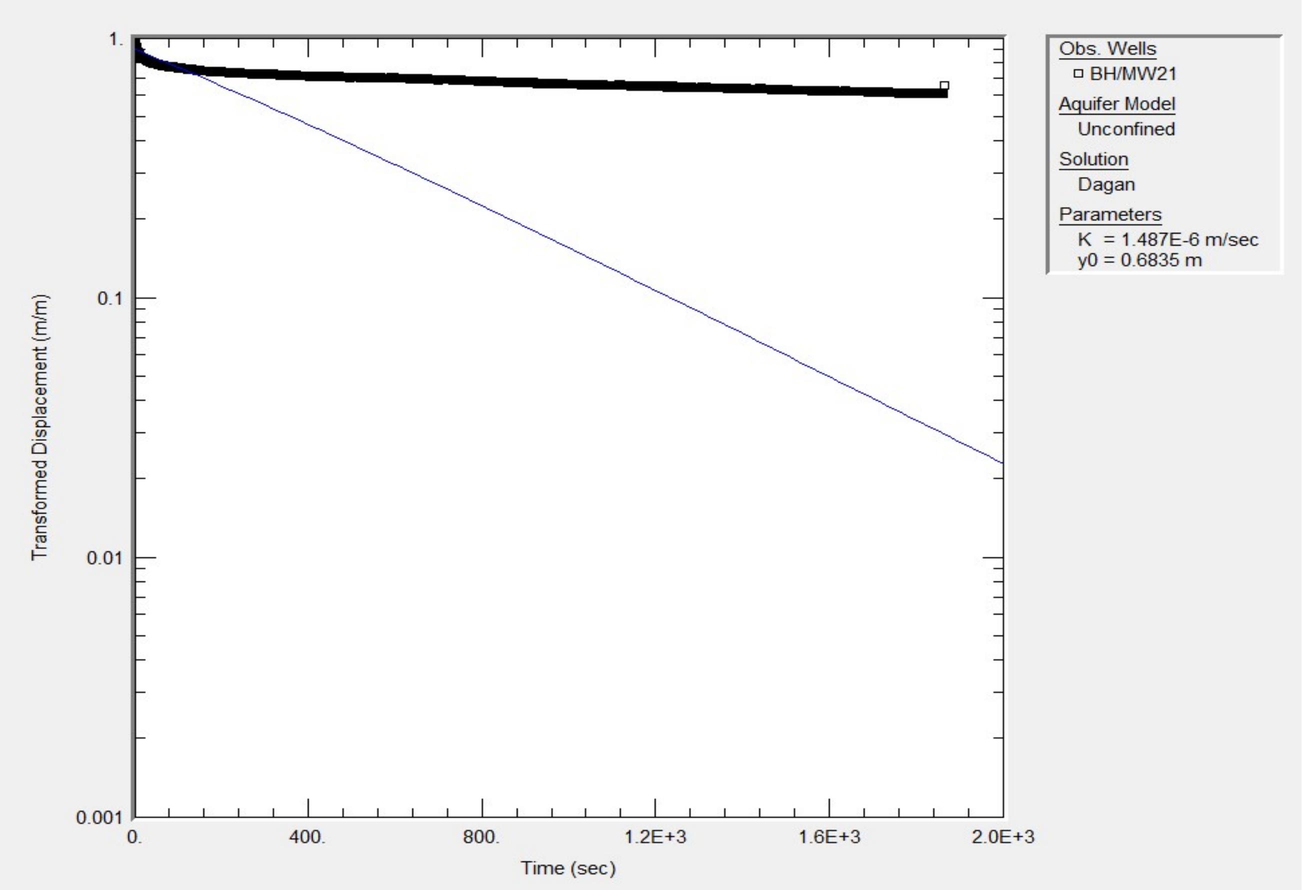
Appendix D:
Borehole Permeability Test Results

TATHAM ENGINEERING

Estimated Hydraulic Conductivity - Slug Test
Dagan Equation

Date Completed:	21-Apr-23
Conducted by:	JM/NT

Well Number:	BH/MW21	
Well Screen Bottom:	2.3	mbgs
Top of Pipe:	0.09	mbgs
Well Casing Diameter:	5	cm
Well Elevation:	245.2	masl
Static Water Level:	1.4	mbgs
K:	1.49E-06	m/s



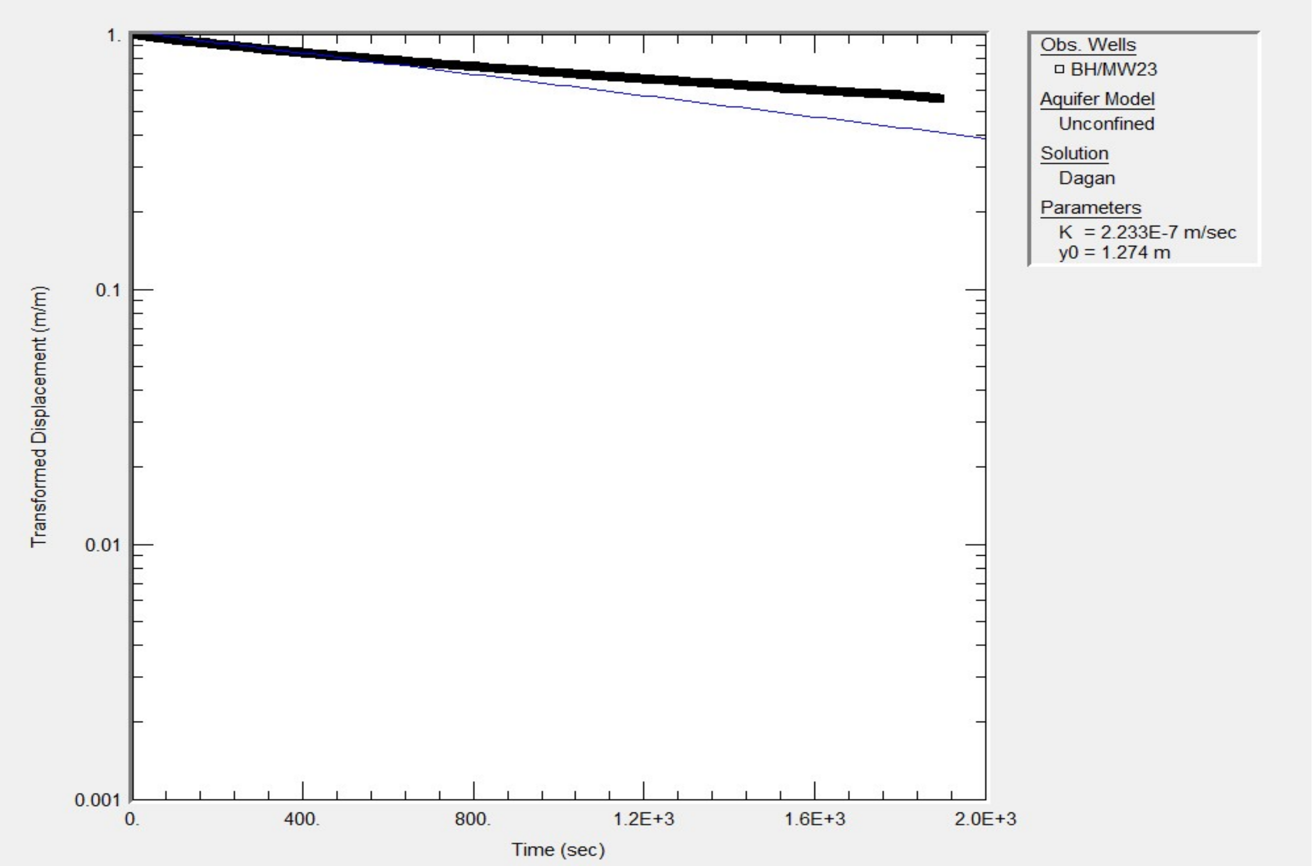
Dagan, G., 1978. A note on packer, slug, and recovery tests in unconfined aquifers, Water Resources Research, vol. 14, no. 5. pp. 929-934.

TATHAM ENGINEERING

Estimated Hydraulic Conductivity - Slug Test
Dagan Equation

Date Completed:	21-Apr-23
Conducted by:	JM/NT

Well Number:	BH/MW23	
Well Screen Bottom:	3	mbgs
Top of Pipe:	0.91	mags
Well Casing Diameter:	5	cm
Well Elevation:	247.3	masl
Static Water Level:	0.07	mags
K:	2.23E-07	m/s

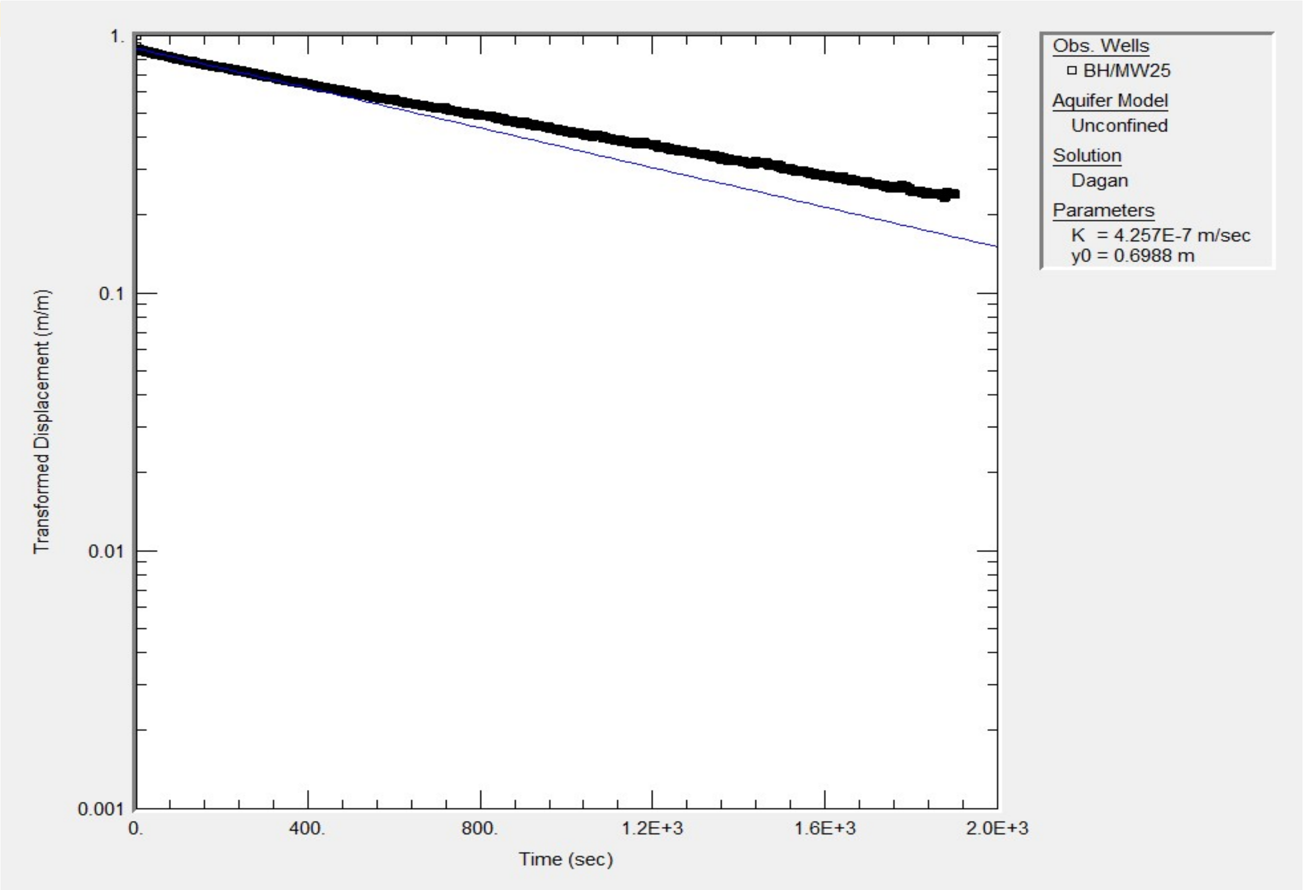


Dagan, G., 1978. A note on packer, slug, and recovery tests in unconfined aquifers, Water Resources Research, vol. 14, no. 5. pp. 929-934.

Estimated Hydraulic Conductivity - Slug Test
Dagan Equation

Date Completed:	21-Apr-23
Conducted by:	JM/NT

Well Number:	BH/MW25	
Well Screen Bottom:	2.7	mbgs
Top of Pipe:	0.93	mags
Well Casing Diameter:	5	cm
Well Elevation:	248.3	masl
Static Water Level:	0.21	mbgs
K:	4.26E-07	m/s



Dagan, G., 1978. A note on packer, slug, and recovery tests in unconfined aquifers, Water Resources Research, vol. 14, no. 5. pp. 929-934.

Appendix E:
Groundwater Quality

CADUCEON
ENVIRONMENTAL LABORATORIES
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CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: G115006 **REPORT No: 23-008175 - Rev. 0**

Report To:
Tatham Engineering
115 Sandford Fleming Drive
Suite 200
Collingwood, ON L9Y 5A6

CADUCEON Environmental Laboratories
112 Commerce Park Dr Unit L
Barrie, ON L4N 8W8

Attention: Alicia Kimberley

DATE RECEIVED: 2023-Apr-22
DATE REPORTED: 2023-May-08
SAMPLE MATRIX: Ground Water

CUSTOMER PROJECT: 121387
P.O. NUMBER: 9th Ave E Owen Sound

Analyses	Qty	Site Analyzed	Authorized	Date Analyzed	Lab Method	Reference Method
Anions (Liquid)	1	OTTAWA	PCURIEL	2023-Apr-25	A-IC-01	SM 4110B
BOD5 (Liquid)	1	KINGSTON	MDUBIEN	2023-Apr-26	BOD-001	SM 5210B
Cond/pH/Alk Auto (Liquid)	1	OTTAWA	SBOUDREAU	2023-Apr-25	COND-02/PH-02/ALK-02	SM 2510B/4500H/2320B
Cyanide Total (Liquid)	1	KINGSTON	KWELCH	2023-Apr-27	CN-001	SM 4500-CN-E
Chromium VI (Liquid)	1	OTTAWA	CBURKE	2023-May-05	D-CRVI-01	MECP E3056
ICP/MS Total (Liquid)	1	OTTAWA	TPRICE	2023-Apr-28	D-ICPMS-01	EPA 6020
ICP/OES Total (Liquid)	1	OTTAWA	NHOGAN	2023-Apr-26	D-ICP-01	SM 3120B
Mercury (Liquid)	1	OTTAWA	APRUDYVUS	2023-Apr-27	D-HG-02	SM 3112B
Nonylphenols (Subcontracted)	1	SGS_LAKEFIELD	CBURKE	2023-May-05		Subcontracted
OC Pesticides (Liquid)	1	KINGSTON	CSUMMERHAYS	2023-Apr-28	PESTCL-001	EPA 8081
Oil & Grease (Liquid)	1	KINGSTON	MTYMCHUK	2023-Apr-26	O&G-001	SM 5520
PCB's (Liquid)	1	KINGSTON	CSUMMERHAYS	2023-Apr-27	PCB-001	EPA 8081
PHC F1 (Liquid)	1	RICHMOND_HILL	FLENA	2023-Apr-27	C-VPHW-01	MECP E3421
PHC F2-4 (Liquid)	1	KINGSTON	KPARKER	2023-Apr-26	PHC-W-001	MECP E3421
Phenols (Liquid)	1	KINGSTON	KWELCH	2023-Apr-28	PHEN-01	MECP E3179
SVOC - Semi-Volatiles (Liquid)	1	KINGSTON	EASIEDU	2023-Apr-27	NAB-W-001	EPA 8270D
TP & TKN (Liquid)	1	KINGSTON	KDIBBITS	2023-May-03	TPTKN-001	MECP E3516.2
TSS (Liquid)	1	KINGSTON	JMACINNES	2023-Apr-26	TSS-001	SM 2540D
VOC-Volatiles (Liquid)	1	RICHMOND_HILL	FLENA	2023-Apr-27	C-VOC-02	EPA 8260

µg/g = micrograms per gram (parts per million) and is equal to mg/Kg
F1 C6-C10 hydrocarbons in µg/g, (F1-btex if requested)
F2 C10-C16 hydrocarbons in µg/g, (F2-napth if requested)
F3 C16-C34 hydrocarbons in µg/g, (F3-pah if requested)
F4 C34-C50 hydrocarbons in µg/g
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
Any deviations from the method are noted and reported for any particular sample.
nC6 and nC10 response factor is within 30% of response factor for toluene:
nC10,nC16 and nC34 response factors within 10% of each other:
C50 response factors within 70% of nC10+nC16+nC34 average:
Linearity is within 15%:
All results expressed on a dry weight basis.
Unless otherwise noted all chromatograms returned to baseline by the retention time of nC50.

R.L. = Reporting Limit
NC = Not Calculated
Test methods may be modified from specified reference method unless indicated by an *

Unless otherwise noted all extraction, analysis, QC requirements and limits for holding time were met.
If analyzed for F4 and F4G they are not to be summed but the greater of the two numbers are to be used in application to the CWS PHC
QC will be made available upon request.

CBurke

Christine Burke
Laboratory Manager

CBurke

Christine Burke
Laboratory Manager

				Client I.D.	BH/MW 25
				Sample I.D.	23-008175-1
				Date Collected	2023-Apr-21
Parameter	**Units**	**R.L.**	**Limits**		-
pH @25°C	pH units	-	10.5, 8.5	SAN, STORM	8.00
Fluoride	mg/L	0.1	10	SAN	<0.1
BOD5	mg/L	3	300, 15	SAN, STORM	<3
Total Suspended Solids	mg/L	3	350, 15	SAN, STORM	**32**
Phosphorus (Total)	mg/L	0.01	10, 0.4	SAN, STORM	0.03
Total Kjeldahl Nitrogen	mg/L	0.1	100	SAN	0.1
Cyanide (Total)	mg/L	0.005	2, 0.02	SAN, STORM	<0.005
Phenolics	mg/L	0.001	1.0, 0.008	SAN, STORM	<0.001
Hardness (as CaCO3)	mg/L	-			412
Aluminum (Total)	mg/L	0.01	50	SAN	0.81
Barium (Total)	mg/L	0.001			0.034
Beryllium (Total)	mg/L	0.001			<0.001
Iron (Total)	mg/L	0.005			1.16
Manganese (Total)	mg/L	0.001	5, 0.05	SAN, STORM	0.037
Tin (Total)	mg/L	0.05	5	SAN	<0.05
Titanium (Total)	mg/L	0.005	5	SAN	0.025
Tungsten (Total)	mg/L	0.01			<0.01
Zinc (Total)	mg/L	0.005	2, 0.04	SAN, STORM	0.013
Zirconium (Total)	mg/L	0.003			<0.003
Antimony (Total)	mg/L	0.0001	5	SAN	0.0006
Arsenic (Total)	mg/L	0.0001	1, 0.02	SAN, STORM	0.0004

Christine Burke
Laboratory Manager

				Client I.D.	BH/MW 25
				Sample I.D.	23-008175-1
				Date Collected	2023-Apr-21
Parameter	**Units**	**R.L.**	**Limits**		-
Cadmium (Total)	mg/L	0.000015	2, 0.008	SAN, STORM	0.000016
Chromium (Total)	mg/L	0.001	2, 0.08	SAN, STORM	<0.001
Cobalt (Total)	mg/L	0.0001	5	SAN	0.0005
Copper (Total)	mg/L	0.0001	2, 0.04	SAN, STORM	0.0019
Lead (Total)	mg/L	0.00002	1, 0.12	SAN, STORM	0.00050
Molybdenum (Total)	mg/L	0.0001	5	SAN	0.0015
Nickel (Total)	mg/L	0.0002	2, 0.08	SAN, STORM	0.0025
Selenium (Total)	mg/L	0.001	1, 0.02	SAN, STORM	<0.001
Silver (Total)	mg/L	0.0001	5, 0.12	SAN, STORM	<0.0001
Thallium (Total)	mg/L	0.00005			<0.00005
Uranium (Total)	mg/L	0.00005			0.00147
Vanadium (Total)	mg/L	0.0001			0.0007
Chromium (VI)	mg/L	0.001	0.04	STORM	<0.001
Mercury	mg/L	0.00002	0.01, 0.0004	SAN, STORM	<0.00002

Christine Burke
Laboratory Manager

				Client I.D.	BH/MW 25
				Sample I.D.	23-008175-1
				Date Collected	2023-Apr-21
Parameter	**Units**	**R.L.**	**Limits**		-
Acetone	µg/L	30			<30
Benzene	mg/L	0.0005	0.01, 0.002	SAN, STORM	<0.0005
Bromodichloromethane	µg/L	2			<2
Bromoform	µg/L	5			<5
Bromomethane	µg/L	0.5			<0.5
Carbon Tetrachloride	µg/L	0.2			<0.2
Chlorobenzene	µg/L	0.5			<0.5
Chloroform	mg/L	0.001	0.04, 0.002	SAN, STORM	<0.001
Dibromochloromethane	µg/L	2			<2
Ethylene Dibromide	µg/L	0.2			<0.2
Dichlorobenzene,1,2-	mg/L	0.0005	0.05, 0.0056	SAN, STORM	<0.0005
Dichlorobenzene,1,3-	µg/L	0.5			<0.5
Dichlorobenzene,1,4-	mg/L	0.0005	0.08, 0.0068	SAN, STORM	<0.0005
Dichlorodifluoromethane (Freon 12)	µg/L	2			<2
Dichloroethane,1,1-	µg/L	0.5			<0.5
Dichloroethane,1,2-	µg/L	0.5			<0.5
Dichloroethylene,1,1-	µg/L	0.5			<0.5
Dichloroethylene,1,2-cis-	mg/L	0.0005	0.0056	STORM	<0.0005
Dichloroethylene,1,2-trans-	µg/L	0.5			<0.5
Dichloropropane,1,2-	µg/L	0.5			<0.5
Dichloropropene,1,3-cis-	µg/L	0.5			<0.5

