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# **SPECIFICATIONS**

## **Town of Orangeville Fire Station**

**10 Commerce Road  
Orangeville, Ontario**

**Issued for Tender –August 18<sup>th</sup>, 2025.**

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**Alaimo Architecture Inc.  
Project: 2021-020**

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**DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS**

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See Civil drawings: C0, C1 & C2 for additional on drawing specifications and notes.

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END OF DOCUMENT

**1 GENERAL**

- 1.1 The requirements of the Articles of Agreement, Conditions of the Contract, Division 1 apply to and form all Sections of the Contract Documents and the Work.
- 1.2 Work in this Specification is divided into descriptive sections which are not intended to identify absolute contractual limits between Subcontractors, nor between the Contractor and their Subcontractors. The Contractor is responsible for organizing division of labour and supply of materials essential to complete the Contract. The Consultant assumes no liability to act as an arbiter to establish subcontract limits between Sections or Divisions of Work.
- 1.3 It is intended that Work supplied under these Contract Documents shall be complete and fully operational in every detail for the purpose required. Provide all items, articles, materials, services and incidentals, whether or not expressly specified or shown on Drawings, to make finished Work complete and fully operational, consistent with the intent of the Contract Documents.
- 1.4 Work designated as "N.I.C." is not included in this Contract.
- 1.5 Specifications, Schedules and Drawings are complementary, and items mentioned or indicated on one may not be mentioned or indicated on the others.
- 1.6 Contractors finding discrepancies or ambiguities in, or omissions from the Drawings, Specifications or other Contract Documents, or having doubt as to the meaning and intent of any part thereof shall contact the Consultant for clarification. If the Consultant is not contacted for clarification, execute the Work in accordance with the most stringent requirements.
- 1.7 Mention in the specifications or indication on the drawings of materials, Products, operations, or methods, requires that the Contractor provide each item mentioned or indicated of the quality or subject to the qualifications noted; perform according to the conditions stated in each operation prescribed; and provide labour, materials, Products, equipment and services to complete the Work.
- 1.8 Where the singular or masculine is used in the Contract Documents, it shall be read and construed as if the plural, feminine or neuter had been used when the context or the statement so requires and as required to complete the Work, and the rest of the sentence, clause, paragraph, or Article shall be construed as if all changes in grammar, gender or terminology thereby rendered necessary had been made.
- 1.9 The terms "approved", "review", "reviewed", "accepted", "acceptance", "acceptable", "satisfactory", "selected", "directed", "instructed", "required", "submit", "permitted" or similar words or phrases are used in standards or elsewhere in Contract Documents, it shall be understood, that words "by (to) the Consultant" follow, unless context provides otherwise.



1.10 Where the words 'submit', 'acceptable' and 'satisfactory' are used in the Contract Documents, they shall be considered to be followed by the words 'to the Consultant' unless the context provides otherwise.

1.11 The terms “exposed” or “exposed to view” refers to surfaces that are within the line of vision of persons from any accessible viewpoint, both within and without the building. Where any part of a surface is exposed to view, all other portions of that surface shall also be considered as exposed to view.

## 2 DEFINITIONS

2.1 “Agreement to Bond” means a letter or form issued by a licensed bonding agency advising that, if the Bidder is successful, the bonding agency will issue required bonds.

2.2 “Award” means the acceptance of a Tender in accordance with this Contract.

2.3 “Bidder” means a person or company who submits a Tender.

2.4 “Budget” means an amount approved for operating expenses or capital projects.

2.5 “Certificate of Insurance” means a certified document issued by an insurance company licensed to operate by the Government of Canada or the Province of Ontario, certifying that the Bidder is insured in accordance with the Owner’s requirements.

2.6 “Change Order” means a written order issued from the Owner that changes the scope or specifications of the Work.

2.7 “Consultant” means the provider of a Service who, by virtue of professional expertise or service, is contracted by the Owner to undertake a specific task or assignment. Examples include: an architect or engineer drawing plans and managing construction for a particular building or project; a lawyer representing the Owner for a particular legal matter; an appraiser providing an opinion of value on an asset; etc.

2.8 “Contract Administrator” or “Engineer” or “Project Manager” means the Consultant, or such other officer, as may be authorized by the Owner to act in a particular capacity.

2.9 “Contractor” means the person, partnership or corporation, and any employee or agent thereof that has been successful in the award of a Tender and thereby agrees to supply the goods and/or services under the terms of the Contract and is undertaking the Work as identified in the Contract.

2.10 “Goods and/or Services” means supplies, equipment, maintenance, and professional services.