Christine Burke
Laboratory Manager

				Client I.D.	BH/MW 25
				Sample I.D.	23-008175-1
				Date Collected	2023-Apr-21
Parameter	**Units**	**R.L.**	**Limits**		-
Dichloropropene,1,3-cis+trans- (Calculated)	µg/L	0.5			<0.5
Dichloropropene,1,3-trans-	mg/L	0.0005	0.14, 0.0056	SAN, STORM	<0.0005
Ethylbenzene	mg/L	0.0005	0.16, 0.002	SAN, STORM	<0.0005
Hexane	µg/L	5			<5
Dichloromethane (Methylene Chloride)	mg/L	0.005	2, 0.0052	SAN, STORM	<0.005
Methyl Ethyl Ketone	µg/L	20			<20
Methyl Isobutyl Ketone	µg/L	20			<20
Methyl tert-Butyl Ether (MTBE)	µg/L	2			<2
Styrene	µg/L	0.5			<0.5
Tetrachloroethane,1,1,1,2-	µg/L	0.5			<0.5
Tetrachloroethane,1,1,2,2-	mg/L	0.0005	1.4, 0.017	SAN, STORM	<0.0005
Tetrachloroethylene	mg/L	0.0005	1, 0.0044	SAN, STORM	<0.0005
Toluene	mg/L	0.0005	0.016, 0.002	SAN, STORM	<0.0005
Trichloroethane,1,1,1-	µg/L	0.5			<0.5
Trichloroethane,1,1,2-	µg/L	0.5			<0.5
Trichloroethylene	mg/L	0.0005	0.4, 0.0076	SAN, STORM	<0.0005
Trichlorofluoromethane (Freon 11)	µg/L	5			<5
Vinyl Chloride	µg/L	0.2			<0.2
Xylene, m,p-	µg/L	1			<1
Xylene, m,p,o-	mg/L	0.0011	0.0044	STORM	<0.0011
Xylene, o-	µg/L	0.5			<0.5

Christine Burke
Laboratory Manager

				Client I.D.	BH/MW 25
				Sample I.D.	23-008175-1
				Date Collected	2023-Apr-21
Parameter	**Units**	**R.L.**	**Limits**		-
PHC F1 (C6-C10)	µg/L	25			<25
PHC F2 (>C10-C16)	µg/L	50			<50
PHC F3 (>C16-C34)	µg/L	400			<400
PHC F4 (>C34-C50)	µg/L	400			<400
Oil and Grease (Mineral)	mg/L	1.0	15	SAN	<1.0
Oil and Grease (Anim/Veg)	mg/L	1.0	150	SAN	3.6

Christine Burke
Laboratory Manager

				Client I.D.	BH/MW 25
				Sample I.D.	23-008175-1
				Date Collected	2023-Apr-21
Parameter	**Units**	**R.L.**	**Limits**		-
Acenaphthene	µg/L	0.05			<0.05
Acenaphthylene	µg/L	0.05			<0.05
Anthracene	µg/L	0.05			<0.05
Benzo[a]anthracene	µg/L	0.05			<0.05
Benzo(a)pyrene	µg/L	0.01			<0.01
Benzo(b)fluoranthene	µg/L	0.05			<0.05
Benzo(g,h,i)perylene	µg/L	0.05			<0.05
Benzo(k)fluoranthene	µg/L	0.05			<0.05
Bis(2-ethylhexyl) Phthalate	mg/L	0.005	0.012, 0.0088	SAN, STORM	<0.005
Chrysene	µg/L	0.05			<0.05
Dibenzo(a,h)anthracene	µg/L	0.05			<0.05
Di-n-Butyl Phthalate	mg/L	0.001	0.08, 0.015	SAN, STORM	<0.001
Dichlorobenzidine,3,3'-	mg/L	0.0005	0.002, 0.0008	SAN, STORM	<0.0005
Fluoranthene	µg/L	0.05			<0.05
Fluorene	µg/L	0.05			<0.05
Indeno(1,2,3,-cd)Pyrene	µg/L	0.05			<0.05
Methylnaphthalene,1-	µg/L	0.05			<0.05
Methylnaphthalene,2-(1-)	µg/L	1			<1
Methylnaphthalene,2-	µg/L	0.05			<0.05
Naphthalene	µg/L	0.05			<0.05
Pentachlorophenol	mg/L	0.0002	0.005, 0.002	SAN, STORM	<0.0002 (Ph)

Christine Burke
Laboratory Manager

				Client I.D.	BH/MW 25
				Sample I.D.	23-008175-1
				Date Collected	2023-Apr-21
Parameter	**Units**	**R.L.**	**Limits**		-
Phenanthrene	µg/L	0.05			<0.05
Pyrene	µg/L	0.05			<0.05
Total PAH	mg/L	0.0001	0.005, 0.002	SAN, STORM	<0.0001

				Client I.D.	BH/MW 25
				Sample I.D.	23-008175-1
				Date Collected	2023-Apr-21
Parameter	**Units**	**R.L.**	**Limits**		-
Poly-Chlorinated Biphenyls (PCB's)	mg/L	0.00005	0.001, 0.0004	SAN, STORM	<0.00017
Identification Comment	-	-			-
Hexachlorobenzene	mg/L	0.00001	0.0001, 0.00004	SAN, STORM	<0.00001
Lindane (Hexachlorocyclohexane, Gamma)	mg/L	0.0004	0.1, 0.04	SAN, STORM	<0.0004
Mirex	mg/L	0.001	0.1, 0.04	SAN, STORM	<0.001
DDT (Total)	mg/L	0.00001	0.0001, 0.00004	SAN, STORM	<0.00001
Chlordane (Alpha + Gamma)	mg/L	0.00005	0.1, 0.04	SAN, STORM	<0.00005
Aldrin + Dieldrin	mg/L	0.00002	0.0002, 0.00008	SAN, STORM	<0.00002

Christine Burke
Laboratory Manager

Subcontracted Analyses

				Client I.D.	BH/MW 25
				Sample I.D.	23-008175-1
				Date Collected	2023-Apr-21
Parameter	**Units**	**R.L.**	**Limits**		-
Nonylphenol Monoethoxylate	µg/L	-			<10
Nonylphenol Diethoxylate	µg/L	-			<10
Nonylphenols	mg/L	-	0.001, 0.001	SAN, STORM	<0.001
Nonylphenol Ethoxylates	mg/L	-	0.01, 0.01	SAN, STORM	<0.01

Comments:

Phenol (SS) fails low

Chromium (VI) result is based on total Chromium

: City of Owen Sound Sewer Use By-Law
SAN: Sanitary Sewer By Law
STORM: Storm Sewer By Law

Summary of Exceedances		
Storm Sewer By Law		
BH/MW 25	**Found Value**	**Limit**
Total Suspended Solids	32	15

Christine Burke
Laboratory Manager

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: G115006 **REPORT No: 23-008175 - Rev. 0**

Report To:
Tatham Engineering
115 Sandford Fleming Drive
Suite 200
Collingwood, ON L9Y 5A6

CADUCEON Environmental Laboratories
112 Commerce Park Dr Unit L
Barrie, ON L4N 8W8

Attention: Alicia Kimberley

DATE RECEIVED: 2023-Apr-22
DATE REPORTED: 2023-May-08
SAMPLE MATRIX: Ground Water

CUSTOMER PROJECT: 121387
P.O. NUMBER: 9th Ave E Owen Sound

Analyses	Qty	Site Analyzed	Authorized	Date Analyzed	Lab Method	Reference Method
Chromium VI (Liquid)	1	OTTAWA	CBURKE	2023-May-05	D-CRVI-01	MECP E3056
ICP/MS Total (Liquid)	1	OTTAWA	TPRICE	2023-Apr-28	D-ICPMS-01	EPA 6020
ICP/OES Total (Liquid)	1	OTTAWA	NHOGAN	2023-Apr-26	D-ICP-01	SM 3120B
ICP/OES (Liquid)	1	OTTAWA	NHOGAN	2023-Apr-25	D-ICP-01	SM 3120B
Mercury (Liquid)	1	OTTAWA	APRUDYVUS	2023-Apr-27	D-HG-02	SM 3112B

R.L. = Reporting Limit
NC = Not Calculated
Test methods may be modified from specified reference method unless indicated by an *

CBurke

Christine Burke
Laboratory Manager

				Client I.D.	BH/MW 25
				Sample I.D.	23-008175-1
				Date Collected	2023-Apr-21
Parameter	**Units**	**R.L.**	**Limits**		-
Aluminum	µg/L	10	75	INTERIM	41
Hardness (as CaCO3)	mg/L	-			412
Aluminum (Total)	mg/L	0.01			0.81
Boron (Total)	µg/L	5	200	INTERIM	53
Calcium (Total)	mg/L	0.02			81.3
Iron (Total)	µg/L	5	300	PWQO	**1160**
Magnesium (Total)	mg/L	0.02			50.9
Manganese (Total)	mg/L	0.001			0.037
Tin (Total)	mg/L	0.05			<0.05
Titanium (Total)	mg/L	0.005			0.025
Tungsten (Total)	µg/L	10	30	INTERIM	<10
Zinc (Total)	µg/L	5	20, 30	INTERIM, PWQO	13
Zirconium (Total)	µg/L	3	4	INTERIM	<3
Antimony (Total)	µg/L	0.1	20	INTERIM	0.6
Arsenic (Total)	µg/L	0.1	5, 5	INTERIM, PWQO	0.4
Beryllium (Total)	µg/L	0.1	11	PWQO	<0.1
Cadmium (Total)	µg/L	0.015	0.1, 0.2	INTERIM, PWQO	0.016
Chromium (Total)	mg/L	0.001			<0.001
Cobalt (Total)	µg/L	0.1	0.9	INTERIM	0.5
Copper (Total)	µg/L	0.1	5	INTERIM	1.9
Lead (Total)	µg/L	0.02	1, 5	INTERIM, PWQO	0.50

Christine Burke
Laboratory Manager

				Client I.D.	BH/MW 25
				Sample I.D.	23-008175-1
				Date Collected	2023-Apr-21
Parameter	**Units**	**R.L.**	**Limits**		-
Molybdenum (Total)	µg/L	0.1	40	INTERIM	1.5
Nickel (Total)	µg/L	0.2	25	PWQO	2.5
Selenium (Total)	µg/L	1	100	PWQO	<1
Silver (Total)	µg/L	0.1	0.1	PWQO	<0.1
Thallium (Total)	µg/L	0.05	0.3, 0.3	INTERIM, PWQO	<0.05
Uranium (Total)	µg/L	0.05	5	INTERIM	1.47
Vanadium (Total)	µg/L	0.100	6	INTERIM	0.700
Chromium (VI)	µg/L	1.0	1	PWQO	<1.0
Mercury	µg/L	0.02	0.2	PWQO	<0.02

Chromium (VI) result is based on total Chromium

: PWQO Limits
INTERIM: Interim PWQO
PWQO: PWQO

Summary of Exceedances

PWQO

BH/MW 25	**Found Value**	**Limit**
Iron (Total)	1160	300

Christine Burke
Laboratory Manager

CADUCEON
ENVIRONMENTAL LABORATORIES
Client committed. Quality assured. Canadian owned.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: G115006 **REPORT No: 23-008175 - Rev. 0**

Report To:
Tatham Engineering
115 Sandford Fleming Drive
Suite 200
Collingwood, ON L9Y 5A6

CADUCEON Environmental Laboratories
112 Commerce Park Dr Unit L
Barrie, ON L4N 8W8

Attention: Alicia Kimberley

DATE RECEIVED: 2023-Apr-22
DATE REPORTED: 2023-May-08
SAMPLE MATRIX: Ground Water

CUSTOMER PROJECT: 121387
P.O. NUMBER: 9th Ave E Owen Sound

Analyses	Qty	Site Analyzed	Authorized	Date Analyzed	Lab Method	Reference Method
PHC F1 (Liquid)	1	RICHMOND_HILL	FLENA	2023-Apr-27	C-VPHW-01	MECP E3421
PHC F2-4 (Liquid)	1	KINGSTON	KPARKER	2023-Apr-26	PHC-W-001	MECP E3421
VOC-Volatiles (Liquid)	1	RICHMOND_HILL	FLENA	2023-Apr-27	C-VOC-02	EPA 8260

µg/g = micrograms per gram (parts per million) and is equal to mg/Kg
F1 C6-C10 hydrocarbons in µg/g, (F1-btex if requested)
F2 C10-C16 hydrocarbons in µg/g, (F2-napth if requested)
F3 C16-C34 hydrocarbons in µg/g, (F3-pah if requested)
F4 C34-C50 hydrocarbons in µg/g
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
Any deviations from the method are noted and reported for any particular sample.
nC6 and nC10 response factor is within 30% of response factor for toluene:
nC10,nC16 and nC34 response factors within 10% of each other:
C50 response factors within 70% of nC10+nC16+nC34 average:
Linearity is within 15%:
All results expressed on a dry weight basis.
Unless otherwise noted all chromatograms returned to baseline by the retention time of nC50.

R.L. = Reporting Limit
NC = Not Calculated
Test methods may be modified from specified reference method unless indicated by an *

Unless otherwise noted all extraction, analysis, QC requirements and limits for holding time were met.
If analyzed for F4 and F4G they are not to be summed but the greater of the two numbers are to be used in application to the CWS PHC
QC will be made available upon request.

CBurke
Christine Burke
Laboratory Manager

				Client I.D.	BH/MW 25
				Sample I.D.	23-008175-1
				Date Collected	2023-Apr-21
Parameter	**Units**	**R.L.**	**Limits**	**Reg 153 - Liquid**	-
Acetone	µg/L	30	2700	T1GW	<30
Benzene	µg/L	0.5	0.5	T1GW	<0.5
Bromodichloromethane	µg/L	2	2	T1GW	<2
Bromoform	µg/L	5	5	T1GW	<5
Bromomethane	µg/L	0.5	0.89	T1GW	<0.5
Carbon Tetrachloride	µg/L	0.2	0.2	T1GW	<0.2
Chlorobenzene	µg/L	0.5	0.5	T1GW	<0.5
Chloroform	µg/L	1	2	T1GW	<1
Dibromochloromethane	µg/L	2	2	T1GW	<2
Ethylene Dibromide	µg/L	0.2	0.2	T1GW	<0.2
Dichlorobenzene,1,2-	µg/L	0.5	0.5	T1GW	<0.5
Dichlorobenzene,1,3-	µg/L	0.5	0.5	T1GW	<0.5
Dichlorobenzene,1,4-	µg/L	0.5	0.5	T1GW	<0.5
Dichlorodifluoromethane (Freon 12)	µg/L	2	590	T1GW	<2
Dichloroethane,1,1-	µg/L	0.5	0.5	T1GW	<0.5
Dichloroethane,1,2-	µg/L	0.5	0.5	T1GW	<0.5
Dichloroethylene,1,1-	µg/L	0.5	0.5	T1GW	<0.5
Dichloroethylene,1,2-cis-	µg/L	0.5	1.6	T1GW	<0.5
Dichloroethylene,1,2-trans-	µg/L	0.5	1.6	T1GW	<0.5
Dichloropropane,1,2-	µg/L	0.5	0.5	T1GW	<0.5
Dichloropropene,1,3-cis-	µg/L	0.5			<0.5

Christine Burke
Laboratory Manager

				Client I.D.	BH/MW 25
				Sample I.D.	23-008175-1
				Date Collected	2023-Apr-21
Parameter	**Units**	**R.L.**	**Limits**	**Reg 153 - Liquid**	-
Dichloropropene,1,3-cis+trans- (Calculated)	µg/L	0.5	0.5	T1GW	<0.5
Dichloropropene,1,3-trans-	µg/L	0.5			<0.5
Ethylbenzene	µg/L	0.5	0.5	T1GW	<0.5
Hexane	µg/L	5	5	T1GW	<5
Dichloromethane (Methylene Chloride)	µg/L	5	5	T1GW	<5
Methyl Ethyl Ketone	µg/L	20	400	T1GW	<20
Methyl Isobutyl Ketone	µg/L	20	640	T1GW	<20
Methyl tert-Butyl Ether (MTBE)	µg/L	2	15	T1GW	<2
Styrene	µg/L	0.5	0.5	T1GW	<0.5
Tetrachloroethane,1,1,1,2-	µg/L	0.5	1.1	T1GW	<0.5
Tetrachloroethane,1,1,2,2-	µg/L	0.5	0.5	T1GW	<0.5
Tetrachloroethylene	µg/L	0.5	0.5	T1GW	<0.5
Toluene	µg/L	0.5	0.8	T1GW	<0.5
Trichloroethane,1,1,1-	µg/L	0.5	0.5	T1GW	<0.5
Trichloroethane,1,1,2-	µg/L	0.5	0.5	T1GW	<0.5
Trichloroethylene	µg/L	0.5	0.5	T1GW	<0.5
Trichlorofluoromethane (Freon 11)	µg/L	5	150	T1GW	<5
Vinyl Chloride	µg/L	0.2	0.5	T1GW	<0.2
Xylene, m,p-	µg/L	1			<1
Xylene, m,p,o-	µg/L	1.1	72	T1GW	<1.1
Xylene, o-	µg/L	0.5			<0.5

Christine Burke
Laboratory Manager

				Client I.D.	BH/MW 25
				Sample I.D.	23-008175-1
				Date Collected	2023-Apr-21
Parameter	**Units**	**R.L.**	**Limits**	**Reg 153 - Liquid**	-
PHC F1 (C6-C10)	µg/L	25	420	T1GW	<25
PHC F2 (>C10-C16)	µg/L	50	150	T1GW	<50
PHC F3 (>C16-C34)	µg/L	400	500	T1GW	<400
PHC F4 (>C34-C50)	µg/L	400	500	T1GW	<400

Reg 153 - Liquid: Reg 153 - Liquid
T1GW: R153 Tbl. 1 - GW

Christine Burke
Laboratory Manager

GENERAL SAMPLE SUBMISSION FORM

CADUCEON
ENVIRONMENTAL LABORATORIES
Client committed. Quality assured. Proudly Canadian.

SAMPLES SUBMITTED TO:

- Kingston ☐
- Ottawa ☐
- Richmond Hill ☐
- Barrie ☒
- Windsor ☐

TESTING REQUIREMENTS

- ☒ O'Reg 153/04 Table (1 - 9) ____
- ☐ O'Reg 406/19 Table (1 - 9.1) ____
- ☐ RPI
- ☐ Coarse
- ☐ MISA
- ☒ Other: Owen Sound Sewer By-Law
- ☐ ICC
- ☐ Medium/Fine
- ☒ PWQO
- Record of Site ____
- SPLP Table (1-9.1) ____
- ☐ Agricultural
- ☐ O'Reg 558 TCLP
- ☐ Landfill Monitoring

REPORT NUMBER (Lab Use)

23-008175

Are any samples to be submitted intended for Human Consumption under any Drinking Water Regulations? ☐ Yes ☑ No (If yes, submit all Drinking Water Samples on a Drinking Water Chain of Custody)

Organization: Tatham Engineering

Contact: ntrembley@tathameng.com

Tel: akimberley@tathameng.com

Fax:

Email: Kgardner@tathameng.com

Additional Info (email, cell, etc): jmiller@tathameng.com

Address: 41 King St. Barrie, ON.

Invoicing Address (if different):

Quote #: Q3091_Tatham

P.O. #:

Project Name or #: 121387-9th Ave E

Additional Info: Owen Sound, ON

ANALYSES REQUESTED: PWQO Metals; O.Reg 153/04; PHCs; VOCs; Owen Sound Sewer By-Law

Suspected Highly Contaminated

TURNAROUND SERVICE REQUESTED (see back page)
*Must be arranged in advance

- ☐ Platinum* 200% Surcharge
- ☐ Gold* 100% Surcharge
- ☐ Silver 50% Surcharge
- ☐ Bronze 25% Surcharge
- ☒ Standard 5-7 days
- ☐ Specific Date: ____

* Sample Matrix Legend: WW=Waste Water, SW=Surface Water, GW=Groundwater, LS=Liquid Sludge, SS=Solid Sludge, S=Soil, Sed=Sediment, PC=Paint Chips, F=Filter, Oil= Oil

Lab No.	Sample Source and/or Sample Identification	S.P.L. (Watertrax)	Sample Matrix *	Date Collected (yy-mm-dd)	Time Collected	PWQO Metals	O.Reg 153/04	PHCs	VOCs	Owen Sound Sewer By-Law	X	Field pH	Field Temp.	# Bottles/ Sample	Field Filtered Y/N
	BH/MW 25		GW	23-04-21	13:30	X	X	X	X	X				20	
				as per bottles ES 23-04-24											

gen chem + nut + CN + S_2 + phenols + 500mL Amber + 3x1L Amber → K
1x1L (PHC) → SGS

gen chem + metals(f) + CrVI(f) + Hg(f) → O
Vials → RH

gen chem(f) + Hg(f) + metals + CrVI extra → Barrie

SAMPLE SUBMISSION INFORMATION

	Sampled by:	Submitted by:
Print:	Noah Trembley	Noah Trembley
Sign:	NTrembley	NTrembley
Date (yy-mm-dd)/Time:	23-04-21	23-04-21

SHIPPING INFORMATION

- Courier (Client account) ☐
- Courier (Caduceon account) ☐
- Drop Off ☒
- Caduceon (Pick-up) ☐

Invoice

# of Pieces

REPORTING / INVOICING

- Report by Fax ☐
- Report by Email ☒
- Invoice by Email ☐
- Invoice by Mail ☐

SAMPLE RECEIVING INFORMATION (LABORATORY USE ONLY)

Received By (print): Madison

Signature: MB3

Date Received (yy-mm-dd): 23-04-22

Time Received: 11:30

Laboratory Prepared Bottles: ☑ Yes ☐ No

Sample Temperature °C: 12.6

Labeled by: AM

Comments:
- ~~Testing~~ according to quote referenced above: Q3091_Tatham. And email chain from April 17th, 2023 request

Page 1 of 1

G 115006

CofC, Oct 2021 Revision No: 24

Appendix F:
Water Taking Estimates

TATHAM ENGINEERING

Construction Dewatering Rate Estimate
Dupuit - Linear Flow

Phase 1

$$Q = Kx\frac{H^2 - h^2}{L_0}$$

Ground Elevation		247.3	m asl	BH/MW23
Highest Groundwater Elevation		247.4	m asl	BH/MW23 on 04/21/2023
Lowest Proposed Excavation		244.8	m asl	Assume 2.5 m inverts
Target Water Level		243.8	m asl	Assume 1 m of drawdown
Aquifer Bottom		243.8	m asl	
Hydraulic Conductivity	K	1.50E-06	m/s	
Length of Excavation	x	650	m	
Width of Excavation	a	4	m	
Calculated Parameters				
Water level above aquifer bottom	H	3.6	m	
Target water level above aquifer bottom	h	0	m	
Radius of Influence	R_0	13	m	
Length of Influence (L_0=R_0/2)	L_0	7	m	
Precipitation		26,000	L/day	
Construction Dewatering Flow Rate - Steady State	Q	**165,100**	L/day	
Maximum Construction Dewatering Flow Rate (safety factor of 2)	2Q	**330,200**	L/day	
Maximum Construction Dewatering Flow Rate (safety factor of 2) with 10 mm rainfall event	2Q	**356,200**	L/day	
Maximum Construction Dewatering Flow Rate (safety factor of 2) with 10 mm rainfall event per 100 m of trench	2Q	**54,800**	L/day/100 m	

Phase 2

$$Q = Kx\frac{H^2 - h^2}{L_0}$$

Ground Elevation		248.8	m asl	BH/MW14
Highest Groundwater Elevation		248.2	m asl	BH/MW14 on 02/13/2023
Lowest Proposed Excavation		246.3	m asl	Assume 2.5 m inverts
Target Water Level		245.3	m asl	Assume 1 m of drawdown
Aquifer Bottom		245.3	m asl	
Hydraulic Conductivity	K	1.50E-06	m/s	
Length of Excavation	x	860	m	
Width of Excavation	a	4	m	
Calculated Parameters				
Water level above aquifer bottom	H	2.9	m	
Target water level above aquifer bottom	h	0	m	
Radius of Influence	R_0	11	m	
Length of Influence ($L_0=R_0/2$)	L_0	5	m	
Precipitation		34,400	L/day	
Construction Dewatering Flow Rate - Steady State	Q	**175,900**	L/day	
Maximum Construction Dewatering Flow Rate (safety factor of 2)	2Q	**351,800**	L/day	
Maximum Construction Dewatering Flow Rate (safety factor of 2) with 10 mm rainfall event	2Q	**386,200**	L/day	
Maximum Construction Dewatering Flow Rate (safety factor of 2) with 10 mm rainfall event per 100 m of trench	2Q	**44,900**	L/day/100 m	

Construction Dewatering Rate Estimate
Dupuit - Linear Flow

Phase 3

$$Q = Kx\frac{H^2 - h^2}{L_0}$$

Ground Elevation		237.7	m asl	BH/MW9
Highest Groundwater Elevation		235.5	m asl	BH/MW9 on 02/13/2023
Lowest Proposed Excavation		234.2	m asl	Assume 3.5 m inverts
Target Water Level		233.2	m asl	Assume 1 m of drawdown
Aquifer Bottom		233.2	m asl	
Hydraulic Conductivity	K	1.50E-06	m/s	
Length of Excavation	x	1000	m	
Width of Excavation	a	4	m	
Calculated Parameters				
Water level above aquifer bottom	H	2.3	m	
Target water level above aquifer bottom	h	0	m	
Radius of Influence	R_0	8	m	
Length of Influence (L_0=R_0/2)	L_0	4	m	
Precipitation		40,000	L/day	
Construction Dewatering Flow Rate - Steady State	Q	**162,300**	L/day	
Maximum Construction Dewatering Flow Rate (safety factor of 2)	2Q	**324,600**	L/day	
Maximum Construction Dewatering Flow Rate (safety factor of 2) with 10 mm rainfall event	2Q	**364,600**	L/day	
Maximum Construction Dewatering Flow Rate (safety factor of 2) with 10 mm rainfall event per 100 m of trench	2Q	**36,460**	L/day/100 m	

Appendix G:
Water Taking Plan

Water Taking Plan

CONSTRUCTION DEWATERING DISCHARGE RATE AND ZONE OF INFLUENCE

The Radius of Influence (ROI) and temporary dewatering discharge rates were calculated in Section 5.1 and the details are summarized below:

ZONE	DESCRIPTION	ROI (m)	CONSTRUCTION DEWATERING FLOW RATE (L/day)	CONSTRUCTION DEWATERING FLOW RATE INLCUDING SAFETY FACTOR OF 2 AND A 10 mm RAIN EVENT (L/day)	CONSTRUCTION DEWATERING FLOW RATE INCLUDING SAFETY FACTOR OF 2 AND A 10 mm RAIN EVENT PER 100 m LENGTH TRENCH (L/day/100 m)
1	Phase 1	13	165,100	356,200	54,800
2	Phase 2	11	175,900	386,200	44,900
3	Phase 3	8	162,300	364,600	36,460

POTENTIAL SETTLEMENT AND MONITORING

Portion of the site is surrounded by residential, industrial and/or commercial structures. Some structure may lie within the dewatering ROI; therefore, there is the potential for settlement related impacts. Prior to construction dewatering, a settlement analysis is to be completed by the geotechnical engineer, to provide input on the recommended monitoring and/or mitigative actions (if any).

Another cause of significant dewatering related settlement is due to pumping of fines through the system. It is imperative any dewatering systems shall be designed and installed adequately to ensure no soil is conveyed through the system. Sufficient filtering techniques should be incorporated at the entry point to avoid migration of fines in the pumping and/or dewatering system. The turbidity of pumped water should be monitored daily to ensure the minimal fines are being conveyed.

POTENTIAL IMPACT ON OTHER WATER USERS

Temporary dewatering activities are not anticipated to impact any water well users as municipal water is available to the nearest neighboring properties, and the proposed development consists of relatively shallow works.

REDUCTION OF GROUNDWATER FLOW TO WATERBODIES

Given the short duration of the proposed construction dewatering and that the water removed will be returned back to the same watershed, dewatering activities are not anticipated to have negative impacts to the nearest waterbody.

WATER QUANTITY, QUALITY AND GROUNDWATER LEVEL MONITORING PROGRAM

Based on baseline groundwater quality analysis, elevated concentrations of Total Suspended Solids (TSS) and iron were noted with respect to the Owen Sound Sewer Use Bylaw Criteria and Provincial Water Quality Objectives (PWQO), respectively. As such the dewatering discharge can only be directed to the storm sewer and/or surface provided that a filtration system allows groundwater quality to meet the Owen Sound Sewer By-Law Criteria, Provincial Water Quality Objectives (PWQO), and the applicable O.Reg.153/04, as amended, Site Condition Standards.

It is recommended that discharge be treated by a sediment control facility such as sediment/ filtration bags or a decantation tank.

If water quality parameters exceed the City of Owen Sound Sewer By-Law Criteria and/or PWQO during construction dewatering, standard treatment options should be evaluated and/or the system should be shut down.

WATER QUALITY MONITORING AND POTENTIAL TREATMENT PLAN

The discharge and monitoring plan are detailed in Table G-1, below.

GROUNDWATER LEVEL MONITORING PROGRAM

The ground water level monitoring program is detailed in Table G-1, below.

DISCHARGE RATE MONITORING

Daily groundwater takings are to be measured and recorded using a flow measuring device during construction dewatering by the contractor, in accordance with O.Reg. 63/16. The total daily takings shall be recorded for the duration of the EASR and be submitted through the MECP online reporting system.

SUMMARY OF QUALIFICATIONS

Alicia Kimberley is a licensed professional geoscientist with a Bachelors and Masters degree in Earth Sciences from McMaster University and the University of Waterloo, respectively. She has twelve years of professional experience with geoenvironmental and hydrogeological assessments.

Her experiences include the design and execution of aquifer testing, in-situ groundwater sampling, groundwater modelling, and preparation of hydrogeological reports to support EASR registry.

Kimberly Gardner obtains a bachelor's degree in Environmental Engineering from the University of Guelph and is a registered Engineering Intern with PEO. She has over three years' experience with environmental and hydrogeological assessments. Her experiences include the completion of Phase One and Two Site Assessments and excess soil programs, field investigations (soil and groundwater sampling) and preparation of a variety of environmental/hydrogeological reports.

DATE OF PLAN PREPARATION

This plan was prepared on May 10, 2023.

Table G-1: Water Quality Monitoring Plan for Dewatering Discharge to Surface

PERIOD	MONITORING LOCATION	PARAMETERS	MONITORING FREQUENCY	TRIGGIER FOR MITIGATION	MITIGATION MEASURES/COMMENTS
Trial Dewatering	Dewatering Discharge	City of Owen Sound Sewer By-Law Criteria and PWQO Metals	Once during trial dewatering	Exceeds the City of Owen Sound Sewer By-Law Criteria and/or PWQO	Modify treatment method and/or shut down.
During Construction	Dewatering Discharge	City of Owen Sound Sewer By-Law Criteria and PWQO Metals	Weekly, then every four weeks after three consecutive weekly compliant samples	City of Owen Sound Sewer By-Law Criteria and/or PWQO	Modify/change treatment method and/or shut down.
		Turbidity	Daily until stable, then weekly. Minimum of five samples	Exceeds 15 NTU	
	Discharge Point	Impact Assessment	At each sampling event	Sedimentation, erosion	Reduce pumping and/or improve sediment/erosion control measures
	On-site monitoring wells	Water level meter	Every two weeks	Water level to be no more than 1 m lower than proposed depth of excavation	Reduce pumping

PERIOD	MONITORING LOCATION	PARAMETERS	MONITORING FREQUENCY	TRIGGIER FOR MITIGATION	MITIGATION MEASURES/COMMENTS
During Construction (cont'd)	Structures closest to the excavations 9th Avenue East	Settlement	Weekly (if needed)	Assessment by geotechnical engineer and/or structural engineer	Minimize the dewatering scope by reducing and/or staging the excavation or by installing a barrier. Alternatively other potential causes should be minimized.
Post Construction	On-site monitoring wells	Water level meter	Every two weeks for four weeks, then every four weeks until 90% recovery	Water level recovery less than 90% of baseline level	Continue monitoring

Appendix H:
Discharge Taking Plan

Discharge Taking Plan

CONSTRUCTION DEWATERING DISCHARGE RATE AND ZONE OF INFLUENCE

The Radius of Influence (ROI) and temporary dewatering discharge rates were calculated in Section 5.1 and the details are summarized below:

ZONE	DESCRIPTION	ROI (m)	CONSTRUCTION DEWATERING FLOW RATE (L/day)	CONSTRUCTION DEWATERING FLOW RATE INLCUDING SAFETY FACTOR OF 2 AND A 10 mm RAIN EVENT (L/day)	CONSTRUCTION DEWATERING FLOW RATE INCLUDING SAFETY FACTOR OF 2 AND A 10 mm RAIN EVENT PER 100 m LENGTH TRENCH (L/day/100 m)
1	Phase 1	13	165,100	356,200	54,800
2	Phase 2	11	175,900	386,200	44,900
3	Phase 3	8	162,300	364,600	36,460

PROPOSED DISCHARGE METHOD AND LOCATION

The preferred discharge location is the storm sewer and/or ground surface. The dewatering discharge will be transported by a hose and/or pipe to the treatment system. Following treatment at a filtration/silt bag or similar and/or sediment tank, the dewatering discharge will be transported by a hose/pipe to the preferred discharge location.

If significant rainfall events occur (including a 100-year storm event), the on-site excavation shall shutdown until storm water infiltration is reduced and the dewatering system can operate efficiently and accurately.

EROSION AND SEDIMENT CONTROL MEASURES

Sediment and erosion control measures will be setup on-site according to typical best management practices.

STATEMENTS

The Water Taking Plan included in Appendix G, including the water quantity and quality monitoring program shall be implemented at the site. No adverse effects on the environment is expected if the plan is adhered to.

SUMMARY OF QUALIFICATIONS

Alicia Kimberley is a licensed professional geoscientist with a Bachelors and Masters degree in Earth Sciences from McMaster University and the University of Waterloo, respectively. She has twelve years of professional experience with geoenvironmental and hydrogeological assessments.

Her experiences include the design and execution of aquifer testing, in-situ groundwater sampling, groundwater modelling, and preparation of hydrogeological reports to support EASR registry.

Kimberly Gardner obtains a bachelor's degree in Environmental Engineering from the University of Guelph and is a registered Engineering Intern with PEO. She has over three years' experience with environmental and hydrogeological assessments. Her experiences include the completion of Phase One and Two Site Assessments and excess soil programs, field investigations (soil and groundwater sampling) and preparation of a variety of environmental/hydrogeological reports.

DATE OF PLAN PREPARATION

This plan was prepared on May 10, 2023.

Appendix G:
Property Owner Consultation

TATHAM
ENGINEERING

115 Sandford Fleming Drive, Suite 200
Collingwood, Ontario L9Y 5A6

T 705-444-2565
E info@tathameng.com
tathameng.com

File 121387

June 7, 2022

Priya Siya Incorporated
485 9th Avenue East
Owen Sound, Ontario N4K 3E2

Re: 9th Avenue East Class Environmental Assessment, City of Owen Sound
Consultation with Key Property Owners

To Whom It May Concern:

The City of Owen Sound has initiated a Municipal Class Environmental Assessment (Class EA) to address infrastructure, road and sidewalk needs and deficiencies within the 9th Avenue East corridor. It is expected that the deficiencies will require repair, replacement and/or improvements to the following (subject to confirmation following engineering investigations and/or condition assessments):

- water distribution system from 100 metres south of Superior Street to 100 metres north of 9th Street East;
- storm sewer system between Superior Street and 9th Street East;
- sanitary sewer system between 7th Street East and 8th Street East;
- road system within the above noted limits; and
- sidewalk system within the above noted limits, including provision of new sidewalk on the west side of 9th Avenue East from 6th Street East to 8th Street East.

The purpose of this letter is to initiate dialogue with key property owners and provide more information on the next steps in the Class EA process (refer to the attached Notice of Study Commencement). We are beginning Phase 2 of the Class EA process: Identify and Evaluate Alternative Solutions, during which we will be hosting a Public Information Centre (PIC) to present the project, detail the development and evaluation of the alternative solutions, and seek stakeholder input. Additional details regarding the PIC will follow in a separate notice.

In the meantime, should you have any questions, comments or concerns regarding the project or the Class EA process, please do not hesitate to contact us (abrownridge@tathameng.com).

Yours truly,
Tatham Engineering Limited

Allan Brownridge, B.E.Sc., P.Eng.
Director, Manager - Municipal Engineering
MJF:rlh
Encl.

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TATHAM
ENGINEERING

115 Sandford Fleming Drive, Suite 200
Collingwood, Ontario L9Y 5A6

T 705-444-2565
E info@tathameng.com

tathameng.com

File 121387

June 7, 2022

Grey Bruce Health Services
1800 8th Street East
Owen Sound, Ontario N4K 6M9

Re: 9th Avenue East Class Environmental Assessment, City of Owen Sound
Consultation with Key Property Owners

To Whom It May Concern:

The City of Owen Sound has initiated a Municipal Class Environmental Assessment (Class EA) to address infrastructure, road and sidewalk needs and deficiencies within the 9th Avenue East corridor. It is expected that the deficiencies will require repair, replacement and/or improvements to the following (subject to confirmation following engineering investigations and/or condition assessments):

- water distribution system from 100 metres south of Superior Street to 100 metres north of 9th Street East;
- storm sewer system between Superior Street and 9th Street East;
- sanitary sewer system between 7th Street East and 8th Street East;
- road system within the above noted limits; and
- sidewalk system within the above noted limits, including provision of new sidewalk on the west side of 9th Avenue East from 6th Street East to 8th Street East.

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In the meantime, should you have any questions, comments or concerns regarding the project or the Class EA process, please do not hesitate to contact us (abrownridge@tathameng.com).

Yours truly,
Tatham Engineering Limited

Allan Brownridge, B.E.Sc., P.Eng.
Director, Manager - Municipal Engineering
MJF:rlh
Encl.

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TATHAM
ENGINEERING

115 Sandford Fleming Drive, Suite 200
Collingwood, Ontario L9Y 5A6

T 705-444-2565
E info@tathameng.com
tathameng.com

File 121387

June 7, 2022

Flato Owen Sound Community
3621 Highway 7 East, Suite 503
Markham, Ontario L3R 0G6

Re: 9th Avenue East Class Environmental Assessment, City of Owen Sound
Consultation with Key Property Owners

To Whom It May Concern:

The City of Owen Sound has initiated a Municipal Class Environmental Assessment (Class EA) to address infrastructure, road and sidewalk needs and deficiencies within the 9th Avenue East corridor. It is expected that the deficiencies will require repair, replacement and/or improvements to the following (subject to confirmation following engineering investigations and/or condition assessments):

- water distribution system from 100 metres south of Superior Street to 100 metres north of 9th Street East;
- storm sewer system between Superior Street and 9th Street East;
- sanitary sewer system between 7th Street East and 8th Street East;
- road system within the above noted limits; and
- sidewalk system within the above noted limits, including provision of new sidewalk on the west side of 9th Avenue East from 6th Street East to 8th Street East.

The purpose of this letter is to initiate dialogue with key property owners and provide more information on the next steps in the Class EA process (refer to the attached Notice of Study Commencement). We are beginning Phase 2 of the Class EA process: Identify and Evaluate Alternative Solutions, during which we will be hosting a Public Information Centre (PIC) to present the project, detail the development and evaluation of the alternative solutions, and seek stakeholder input. Additional details regarding the PIC will follow in a separate notice.

In the meantime, should you have any questions, comments or concerns regarding the project or the Class EA process, please do not hesitate to contact us (abrownridge@tathameng.com).

Yours truly,
Tatham Engineering Limited

Allan Brownridge

Allan Brownridge, B.E.Sc., P.Eng.
Director, Manager - Municipal Engineering
MJF:rlh
Encl.

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TATHAM
ENGINEERING

115 Sandford Fleming Drive, Suite 200
Collingwood, Ontario L9Y 5A6

T 705-444-2565
E info@tathameng.com
tathameng.com

File 121387

June 7, 2022

Canada Bread Company Limited
c/o Corporate Foods Limited
10 Four Seasons Place
Etobicoke, Ontario M9B 6H7

Re: 9th Avenue East Class Environmental Assessment, City of Owen Sound
Consultation with Key Property Owners

To Whom It May Concern:

The City of Owen Sound has initiated a Municipal Class Environmental Assessment (Class EA) to address infrastructure, road and sidewalk needs and deficiencies within the 9th Avenue East corridor. It is expected that the deficiencies will require repair, replacement and/or improvements to the following (subject to confirmation following engineering investigations and/or condition assessments):

- water distribution system from 100 metres south of Superior Street to 100 metres north of 9th Street East;
- storm sewer system between Superior Street and 9th Street East;
- sanitary sewer system between 7th Street East and 8th Street East;
- road system within the above noted limits; and
- sidewalk system within the above noted limits, including provision of new sidewalk on the west side of 9th Avenue East from 6th Street East to 8th Street East.

The purpose of this letter is to initiate dialogue with key property owners and provide more information on the next steps in the Class EA process (refer to the attached Notice of Study Commencement). We are beginning Phase 2 of the Class EA process: Identify and Evaluate Alternative Solutions, during which we will be hosting a Public Information Centre (PIC) to present the project, detail the development and evaluation of the alternative solutions, and seek stakeholder input. Additional details regarding the PIC will follow in a separate notice.

In the meantime, should you have any questions, comments or concerns regarding the project or the Class EA process, please do not hesitate to contact us (abrownridge@tathameng.com).

Yours truly,
Tatham Engineering Limited

Allan Brownridge, B.E.Sc., P.Eng.
Director, Manager - Municipal Engineering
MJF:rlh
Encl.

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TATHAM ENGINEERING

115 Sandford Fleming Drive, Suite 200
Collingwood, Ontario L9Y 5A6

T 705-444-2565
E info@tathameng.com
tathameng.com

File 121387

May 25, 2022

Yusheng Zhao & Amy Yongmei Guo
1150 Superior Street
Owen Sound, Ontario N4K 5N8

Re: 9th Avenue East Class Environmental Assessment, City of Owen Sound
Consultation with Key Property Owners

To Whom It May Concern:

The City of Owen Sound has initiated a Municipal Class Environmental Assessment (Class EA) to address infrastructure, road and sidewalk needs and deficiencies within the 9th Avenue East corridor. It is expected that the deficiencies will require repair, replacement and/or improvements to the following (subject to confirmation following engineering investigations and/or condition assessments):

- water distribution system from 100 metres south of Superior Street to 100 metres north of 9th Street East;
- storm sewer system between Superior Street and 9th Street East;
- sanitary sewer system between 7th Street East and 8th Street East;
- road system within the above noted limits; and
- sidewalk system within the above noted limits, including provision of new sidewalk on the west side of 9th Avenue East from 6th Street East to 8th Street East.

The purpose of this letter is to initiate dialogue with key property owners and provide more information on the next steps in the Class EA process (refer also to the attached Notice of Study Commencement). We are beginning Phase 2 of the Class EA process, the intent of which is to identify and evaluate alternative solutions to address the noted deficiencies. While most of the alternative solutions will be contained within existing municipal road allowances, one solution for the water distribution system is to implement a looping watermain between 8th Street East and Superior Street (watermain loops provide necessary redundancy in case of system issues) which may require watermain to be installed on private property within dedicated easements.

To appropriately identify and evaluate any potential environmental impacts to the affected properties (which includes 1150 Superior Street) it is necessary to undertake a site investigation to document and characterize the existing field conditions (eg. topography, flora and fauna, wildlife, natural features and

habitat, etc.) which will be considered in the subsequent evaluation. The site investigation will include 2 to 3 site visits/walks (corresponding to spring, summer and/or fall seasons) undertaken by a natural environment scientist to facilitate the necessary observations – there will be no need for vehicle access, disturbance to existing conditions, etc.

To complete the investigation, we will require access to your property and thus would appreciate confirmation of same. Please contact the undersigned via email at abrownridge@tathameng.com to confirm access and coordinate the necessary investigations accordingly. We welcome any further questions, comments or concerns that you may have at this time and note that a formal Public Information Centre (PIC) will be hosted in the future (for which a separate notification will be provided).