- 2.11 “Irrevocable Letter of Credit” means an irrevocable document on a financial institution’s standard form requesting that the party to whom it is addressed pay the bearer or a person named therein money as a result of failure to perform or to fulfill all the covenants, undertakings, terms, conditions and agreements contained in the Contract.
- 2.12 “Material Safety Data Sheets (MSDS)” means Material Safety Data Sheets that must be submitted by the Contractor for all hazardous materials, including an index of chemical compounds, with details of properties, handling details, precautions and first-aid procedures.
- 2.13 “Owner” or “Authority” or “Corporation” means **The Town of Orangeville.**
- 2.14 “Place of Work” means **10 Commerce Road, Orangeville, Ontario**, both building and grounds.
- 2.15 “Request for Tenders (RFT)” means a solicitation from the Owner to potential contractors to submit a Tender.
- 2.16 “Surety” means a specified dollar amount in the form of certified cheque, bid bond, performance bond, labour and materials bond, letter of credit or any other form as deemed necessary and stated in a quotation, tender or proposal request issued by the Owner.
- 2.17 “Tender” means a written offer, in the specified form, received from a Bidder in response to a invitation to provide goods and/or services based on an approved format of the Owner containing terms and conditions.
- 2.18 “Work” means the goods and/or services supplied by the Contractor pursuant to the Contract and includes all labour, materials, equipment, and any other items, which are required to execute the Contract.

### **3 CONTRACT ADMINISTRATION**

- 3.1 The Contract Administration office functions performed by the General Contractor are to be done through the web-based contract administration software. Example; "Procore" or similar Contract Administration program.
- 3.2
- 3.3 The Contractor will be required to participate with the balance of the project team by using Procore or similar Contract Admin. program for the duration of the project.
- 3.4 Suppliers and Subcontractors are to be provided with access to Contract Administration software at no cost to the Architect and its consultants. The distribution of information issued by the General Contractor and/or Consultant, and coordination of that information, remains the responsibility of the Contractor.

- 3.5 The software is to be used for issuing electronic project related documents, including Requests for Information, Supplemental Instructions, Proposed Change Orders, Change Orders, Change Directives, Progress Claims, Certificates of Payment, Submittal Reviews, and other forms as may be required. At the discretion of the Consultant, the software may also be used for the distribution and filing of other project-related documents, including but not limited to Field Review Reports, Test Reports, Meeting Minutes, and so on. The software will also provide automatically generated logs of documents issued within the software.
- 3.6 The Contractor will be required to print hard copies of all project related documents issued through the software, and to maintain files of those documents on site at all times. At the conclusion of the project, the Contractor shall export digitally to PDF all documents and files that have been issued through the software and shall provide (3) three USB keys to the Owner in the Construction Close out Documentation package.
- 3.7 Notwithstanding that the software does not require signatures for the issuance and approval of documents, adjustments to the Contract Price and Contract Time in a Change Order shall only be deemed to be agreed to by the Owner and Contractor when executed by hand, and that electronic acceptance does not satisfy the conditions of agreement under GC 6.2.2 of the CCDC2 2008 Stipulated Price Contract.

#### **4 PROGRESS AND COMPLETION**

- 4.1 Substantial Performance of the Work shall be based on the terms of the signed General Contract terms between the General Contractor and the Owner.
- 4.2 Contract Completion of the Work shall be based on the terms of the signed General Contract terms between the General Contractor and the Owner.

#### **5 EXISTING SITE CONDITIONS**

- 5.1 Make a careful examination of the site and investigate and be satisfied as to all matters relating to the nature of the Work to be undertaken, as to the means of access and egress thereto and therefrom, as to the obstacles to be met with, as to the extent of the Work to be performed and any and all matters which are referred to in the Contract Documents.
- 5.2 Report any inconsistencies, ambiguities, discrepancies, omissions, and errors between Site conditions and Contract Documents to the Consultant prior to the commencement of Work. If inconsistencies, ambiguities, discrepancies, omissions, and errors are not reported and clarified, the most stringent requirement shall govern, as determined by the Consultant.

- 5.3 Before commencing the Work of any Section or trade, carefully examine the Work of other Sections and trades upon which it may depend, examine substrate surfaces, and report in writing to the Consultant, defects which might affect new Work. Commencement of Work shall constitute acceptance of conditions and Work of other sections, trades, and Other Contractors upon which the new Work depends. If repair of surfaces is required after commencement of specific work, it shall be included in the work of the trade providing the specific system or finish.