Yours truly,
Tatham Engineering Limited

Allan Brownridge, B.E.Sc., P.Eng.
Director, Manager - Municipal Engineering
MJF:rlh

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TATHAM
ENGINEERING

115 Sandford Fleming Drive, Suite 200
Collingwood, Ontario L9Y 5A6

T 705-444-2565
E info@tathameng.com

tathameng.com

File 121387

May 25, 2022

White Owl Properties Limited
180 Renfrew Drive
Unit 120
Markham, Ontario L3R 9Z2

Re: 9th Avenue East Class Environmental Assessment, City of Owen Sound
Consultation with Key Property Owners

To Whom It May Concern:

The City of Owen Sound has initiated a Municipal Class Environmental Assessment (Class EA) to address infrastructure, road and sidewalk needs and deficiencies within the 9th Avenue East corridor. It is expected that the deficiencies will require repair, replacement and/or improvements to the following (subject to confirmation following engineering investigations and/or condition assessments):

- water distribution system from 100 metres south of Superior Street to 100 metres north of 9th Street East;
- storm sewer system between Superior Street and 9th Street East;
- sanitary sewer system between 7th Street East and 8th Street East;
- road system within the above noted limits; and
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Director, Manager - Municipal Engineering
MJF:rlh

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TATHAM
ENGINEERING

115 Sandford Fleming Drive, Suite 200
Collingwood, Ontario L9Y 5A6

T 705-444-2565
E info@tathameng.com

tathameng.com

File 121387

May 25, 2022

Hydro One Networks Incorporated
Assessment & Taxation Real Estate
185 Clegg Road
Markham, Ontario L6G 1B7

Re: 9th Avenue East Class Environmental Assessment, City of Owen Sound
Consultation with Key Property Owners

To Whom It May Concern:

The City of Owen Sound has initiated a Municipal Class Environmental Assessment (Class EA) to address infrastructure, road and sidewalk needs and deficiencies within the 9th Avenue East corridor. It is expected that the deficiencies will require repair, replacement and/or improvements to the following (subject to confirmation following engineering investigations and/or condition assessments):

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MJF:rlh

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TATHAM
ENGINEERING

115 Sandford Fleming Drive, Suite 200
Collingwood, Ontario L9Y 5A6

T 705-444-2565
E info@tathameng.com
tathameng.com

File 121387

May 25, 2022

Grey County
c/o County Clerk
595 9th Avenue East
Owen Sound, Ontario N4K 3E3

Re: 9th Avenue East Class Environmental Assessment, City of Owen Sound
Consultation with Key Property Owners

To Whom It May Concern:

The City of Owen Sound has initiated a Municipal Class Environmental Assessment (Class EA) to address infrastructure, road and sidewalk needs and deficiencies within the 9th Avenue East corridor. It is expected that the deficiencies will require repair, replacement and/or improvements to the following (subject to confirmation following engineering investigations and/or condition assessments):

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Director, Manager - Municipal Engineering
MJF:rlh

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TATHAM
ENGINEERING

115 Sandford Fleming Drive, Suite 200
Collingwood, Ontario L9Y 5A6

T 705-444-2565
E info@tathameng.com
tathameng.com

File 121387

June 7, 2022

Great Lakes Management Incorporated
8 Automatic Road
Brampton, Ontario L6S 5N4

Re: 9th Avenue East Class Environmental Assessment, City of Owen Sound
Consultation with Key Property Owners

To Whom It May Concern:

The City of Owen Sound has initiated a Municipal Class Environmental Assessment (Class EA) to address infrastructure, road and sidewalk needs and deficiencies within the 9th Avenue East corridor. It is expected that the deficiencies will require repair, replacement and/or improvements to the following (subject to confirmation following engineering investigations and/or condition assessments):

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In the meantime, should you have any questions, comments or concerns regarding the project or the Class EA process, please do not hesitate to contact us (abrownridge@tathameng.com).

Yours truly,
Tatham Engineering Limited

Allan Brownridge, B.E.Sc., P.Eng.
Director, Manager - Municipal Engineering
MJF:rlh
Encl.

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TATHAM ENGINEERING

115 Sandford Fleming Drive, Suite 200
Collingwood, Ontario L9Y 5A6

T 705-444-2565
E info@tathameng.com
tathameng.com

File 121387

June 7, 2022

Ashlar Holdings Incorporated
300 Raglan Street
Collingwood, Ontario   L9Y 3Z1

Re: 9th Avenue East Class Environmental Assessment, City of Owen Sound
Consultation with Key Property Owners

To Whom It May Concern:

The City of Owen Sound has initiated a Municipal Class Environmental Assessment (Class EA) to address infrastructure, road and sidewalk needs and deficiencies within the 9th Avenue East corridor. It is expected that the deficiencies will require repair, replacement and/or improvements to the following (subject to confirmation following engineering investigations and/or condition assessments):

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Encl.

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TATHAM
ENGINEERING

115 Sandford Fleming Drive, Suite 200
Collingwood, Ontario L9Y 5A6

T 705-444-2565
E info@tathameng.com
tathameng.com

File 121387

May 25, 2022

2779300 Ontario Incorporated
159 Galbraith Crescent
Markham, Ontario L3S 1H5

Re: 9th Avenue East Class Environmental Assessment, City of Owen Sound
Consultation with Key Property Owners

To Whom It May Concern:

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Director, Manager - Municipal Engineering
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TATHAM
ENGINEERING

115 Sandford Fleming Drive, Suite 200
Collingwood, Ontario L9Y 5A6

T 705-444-2565
E info@tathameng.com
tathameng.com

File 121387

June 7, 2022

2736003 Ontario Incorporated
250 10th Street West
Owen Sound, Ontario N4K 3R3

Re: 9th Avenue East Class Environmental Assessment, City of Owen Sound
Consultation with Key Property Owners

To Whom It May Concern:

The City of Owen Sound has initiated a Municipal Class Environmental Assessment (Class EA) to address infrastructure, road and sidewalk needs and deficiencies within the 9th Avenue East corridor. It is expected that the deficiencies will require repair, replacement and/or improvements to the following (subject to confirmation following engineering investigations and/or condition assessments):

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Yours truly,
Tatham Engineering Limited

Allan Brownridge

Allan Brownridge, B.E.Sc., P.Eng.
Director, Manager - Municipal Engineering
MJF:rlh
Encl.

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TATHAM
ENGINEERING

115 Sandford Fleming Drive, Suite 200
Collingwood, Ontario L9Y 5A6

T 705-444-2565
E info@tathameng.com
tathameng.com

File 121387

June 7, 2022

1828915 Ontario Incorporated
23 Locksley Place
Brampton, Ontario L6S 2P6

Re: 9th Avenue East Class Environmental Assessment, City of Owen Sound
Consultation with Key Property Owners

To Whom It May Concern:

The City of Owen Sound has initiated a Municipal Class Environmental Assessment (Class EA) to address infrastructure, road and sidewalk needs and deficiencies within the 9th Avenue East corridor. It is expected that the deficiencies will require repair, replacement and/or improvements to the following (subject to confirmation following engineering investigations and/or condition assessments):

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Director, Manager - Municipal Engineering
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Appendix H:
Operations Committee Presentation

9TH AVENUE EAST LOOPING WATERMAIN

OPERATIONS COMMITTEE PROJECT UPDATE

April 20, 2023

AGENDA

- Project Contacts
- Project Objective
- Project Limits
- Phase 1
- Phase 2
- Phase 3
- Questions

Project Contacts

Chris Webb, P.Eng.

Mgr of Engineering Services
City of Owen Sound
(519) 376-1440, ext. 3300
cwebb@owensound.ca

Mark Figueroa, EIT

Project Manager
Tatham Engineering Limited
(705) 444-2565, ext. 2142
mfigueroa@tathameng.com

Project Objective

- Address existing needs and deficiencies in the project area in relation to:
  - Underground infrastructure
  - Road
  - Sidewalks

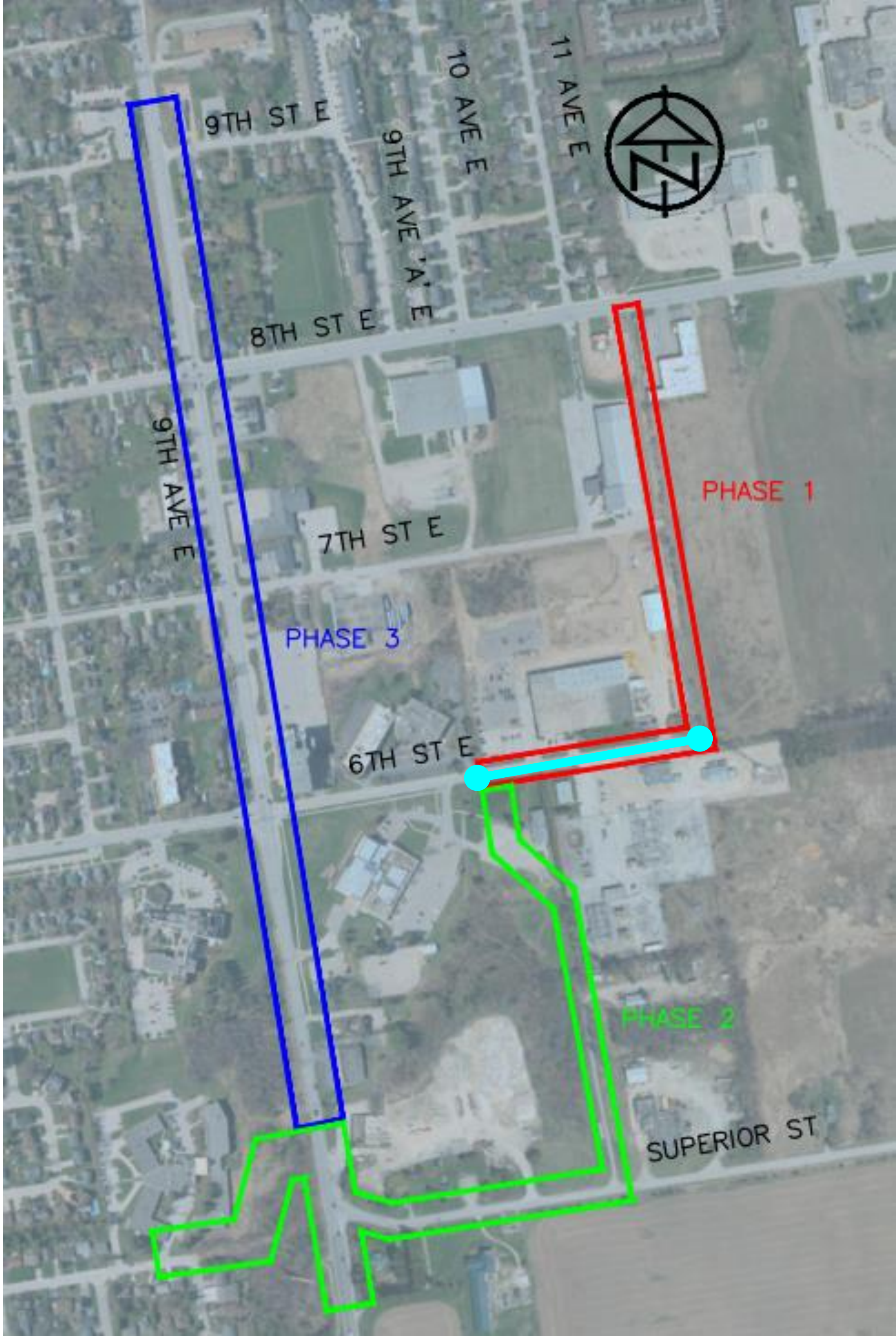
- Improve the overall reliability of the City’s water distribution system

Project Limits

Phase 1

Scope of Work

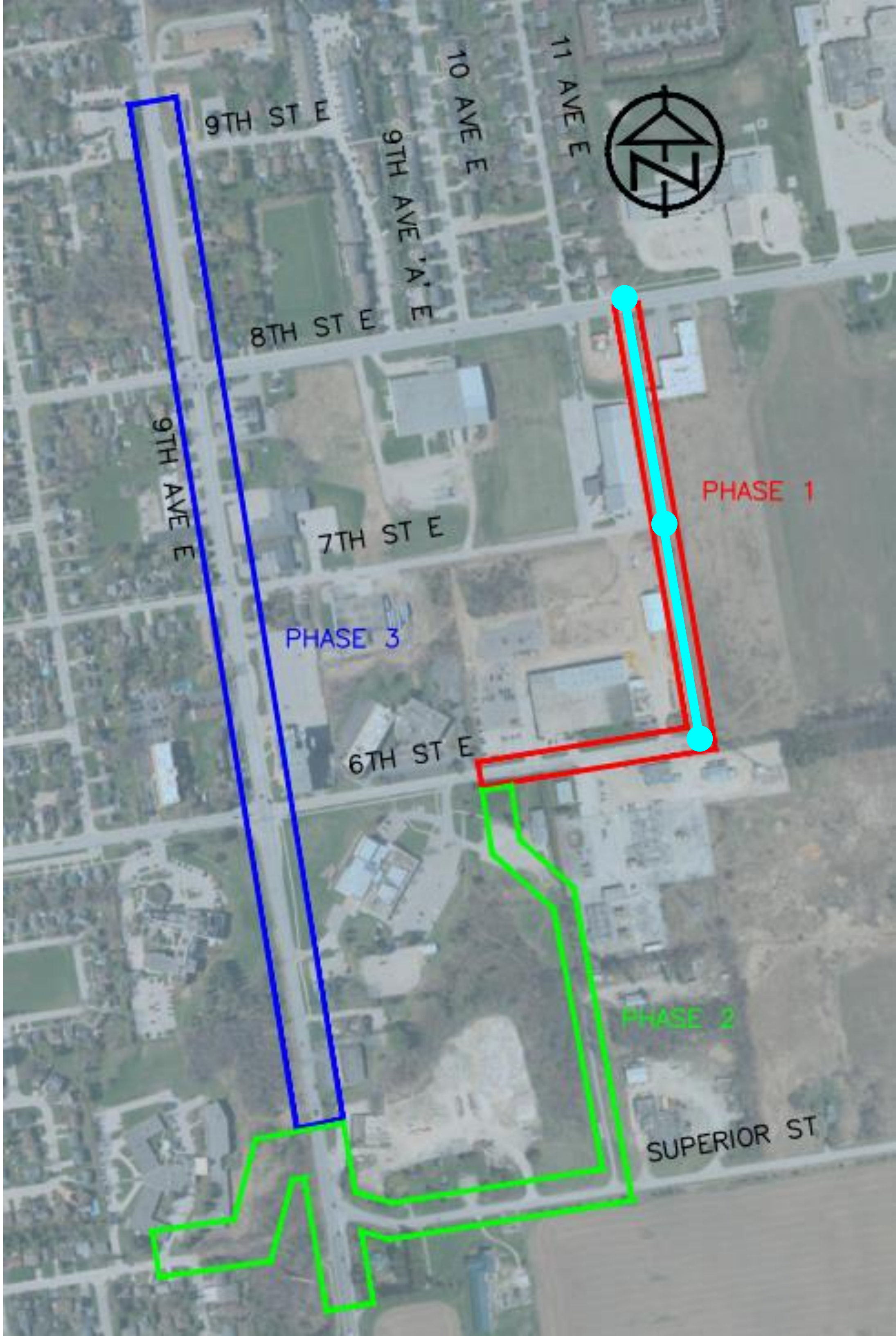
- REPLACE deteriorated watermain on 6th Street East
  - from dead end
  - to future south looping watermain connection
  - length: 200 metres



Phase 1

Scope of Work

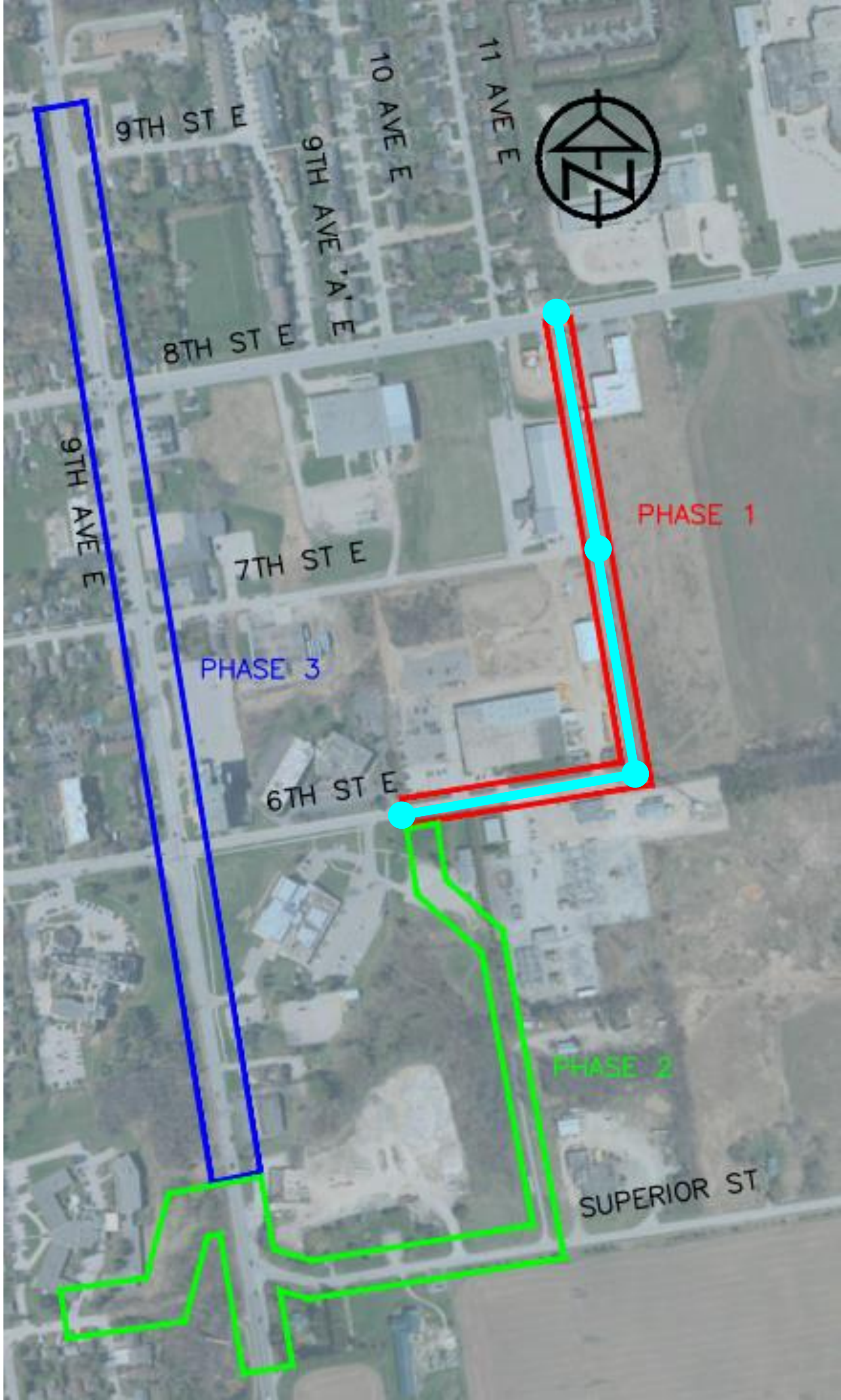
- NEW watermain in City-owned utility corridor
  - from 6th Street East
  - to 8th Street East
  - connection to 7th Street East dead end
  - length: 420 metres



Phase 1

What does this accomplish?

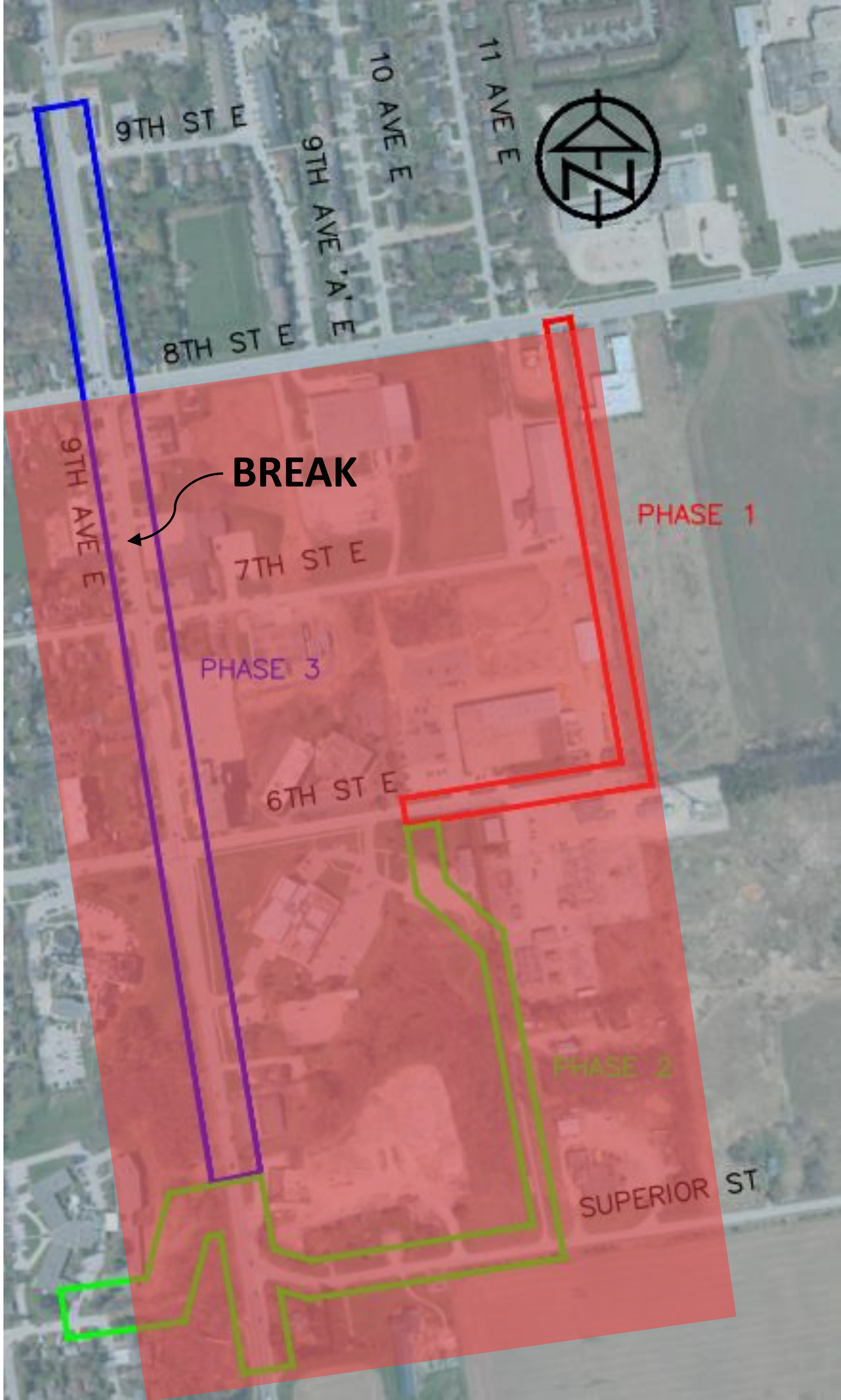
- Improves reliability of water supply on 9th Avenue East
- Limits outages to several hotels, commercial and institutional buildings on 9th Avenue East



Phase 1

What does this accomplish?

- With the current system, a watermain break on 9th Avenue East south of 8th Street East will interrupt water service for all properties south of the break



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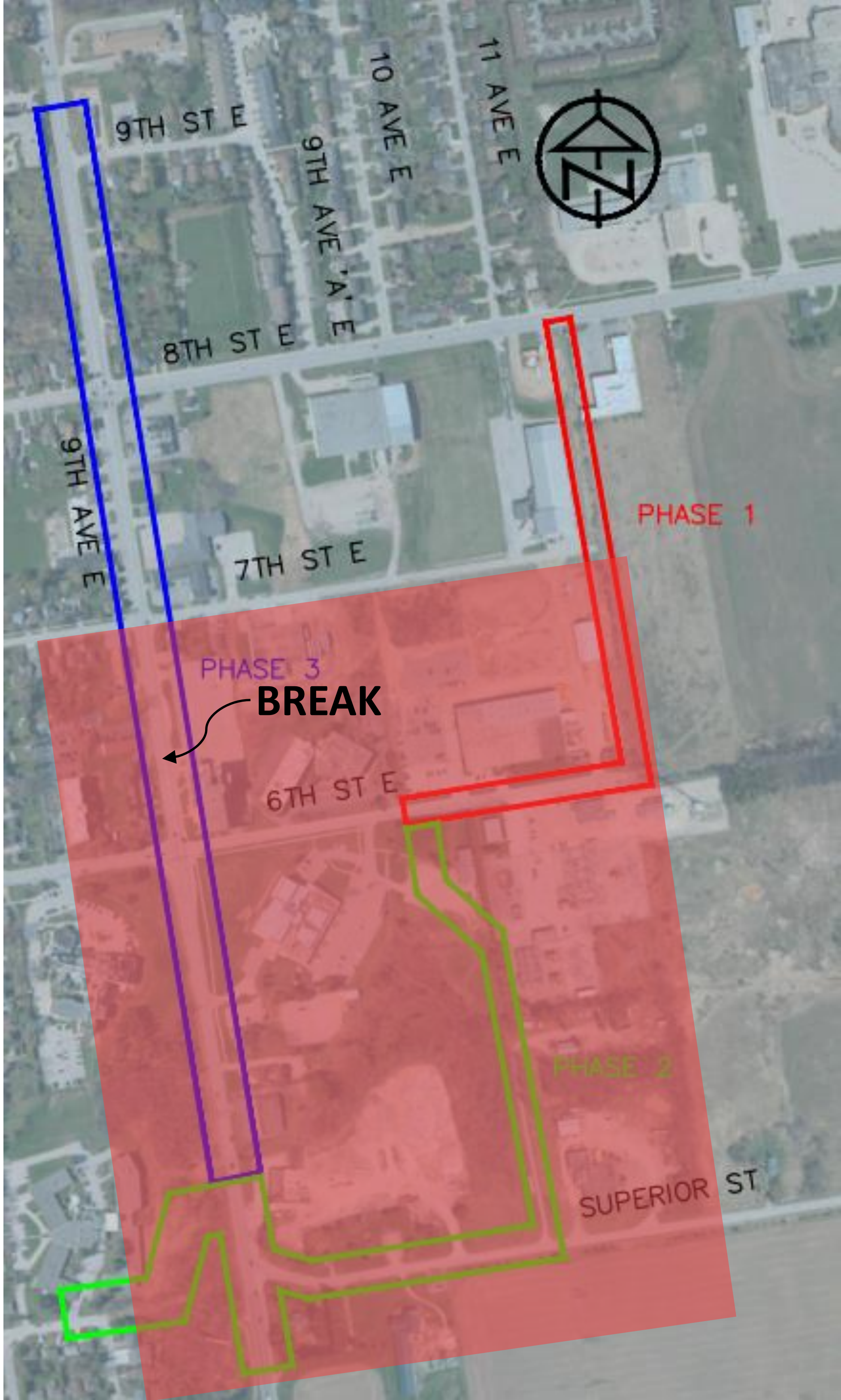

Phase 1

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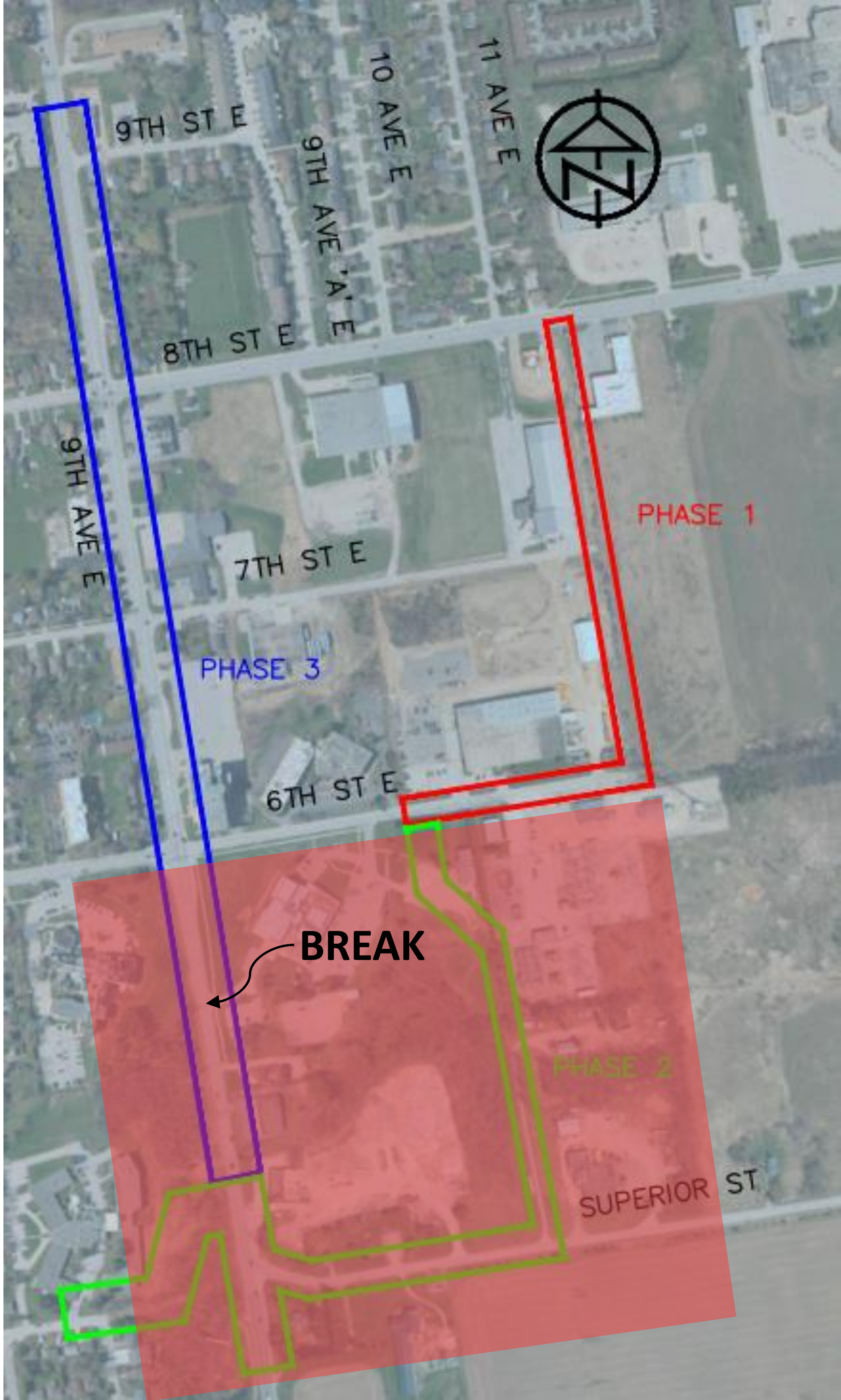
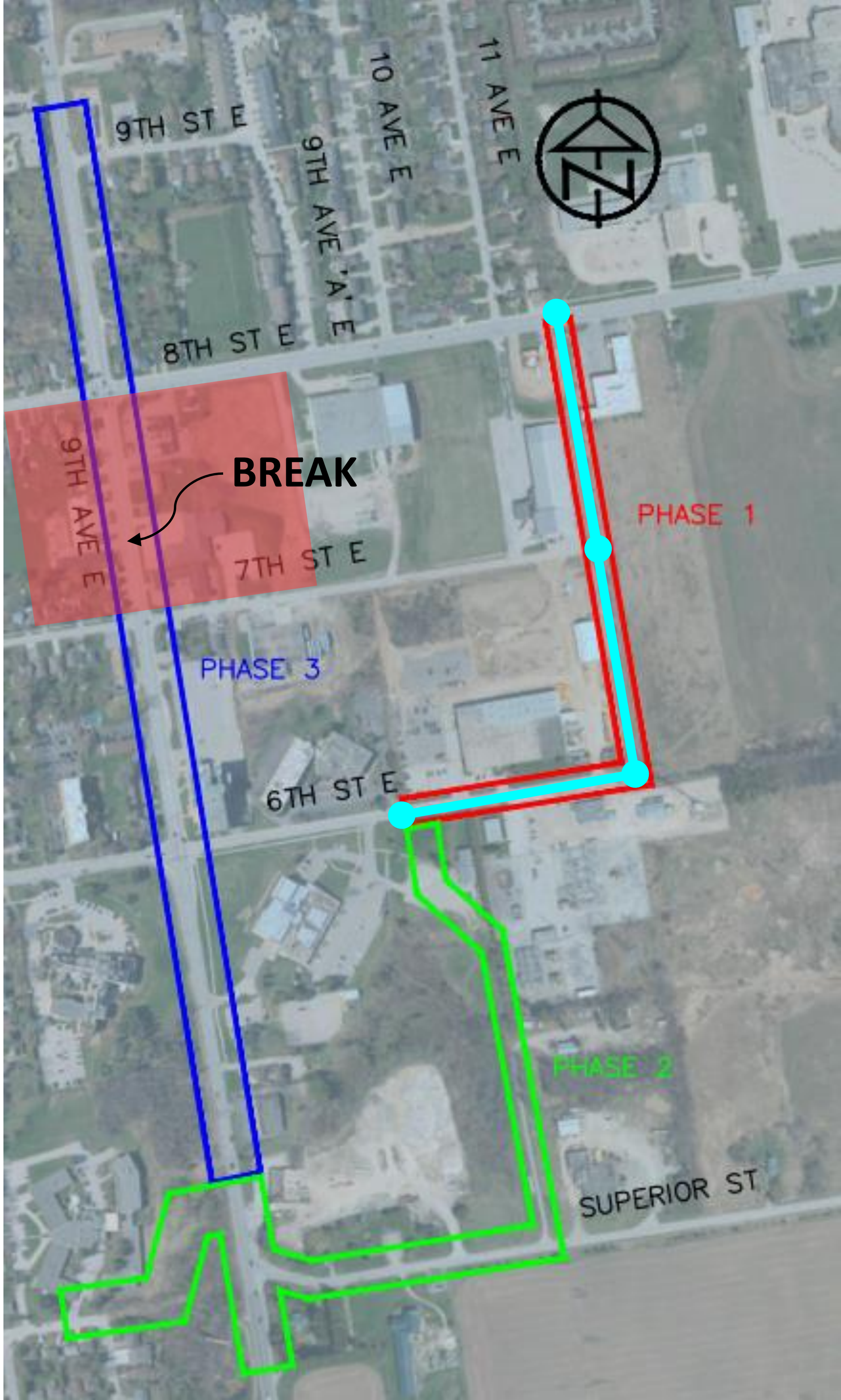
- With the current system, a watermain break on 9th Avenue East south of 8th Street East will interrupt water service for all properties south of the break



Phase 1

What does this accomplish?

- With the Phase 1 loop, only properties in the block with the break will experience water service interruptions



Phase 1

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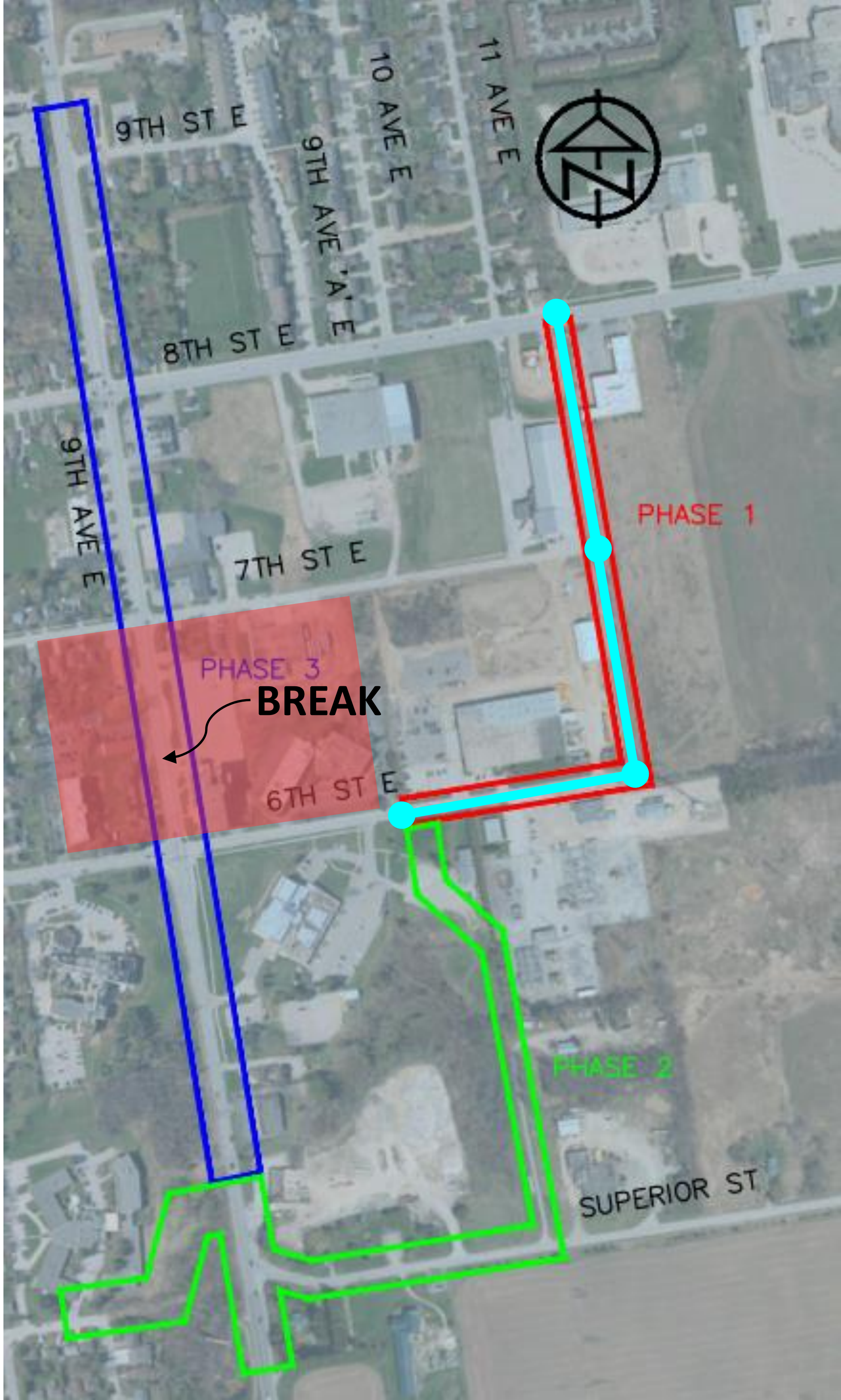
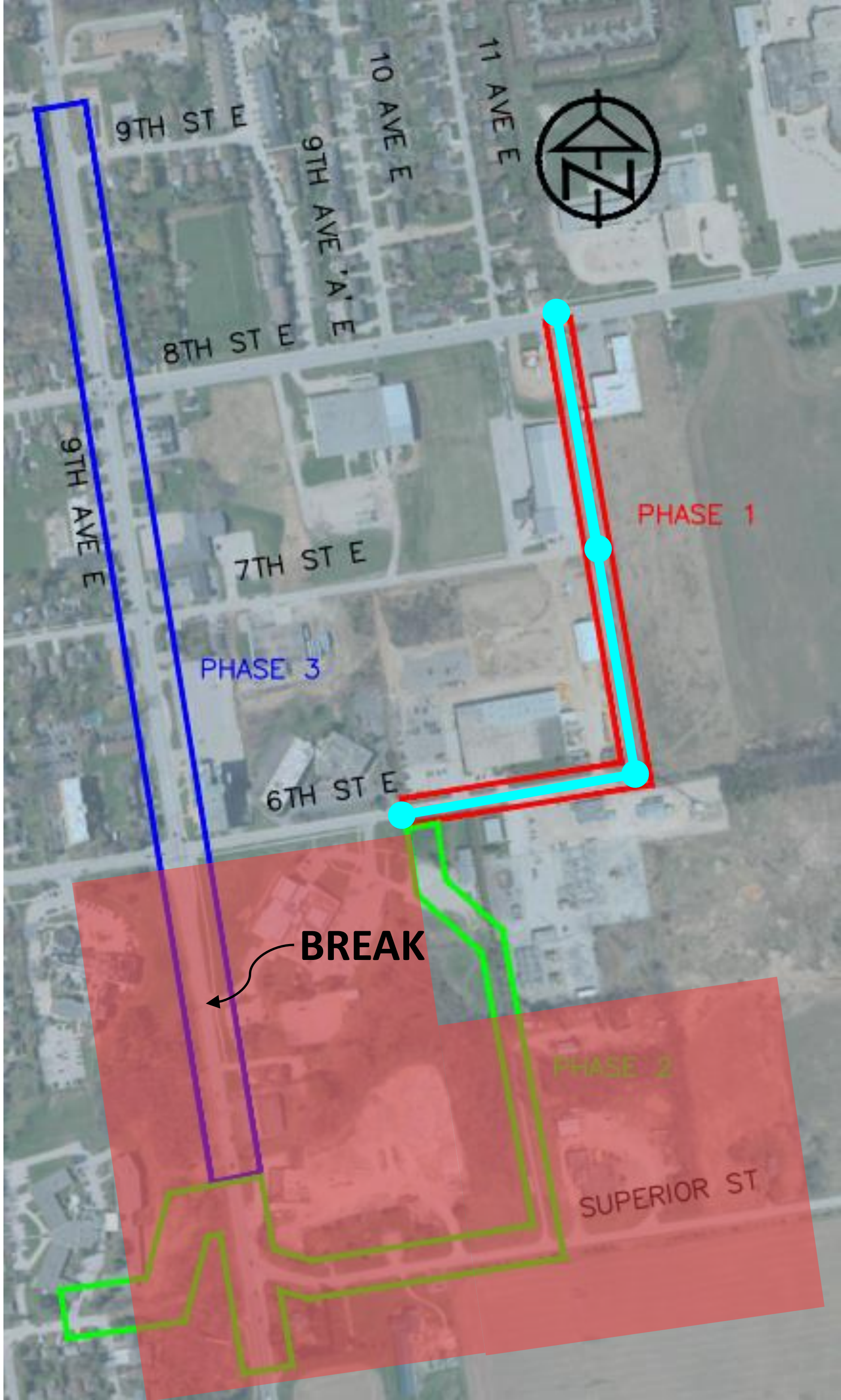


Phase 1

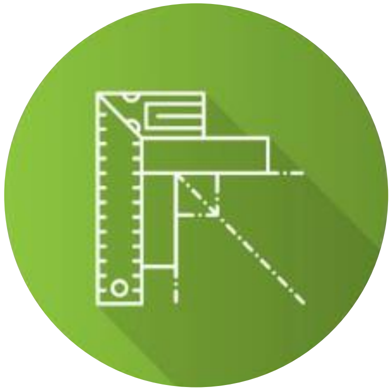
What does this accomplish?

- With the Phase 1 loop, only properties in the block with the break will experience water service interruptions



Phase 1

Schedule

Engineering Design	Tender Period	Construction Period
		
Complete	April 2023	July to Sept 2023

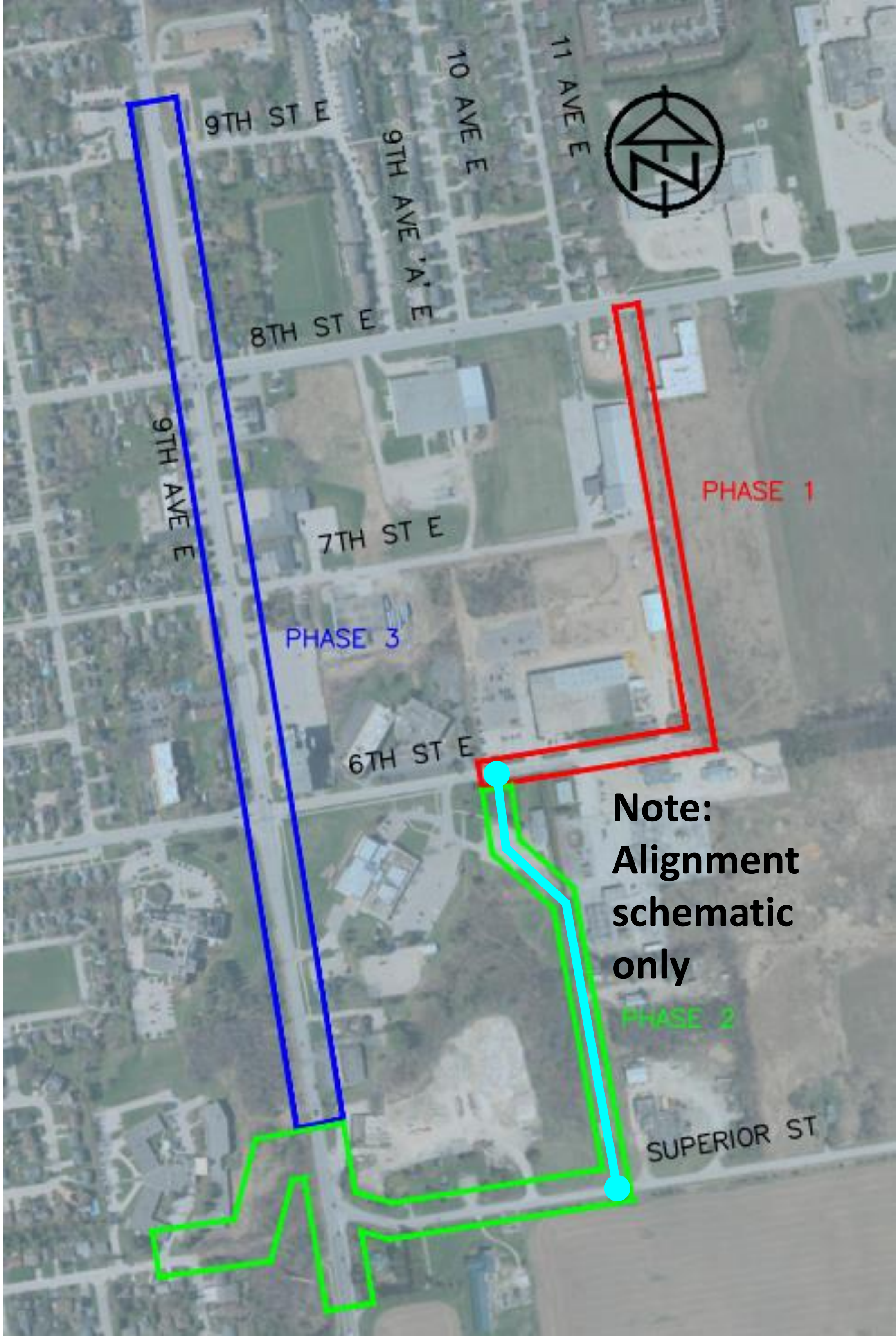
Construction Cost

- Engineer’s estimate available from City staff

Phase 2

Scope of Work

- NEW watermain loop to complete the loop
    - from 6th Street East
    - to Superior Street
    - length: 420 metres
- Undertake a Schedule B Class EA
    - new alignment
    - to be located on non-City owned property



Note: Alignment schematic only

Phase 2

Schedule B Class EA Status

- Background info collected
  - topographic survey
  - geotechnical investigation
  - Environmental Impact Study
- Reviewing 5 potential alignments

- City in discussions with property owners for easements
  - 595 9th Avenue East
  - 1010 Superior Street

Phase 2

Scope of Work

- REPLACE and UPSIZE watermain on Superior Street
  - from dead end
  - to 9th Avenue East
  - length: 280 metres

Phase 2

Scope of Work

- ABANDON watermain on private property
  - 143006 Superior Street
- NEW connection
  - to 9th Avenue East

Phase 2

Scope of Work

- REPLACE and UPSIZE watermain
    - from 9th Avenue East
    - to 8th Avenue 'B' East/4th Street East
    - length: 160 metres

Phase 2

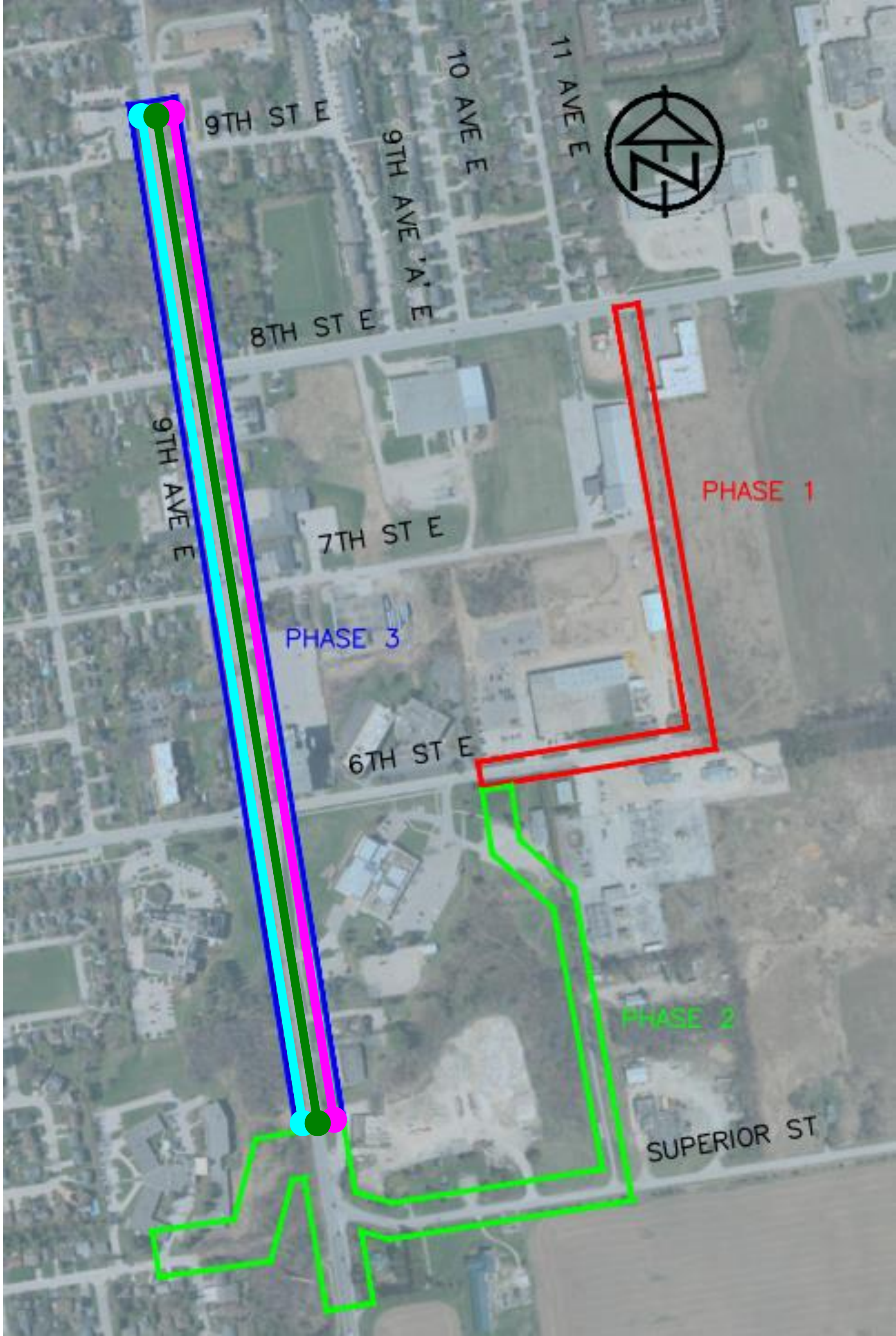
Schedule

Public Consultation	Engineering Design	Tender Period	Construction Period
Summer 2023	Fall 2023	Winter 2024	Summer 2024

Phase 3

Scope of Work

- REPLACE distribution watermain
- REPLACE or RELINE sanitary sewer (localized areas only)
- REPLACE all water and sanitary services
- REPLACE storm sewer



Phase 3

Scope of Work

- REPLACE road asphalt
- REPLACE guiderail
- REPLACE sidewalk (localized areas only)

Phase 3

Schedule

Engineering Design

2024

Tender Period

Late 2024

Construction Period

2025 to 2026

Note: Tender and construction periods subject to MTO Connecting Link funding

QUESTIONS

Appendix I:
Public Information Centre Presentation

9^{TH} AVENUE EAST LOOPING WATERMAIN

SCHEDULE B CLASS EA - PUBLIC INFORMATION CENTRE

November 16, 2023

AGENDA

- Project Contacts
- Study Area
- Class EA Overview
- Problem/Opportunity Statement
- Class EA Schedules
- Background Studies/Investigations
- Alternative Solutions
- Implementation Schedule
- Questions

Project Contacts

where you *want* to live

Chris Webb, P.Eng.

Mgr of Engineering Services
City of Owen Sound
(519) 376-1440 ext. 3300
cwebb@owensound.ca

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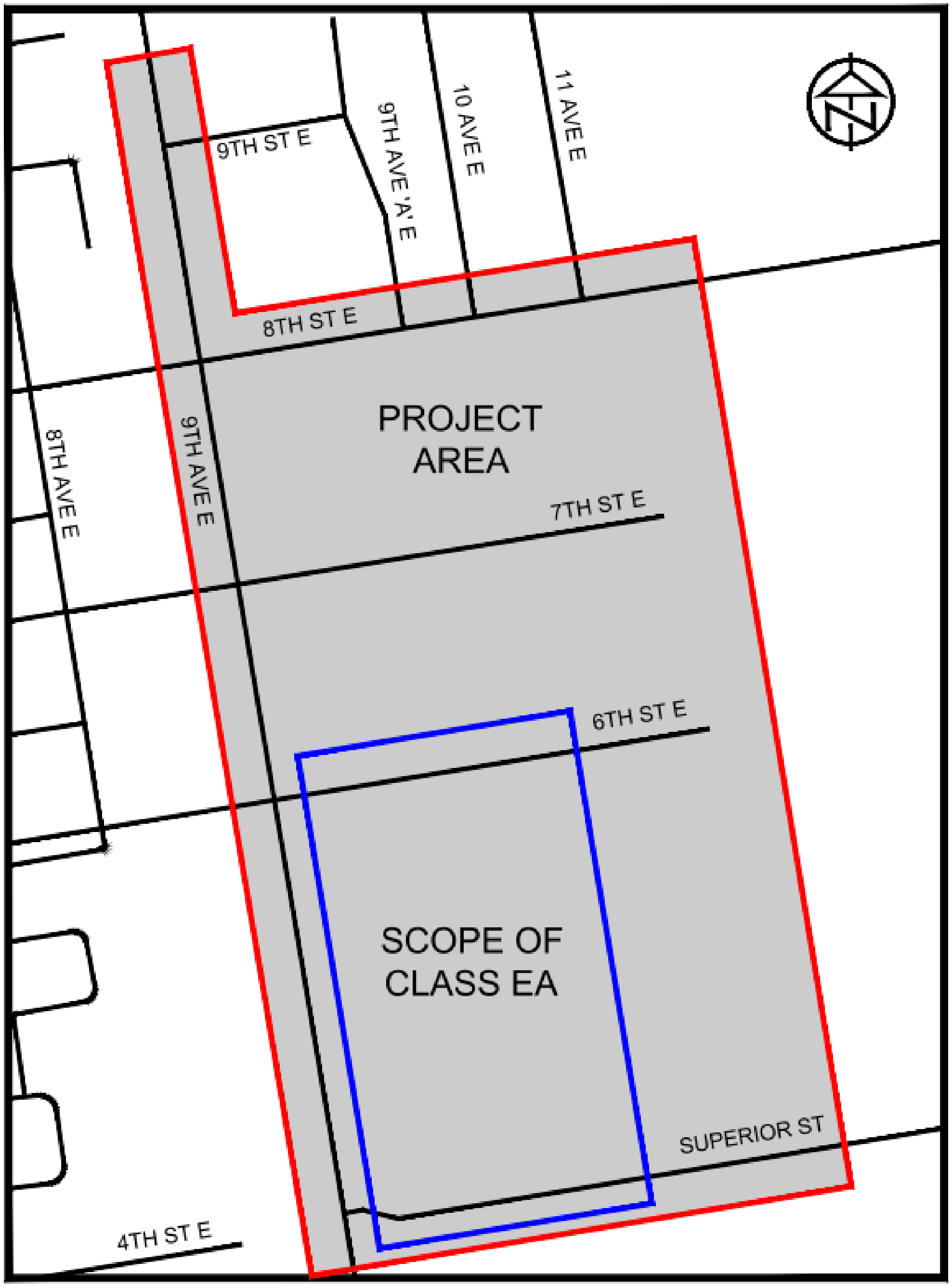
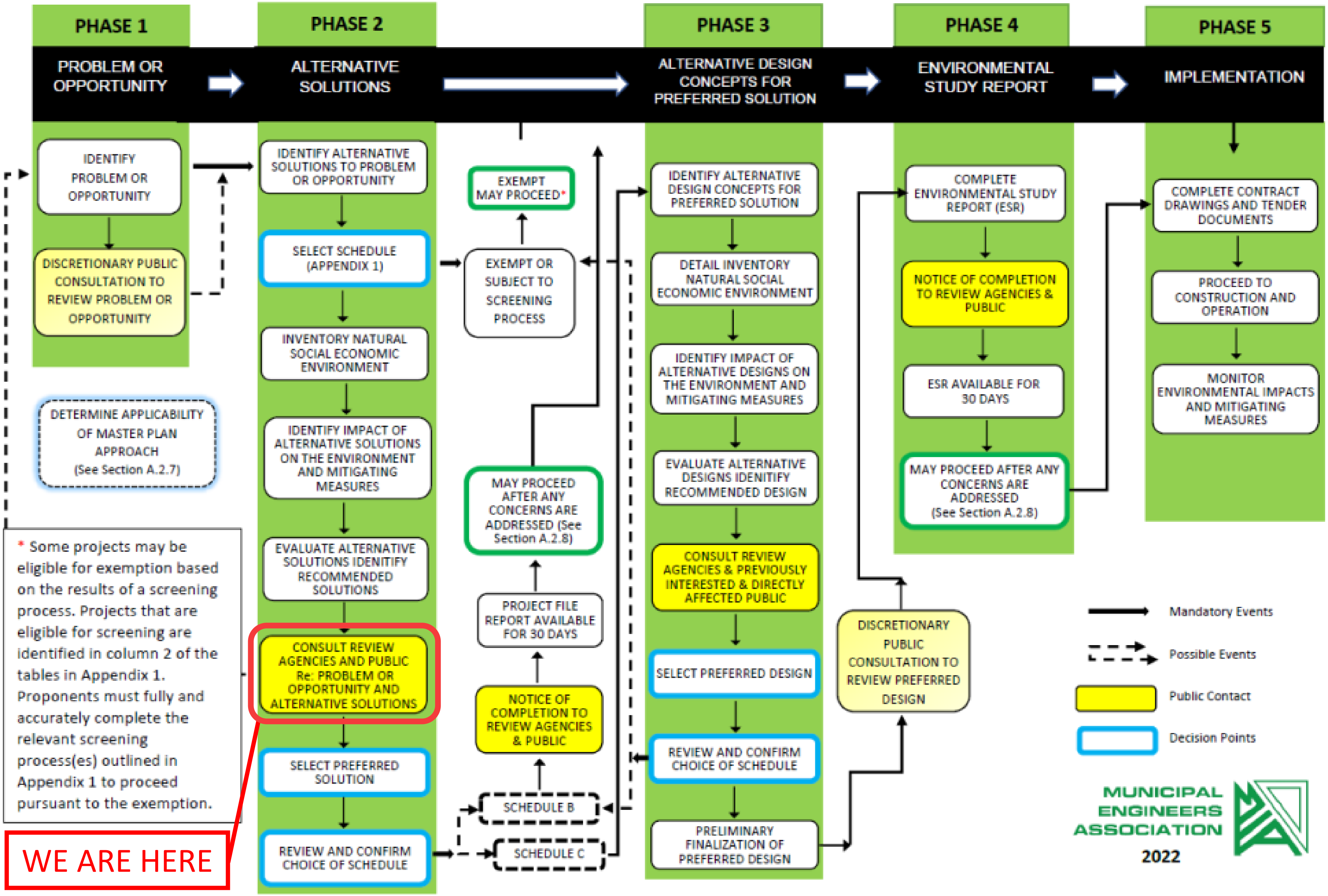
Project Manager
Tatham Engineering Limited
(705) 444-2565 ext. 2142
mfigueroa@tathameng.com

Study Area


9TH ST E
9TH AVE 'A' E
10 AVE E
11 AVE E
8TH ST E
PROJECT AREA
8TH AVE E
9TH AVE E
7TH ST E
6TH ST E
SCOPE OF CLASS EA
SUPERIOR ST
4TH ST E
N

Class EA Overview



PHASE 1

PROBLEM OR OPPORTUNITY

- IDENTIFY PROBLEM OR OPPORTUNITY
- DISCRETIONARY PUBLIC CONSULTATION TO REVIEW PROBLEM OR OPPORTUNITY

DETERMINE APPLICABILITY OF MASTER PLAN APPROACH (See Section A.2.7)

PHASE 2

ALTERNATIVE SOLUTIONS

- IDENTIFY ALTERNATIVE SOLUTIONS TO PROBLEM OR OPPORTUNITY
- SELECT SCHEDULE (APPENDIX 1)
- INVENTORY NATURAL SOCIAL ECONOMIC ENVIRONMENT
- IDENTIFY IMPACT OF ALTERNATIVE SOLUTIONS ON THE ENVIRONMENT AND MITIGATING MEASURES
- EVALUATE ALTERNATIVE SOLUTIONS IDENITIFY RECOMMENDED SOLUTIONS
- CONSULT REVIEW AGENCIES AND PUBLIC Re: PROBLEM OR OPPORTUNITY AND ALTERNATIVE SOLUTIONS
- SELECT PREFERRED SOLUTION
- REVIEW AND CONFIRM CHOICE OF SCHEDULE

EXEMPT OR SUBJECT TO SCREENING PROCESS

EXEMPT MAY PROCEED*

SCHEDULE B

- NOTICE OF COMPLETION TO REVIEW AGENCIES & PUBLIC
- PROJECT FILE REPORT AVAILABLE FOR 30 DAYS
- MAY PROCEED AFTER ANY CONCERNS ARE ADDRESSED (See Section A.2.8)

SCHEDULE C

PHASE 3

ALTERNATIVE DESIGN CONCEPTS FOR PREFERRED SOLUTION

- IDENTIFY ALTERNATIVE DESIGN CONCEPTS FOR PREFERRED SOLUTION
- DETAIL INVENTORY NATURAL SOCIAL ECONOMIC ENVIRONMENT
- IDENTIFY IMPACT OF ALTERNATIVE DESIGNS ON THE ENVIRONMENT AND MITIGATING MEASURES
- EVALUATE ALTERNATIVE DESIGNS IDENIFITY RECOMMENDED DESIGN
- CONSULT REVIEW AGENCIES & PREVIOUSLY INTERESTED & DIRECTLY AFFECTED PUBLIC
- SELECT PREFERRED DESIGN
- REVIEW AND CONFIRM CHOICE OF SCHEDULE
- PRELIMINARY FINALIZATION OF PREFERRED DESIGN

DISCRETIONARY PUBLIC CONSULTATION TO REVIEW PREFERRED DESIGN

PHASE 4

ENVIRONMENTAL STUDY REPORT

- COMPLETE ENVIRONMENTAL STUDY REPORT (ESR)
- NOTICE OF COMPLETION TO REVIEW AGENCIES & PUBLIC
- ESR AVAILABLE FOR 30 DAYS
- MAY PROCEED AFTER ANY CONCERNS ARE ADDRESSED (See Section A.2.8)

PHASE 5

IMPLEMENTATION

- COMPLETE CONTRACT DRAWINGS AND TENDER DOCUMENTS
- PROCEED TO CONSTRUCTION AND OPERATION
- MONITOR ENVIRONMENTAL IMPACTS AND MITIGATING MEASURES

* Some projects may be eligible for exemption based on the results of a screening process. Projects that are eligible for screening are identified in column 2 of the tables in Appendix 1. Proponents must fully and accurately complete the relevant screening process(es) outlined in Appendix 1 to proceed pursuant to the exemption.

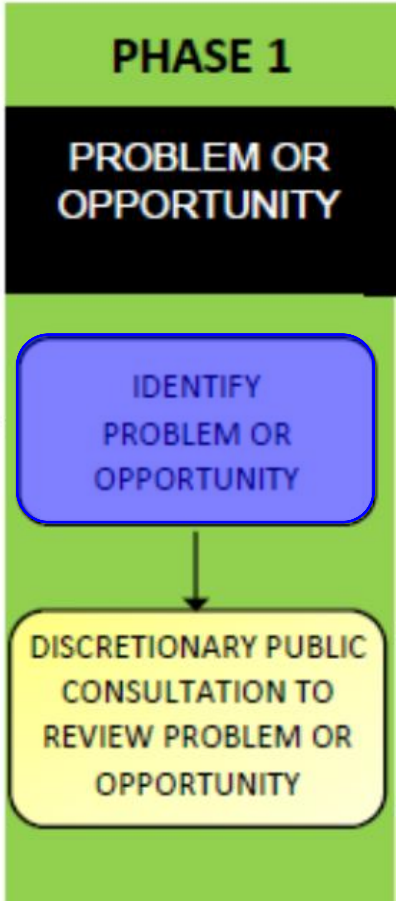
WE ARE HERE

➞	Mandatory Events
- - ➞	Possible Events
🟨	Public Contact
▭	Decision Points

MUNICIPAL ENGINEERS ASSOCIATION
2022

Problem/Opportunity Statement

“That existing infrastructure, road and sidewalk needs and deficiencies within the subject length of 9th Avenue East (100 metres south of Superior Street to 100 metres north of 9th Street East) be addressed in an environmentally sound manner, in consideration of City standards and policies, infrastructure requirements and active transportation opportunities, with the objective of providing safe and reliable service to the people of Owen Sound.”



PHASE 1

PROBLEM OR OPPORTUNITY

IDENTIFY PROBLEM OR OPPORTUNITY

DISCRETIONARY PUBLIC CONSULTATION TO REVIEW PROBLEM OR OPPORTUNITY

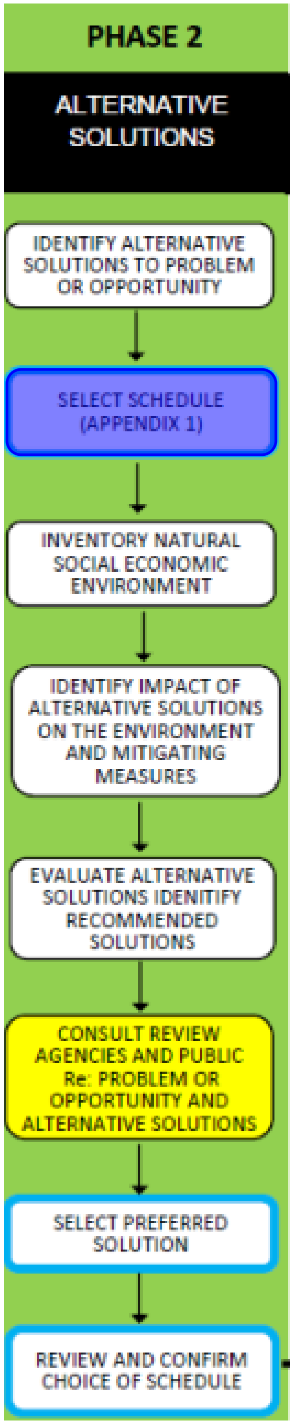
Class EA Schedules

Exempt Activities (formerly Schedule A/A+)

- Watermain and sewer replacements or extensions within an existing City owned road allowance or utility corridor
- Reconstruction of an existing road where number of lanes does not increase
- Sidewalk replacements or extensions
- Guiderail installation

Schedule B Activities

- Watermain and sewer replacements or extensions not located within an existing City owned road allowance or utility corridor



PHASE 2

ALTERNATIVE SOLUTIONS

IDENTIFY ALTERNATIVE SOLUTIONS TO PROBLEM OR OPPORTUNITY

SELECT SCHEDULE (APPENDIX 1)

INVENTORY NATURAL SOCIAL ECONOMIC ENVIRONMENT

IDENTIFY IMPACT OF ALTERNATIVE SOLUTIONS ON THE ENVIRONMENT AND MITIGATING MEASURES

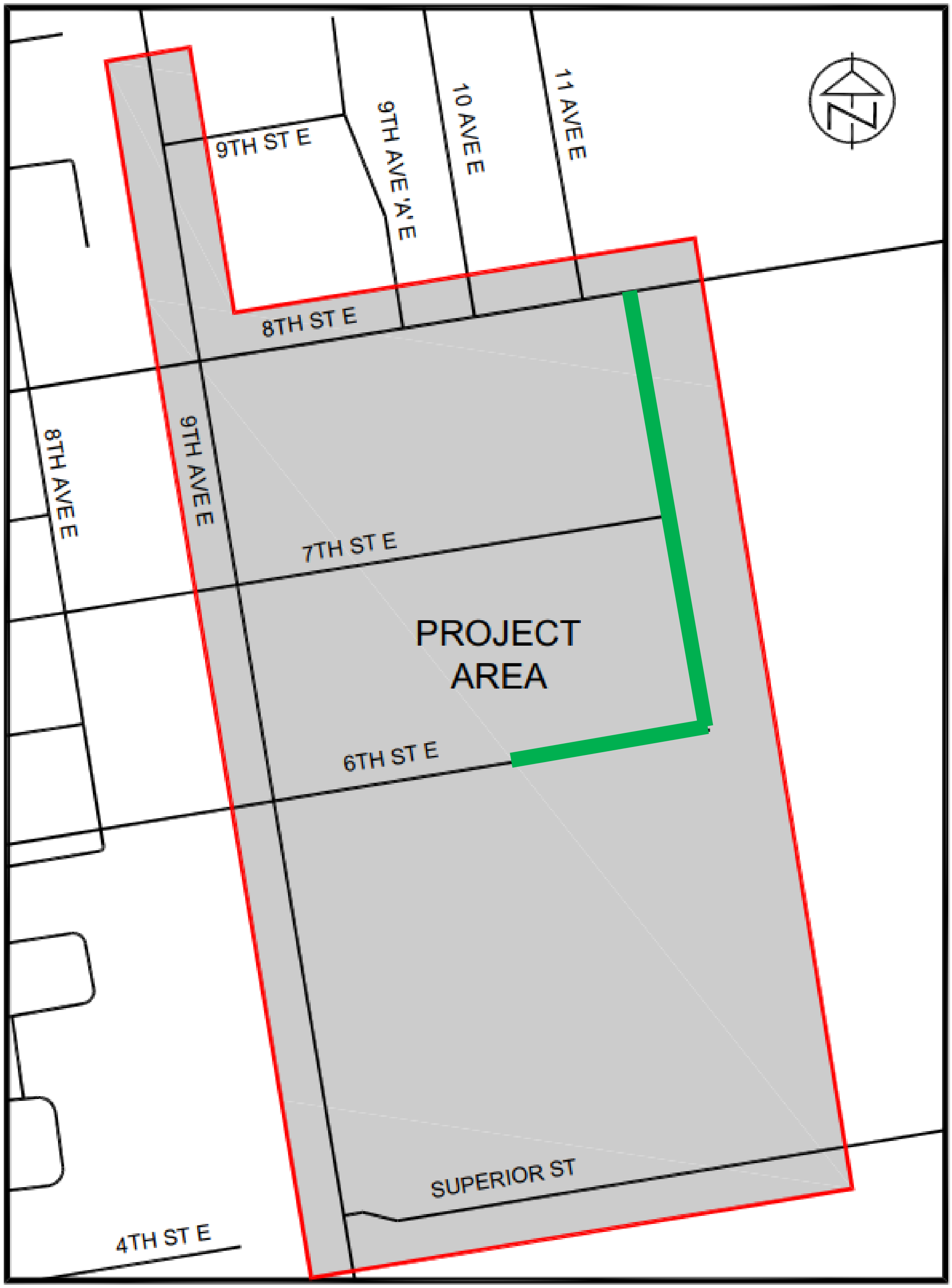
EVALUATE ALTERNATIVE SOLUTIONS IDENITIFY RECOMMENDED SOLUTIONS

CONSULT REVIEW AGENCIES AND PUBLIC Re: PROBLEM OR OPPORTUNITY AND ALTERNATIVE SOLUTIONS

SELECT PREFERRED SOLUTION

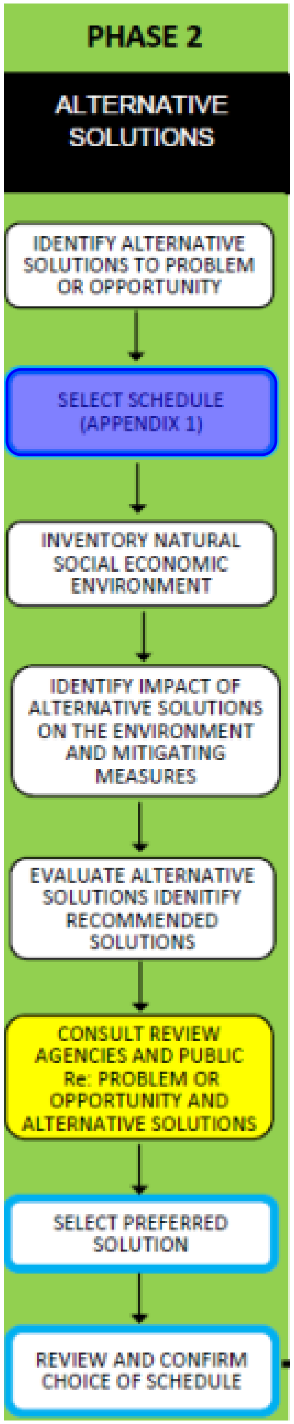
REVIEW AND CONFIRM CHOICE OF SCHEDULE

Class EA Schedules



🟩 Previously complete “Exempt” activities (2023)

- Phase 1 looping watermain in utility corridor & 6th Street East



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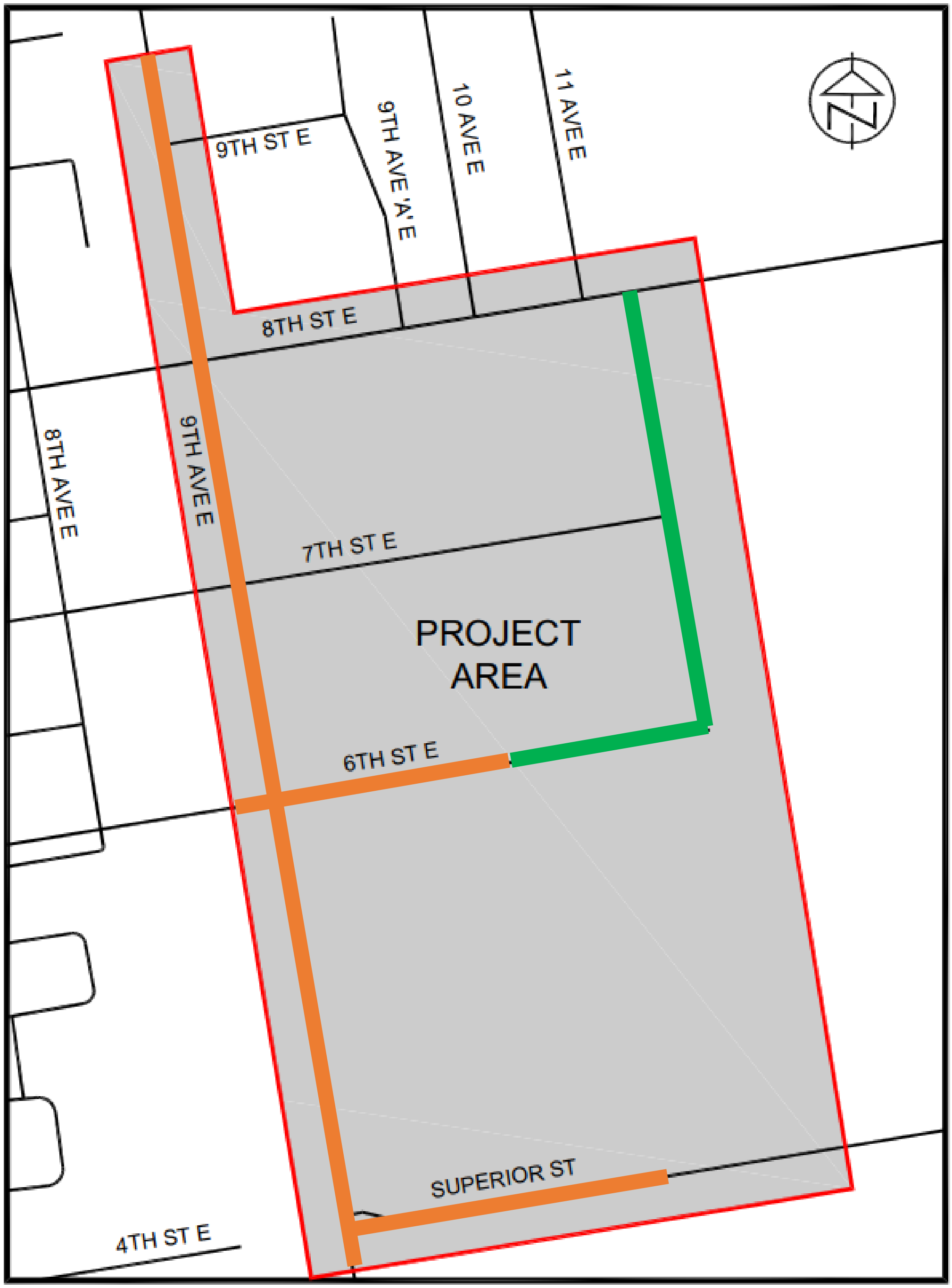
REVIEW AND CONFIRM CHOICE OF SCHEDULE

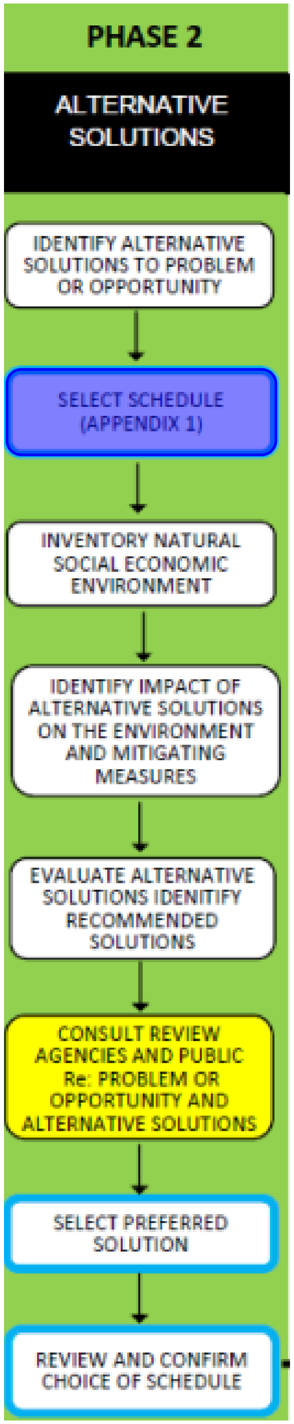
Class EA Schedules



🟩 Previously complete "Exempt" activities (2023)

🟧 Future "Exempt" activities (Timeline TBD)

- Watermain replacement
- Storm sewer replacement on 9th Avenue East
- Localized sanitary sewer replacements
- Road reconstruction
- Localized sidewalk extensions and improvements
- Guiderail replacement



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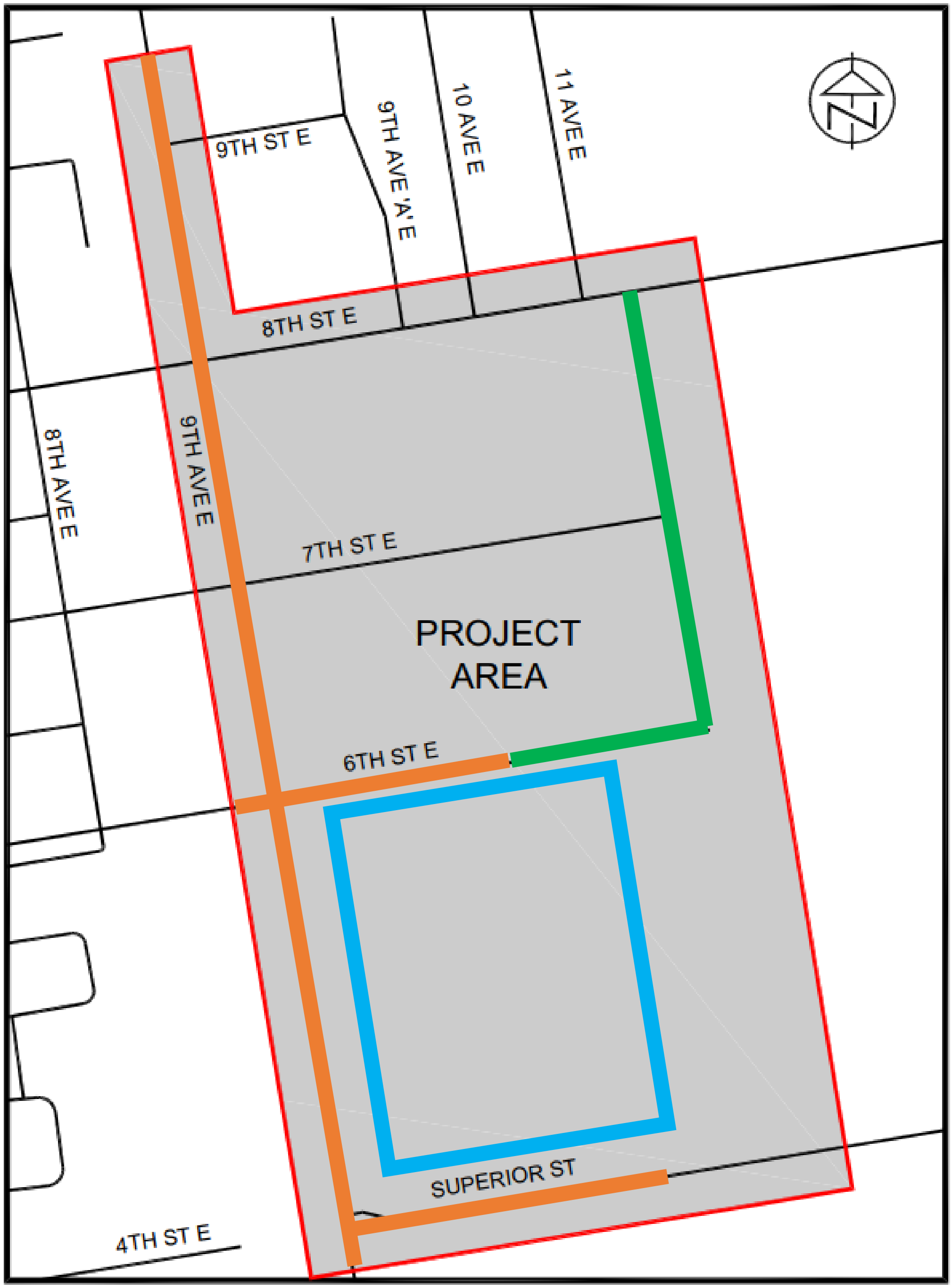
REVIEW AND CONFIRM CHOICE OF SCHEDULE

Class EA Schedules

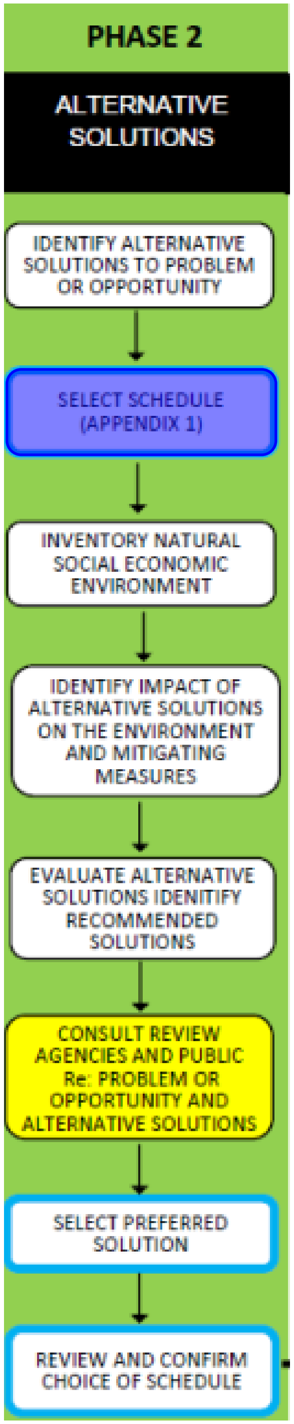


🟩 Previously complete “Exempt” activities (2023)

🟧 Future “Exempt” activities (Timeline TBD)

🟦 Future Schedule B activities (2024)

- Complete watermain loop from Superior Street to 6th Street East
- No road allowances or City owned utility corridors available



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CONSULT REVIEW AGENCIES AND PUBLIC Re: PROBLEM OR OPPORTUNITY AND ALTERNATIVE SOLUTIONS

SELECT PREFERRED SOLUTION

REVIEW AND CONFIRM CHOICE OF SCHEDULE

Background Studies/Investigations

Topographic Survey

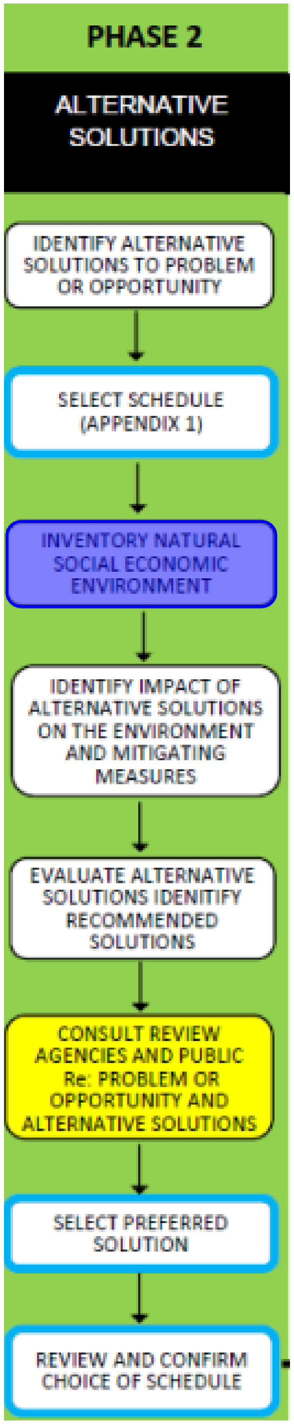
- Collect location and elevation of all surface features
- Forms basis for planning and design

Geotechnical Investigation

- Determine subsurface conditions (soil types, presence/depth of bedrock)
- Collect and analyze soil samples for contaminants and identify options for reuse of excess soil generated during construction
- Provides specifications for road and pipe construction

Hydrogeological Study

- Determine groundwater table elevation
- Identify dewatering requirements during construction
- Forms basis for required dewatering permits from MECP



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ALTERNATIVE SOLUTIONS

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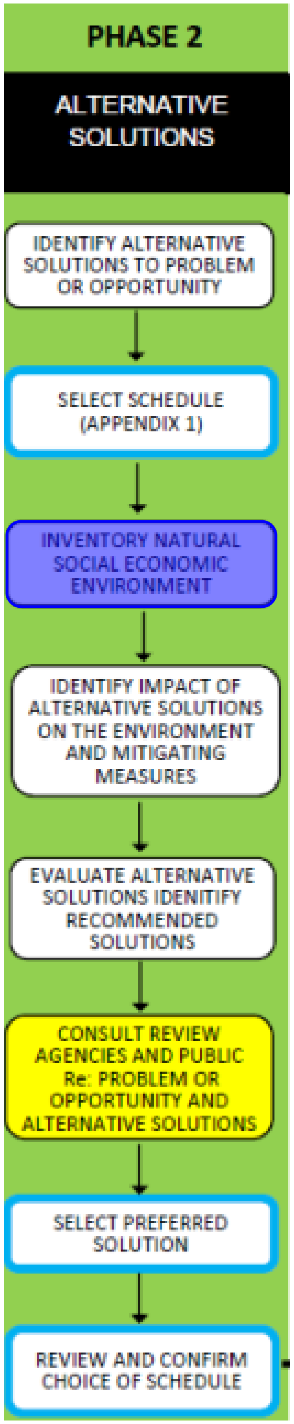
SELECT PREFERRED SOLUTION

REVIEW AND CONFIRM CHOICE OF SCHEDULE

Background Studies/Investigations

Environmental Impact Study

- Collected and reviewed background records from:
    - Grey County
    - Ministry of Natural Resources and Forestry
    - Ministry of the Environment, Conservation and Parks records
- Conducted field surveys:
    - 2 vascular plant inventories (spring and summer 2022)
    - 2 dawn breeding bird surveys
- Completed a Species at Risk habitat assessment through desktop reviews and fieldwork
- Assessed the potential direct and indirect impacts of the project on Natural Heritage Features and Functions in the study area



PHASE 2

ALTERNATIVE SOLUTIONS

IDENTIFY ALTERNATIVE SOLUTIONS TO PROBLEM OR OPPORTUNITY

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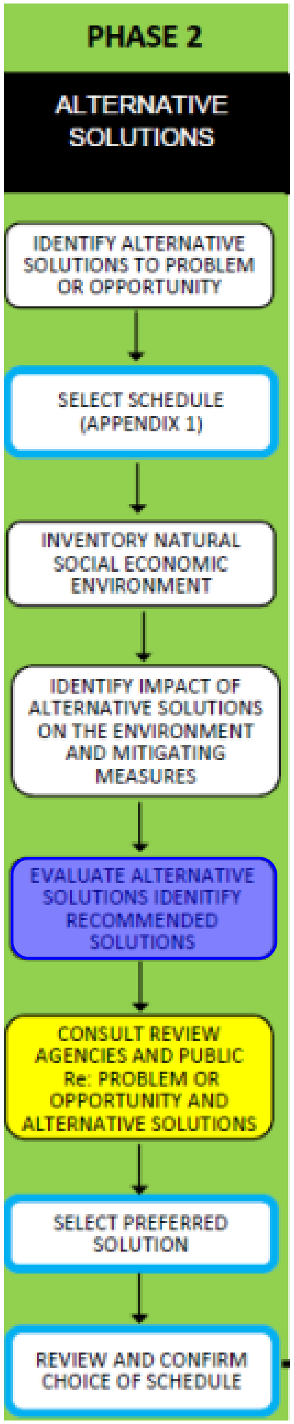
SELECT PREFERRED SOLUTION

REVIEW AND CONFIRM CHOICE OF SCHEDULE

Alternative 0 – Do Nothing

Criteria	Comments	Score
Technical (Water Operations)	- Operational needs not addressed	0
Social Environment	- No easements required - Watermain break results in detrimental impacts to commercial and institutional properties	1
Natural Environment	- No adverse impacts	5
Heritage | Archaeological | Cultural Impacts	- No adverse impacts	5
Cost	- No capital cost - Maintenance costs remain (flushing, fixing breaks)	2
	TOTAL:	**13**



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SELECT PREFERRED SOLUTION

REVIEW AND CONFIRM CHOICE OF SCHEDULE

Alternative 1

PHASE 2

ALTERNATIVE SOLUTIONS

IDENTIFY ALTERNATIVE SOLUTIONS TO PROBLEM OR OPPORTUNITY

↓

SELECT SCHEDULE (APPENDIX 1)

↓

INVENTORY NATURAL SOCIAL ECONOMIC ENVIRONMENT

↓

IDENTIFY IMPACT OF ALTERNATIVE SOLUTIONS ON THE ENVIRONMENT AND MITIGATING MEASURES

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EVALUATE ALTERNATIVE SOLUTIONS IDENITIFY RECOMMENDED SOLUTIONS

↓

CONSULT REVIEW AGENCIES AND PUBLIC Re: PROBLEM OR OPPORTUNITY AND ALTERNATIVE SOLUTIONS

↓

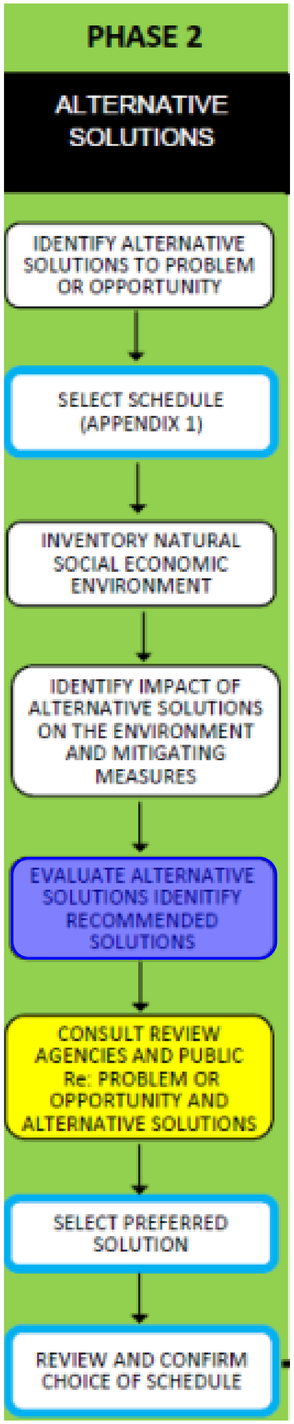
SELECT PREFERRED SOLUTION

↓

REVIEW AND CONFIRM CHOICE OF SCHEDULE

Alternative 1

Criteria	Comments	Score
Technical (Water Operations)	- Operational needs addressed - Relatively straight alignment	5
Social Environment	- New easements required on 2 properties - Significantly reduces impacts of watermain breaks (less customers affected)	3
Natural Environment	- Fragments woodland in south half - Encroaches on potential SAR bat habitat	1
Heritage | Archaeological | Cultural Impacts	- No adverse impacts - Previously disturbed area in north half	5
Cost	- Lowest capital cost (shortest length) - Reduces maintenance costs (flushing, fixing breaks)	5
	TOTAL:	**19**



PHASE 2

ALTERNATIVE SOLUTIONS

IDENTIFY ALTERNATIVE SOLUTIONS TO PROBLEM OR OPPORTUNITY

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SELECT PREFERRED SOLUTION

REVIEW AND CONFIRM CHOICE OF SCHEDULE

Alternative 2

PHASE 2

ALTERNATIVE SOLUTIONS

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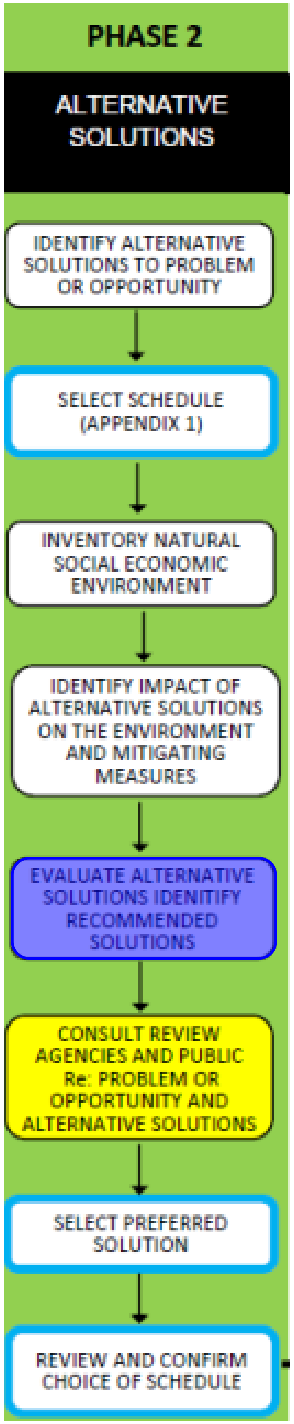
SELECT PREFERRED SOLUTION

REVIEW AND CONFIRM CHOICE OF SCHEDULE

Alternative 2

Criteria	Comments	Score
Technical (Water Operations)	- Operational needs addressed - Relatively straight alignment	5
Social Environment	- New easement required on 1 property - Widen existing easement on 1 property - Significantly reduces impacts of watermain breaks (less customers affected)	4
Natural Environment	- Minimal impacts (limited tree removals)	4
Heritage | Archaeological | Cultural Impacts	- No adverse impacts - All areas previously disturbed	5
Cost	- Lowest capital cost (shortest length) - Reduces maintenance costs (flushing, fixing breaks)	5
	TOTAL:	**23**



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ALTERNATIVE SOLUTIONS

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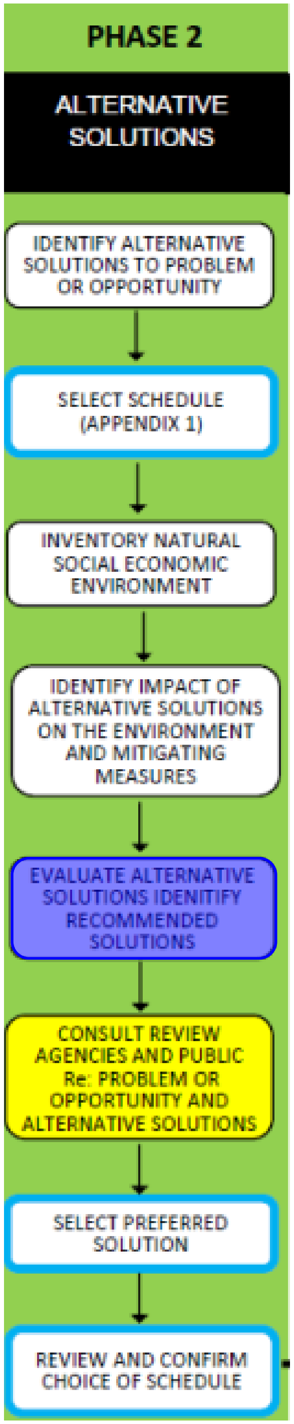
SELECT PREFERRED SOLUTION

REVIEW AND CONFIRM CHOICE OF SCHEDULE

Alternative 3



PHASE 2

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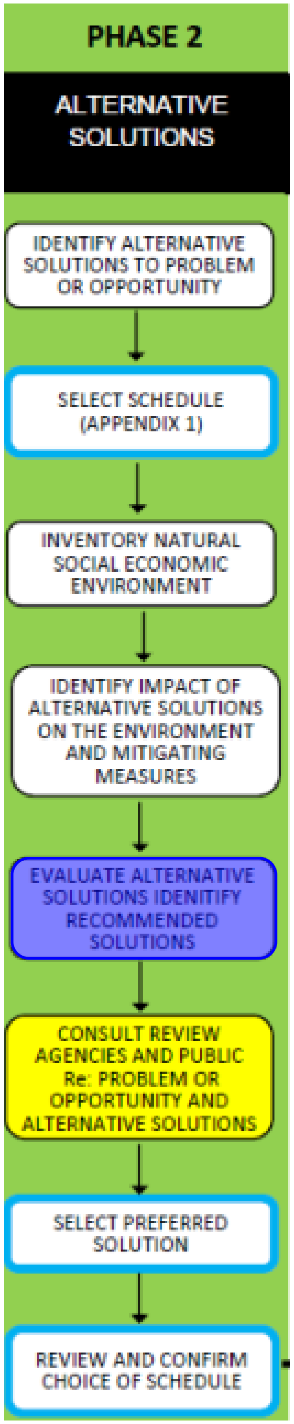
SELECT PREFERRED SOLUTION

REVIEW AND CONFIRM CHOICE OF SCHEDULE

Alternative 3

Criteria	Comments	Score
Technical (Water Operations)	- Operational needs addressed - Straight alignment	5
Social Environment	- Widen existing easements on 2 properties - Significantly reduces impacts of watermain breaks (less customers affected)	4
Natural Environment	- Minimal impacts (limited tree removals)	4
Heritage | Archaeological | Cultural Impacts	- No adverse impacts - All areas previously disturbed	5
Cost	- Lowest watermain capital cost (shortest length) but must relocate building on Grey County property - Reduces maintenance costs (flushing, fixing breaks)	1
	TOTAL:	**19**



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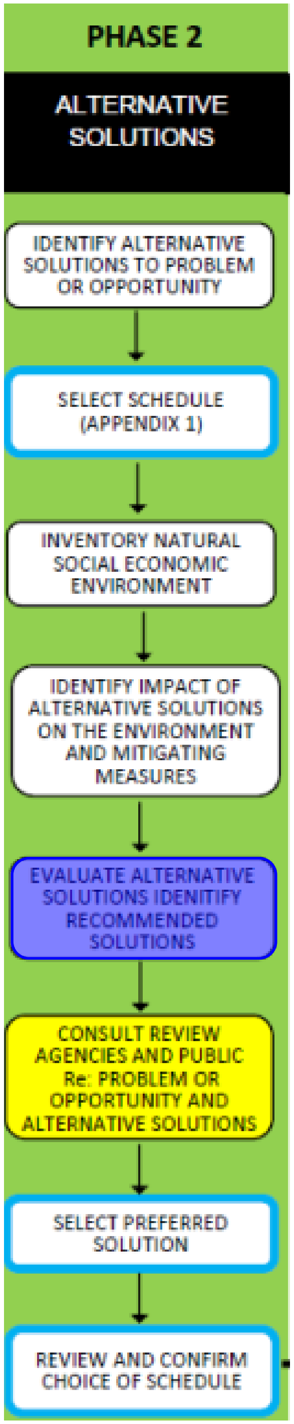
SELECT PREFERRED SOLUTION

REVIEW AND CONFIRM CHOICE OF SCHEDULE

Alternative 4



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ALTERNATIVE SOLUTIONS

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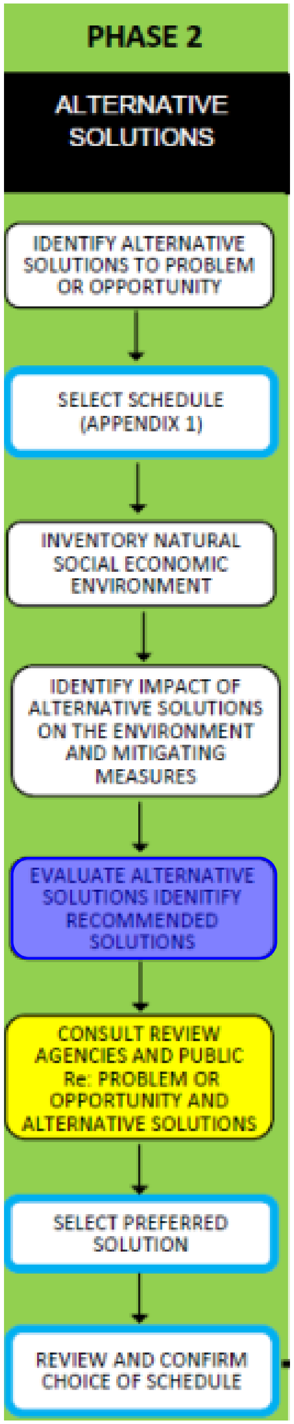
SELECT PREFERRED SOLUTION

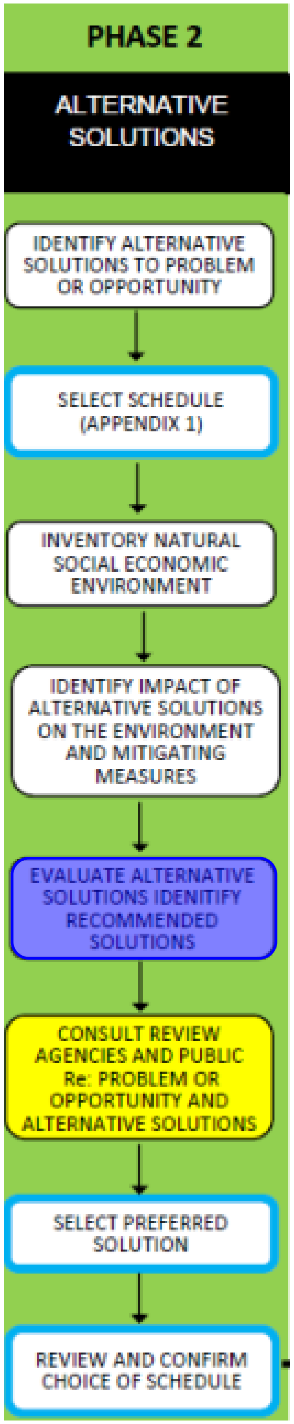
REVIEW AND CONFIRM CHOICE OF SCHEDULE

Alternative 4

Criteria	Comments	Score
Technical (Water Operations)	- Operational needs addressed - Several bends in alignment, longer length	4
Social Environment	- Widen existing easements on 2 properties - New easements required on 2 properties - Significantly reduces impacts of watermain breaks (less customers affected)	3
Natural Environment	- Limited tree removals - Will encroach into wetlands	2
Heritage | Archaeological | Cultural Impacts	- No adverse impacts - All areas previously disturbed	5
Cost	- Largest watermain capital cost (longest length) - Reduces maintenance costs (flushing, fixing breaks)	1
	TOTAL:	**15**



Alternative 5



PHASE 2

ALTERNATIVE SOLUTIONS

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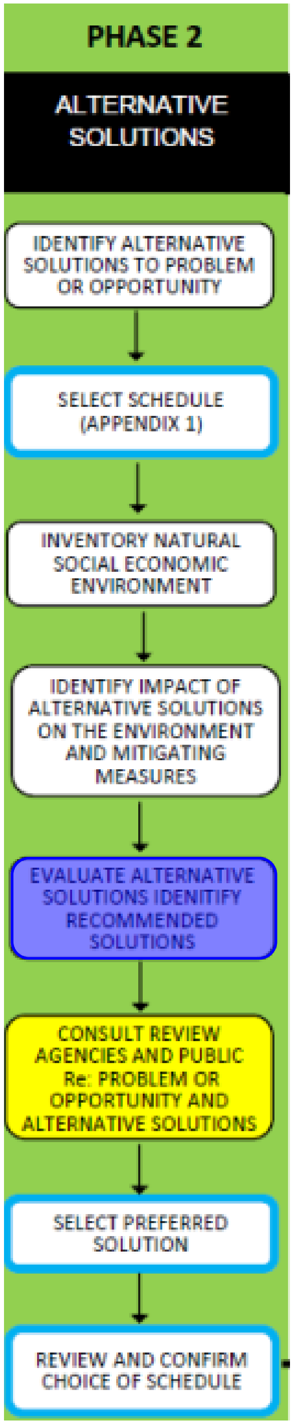
CONSULT REVIEW AGENCIES AND PUBLIC Re: PROBLEM OR OPPORTUNITY AND ALTERNATIVE SOLUTIONS

SELECT PREFERRED SOLUTION

REVIEW AND CONFIRM CHOICE OF SCHEDULE

Alternative 5

Criteria	Comments	Score
Technical (Water Operations)	- Operational needs addressed - Several bends in alignment, longer length	4
Social Environment	- New easements required on 3 properties - Hydro One won’t allow infrastructure or easements through high voltage area - Significantly reduces impacts of watermain breaks (less customers affected)	0
Natural Environment	- Limited tree removals - Will encroach into wetlands	2
Heritage | Archaeological | Cultural Impacts	- No adverse impacts - All areas previously disturbed	5
Cost	- Largest watermain capital cost (longest length) - Reduces maintenance costs (flushing, fixing breaks)	1
	TOTAL:	**12**


PHASE 2
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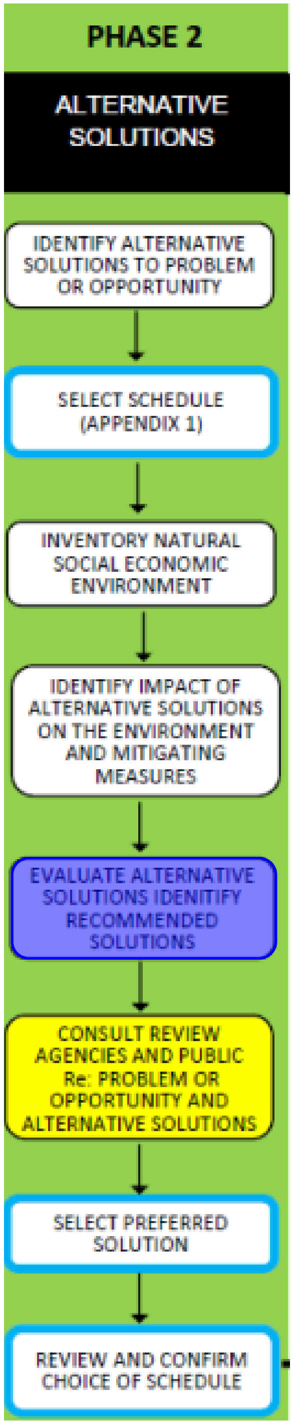
REVIEW AND CONFIRM CHOICE OF SCHEDULE

Recommended Alternative

Criteria	Do Nothing	1	2	3	4	5
Technical (Water Operations)	0	5	5	5	4	4
Social Environment	1	3	4	4	3	0
Natural Environment	5	1	4	4	2	2
Heritage | Archaeological | Cultural Impacts	5	5	5	5	5	5
Cost	2	5	5	1	1	1
Total Score	13	19	23	19	15	12

RECOMMENDED ALTERNATIVE



PHASE 2

ALTERNATIVE SOLUTIONS

IDENTIFY ALTERNATIVE SOLUTIONS TO PROBLEM OR OPPORTUNITY

SELECT SCHEDULE (APPENDIX 1)

INVENTORY NATURAL SOCIAL ECONOMIC ENVIRONMENT

IDENTIFY IMPACT OF ALTERNATIVE SOLUTIONS ON THE ENVIRONMENT AND MITIGATING MEASURES

EVALUATE ALTERNATIVE SOLUTIONS IDENITIFY RECOMMENDED SOLUTIONS

CONSULT REVIEW AGENCIES AND PUBLIC Re: PROBLEM OR OPPORTUNITY AND ALTERNATIVE SOLUTIONS

SELECT PREFERRED SOLUTION

REVIEW AND CONFIRM CHOICE OF SCHEDULE

Implementation Schedule

Public Consultation

Fall 2023

Legal Survey & Engineering Design

Winter/Spring 2024

Tender Period

Spring/Summer 2024

Construction Period

Summer/Fall 2024

QUESTIONS