## 6 **USE OF SITE**

- 6.1 Accept full responsibility for assigned work areas from the time of Contract award until Substantial Performance of the Work.
- 6.2 Check means of access and egress, rights and interests which may be interfered with. Do not block lanes, roadways, entrances of exits. Direct construction traffic and locate access to site as directed by municipality.
- 6.3 Where encroachment beyond property limits is necessary make arrangements with respective property owners.

## 7 **ACCESS/PROPERTY CONSTRAINTS**

- 7.1 Provide and maintain access facilities as may be required for access to the Work.
- 7.2 The street/road/thoroughfare fronting the project shall not be occupied or obstructed during the construction at any time except as expressly permitted by any Road Works Permit if such has been applied for by the General Contractor and obtained prior to any occupancy or obstruction of the street/road/thoroughfare.
- 7.3 Any adjacent private driveways, laneways, right of ways, or other lands not belonging to the Owner shall not be used for any purpose without the prior express written consent of the adjacent property Owners. If the General Contractor intends to utilize adjacent lands to the subject property, it is the sole responsibility of the General Contractor to obtain all requisite approvals and make all necessary preparations including any remedial work required.
- 7.4 Minimize disruption, noise and dust to the functions of existing operational areas of existing buildings. Times of entry, routes of access and time required to complete the Work shall be arranged and scheduled in cooperation with the Owner.
- 7.5 Confine Work and operations of employees to limits indicated by the Contract Documents. Do not unreasonably encumber the premises with products.
- 7.6 Organize delivery of materials/equipment to and removal of debris and equipment from place of Work to permit continual progress of work and suitable for restricted site conditions.
- 7.7 Determine and make arrangement as required for loading and unloading of equipment and Products at times that will not affect public traffic flow and that will be

permitted by the **Town of Orangeville**. Conform to Town by-laws with regard to parking restrictions and other conditions.

- 7.8 Make provisions and arrangements and provide allowances if times for loading and unloading allowed by the Town of Orangeville are other than regular working hours.
- 7.9 All Products, materials and equipment required on Site shall be portable and/or size suitable for access and movement on Site and without causing damage to buildings.
- 7.10 The Work shall be confined to the area defined on the drawings and by the property lines except that services connections and certain portions of landscaping, hard paving and curb work shall be executed on Municipal property under regulation of authorities.
- 7.11 Provide locked doors in barriers, permit access by Owner and Consultant to Work areas and to areas Contractor is responsible for.

## 8 **SECURITY**

- 8.1 Be responsible for security of all areas affected by Work of this Contract until taken over by Owner. Take steps to prevent entry to the Work by unauthorized persons and guard against theft, fire and damage by any cause.
- 8.2 Provide suitable surveillance equipment and /or employ guard services, as required to adequately protect the work.
- 8.3 Make provisions to permit Owner's security personnel to view areas where all Work is being performed.
- 8.4 Take acceptable precautions to guard Work site, premises, materials and the public during and after working hours due to the Work of this Contract.
- 8.5 Any security service provided by the Owner is for the protection of the Owner's interest in the Work on the Site and shall not relieve the Contractor of the responsibility to protect the Site and the Work of the Contract.

## 9 **WEATHER**

- 9.1 Incorporate into the Contract Schedule allowances for the number of working days lost due to inclement weather based on the analysis of information available from Environment Canada, for weather conditions on and near the site, over the time period 1971 - 2022.
- 9.2 The Contractor may be entitled to a schedule extension for those activities on the critical path which are delayed on account of inclement weather, assessed on a quarterly basis, by the number of days in excess of the anticipated number of working days for the quarter in question by more than 20%. No additional payment will be made on account of any such schedule extension.

**10 WASTE AUDIT/PLANS FOR WASTE REDUCTION**

- 10.1 Comply with requirements of authorities having jurisdiction.
- 10.2 Prepare and submit waste audit and waste reduction plan in accordance with Ontario Regulation 102/94 Waste Audits and Waste Reduction Workplans.
- 10.3 Prepare and submit source separation plan in accordance with Ontario Regulation 103/94 Industrial, Commercial and Institutional Source Separation Programs.
- 10.4 Deliver to nearest appropriate depot all materials accepted for recycling by the region or municipality having jurisdiction over the Place of Work, including but not limited to cardboard, paper, plastic, aluminum, steel, and glass. Deliver to nearest appropriate depot all scrap and excess gypsum wallboard for recycling of this material. Pay all costs for this work.

END OF SECTION

1           **GENERAL**

- 1.1           Allowances included herein are for items of Work which could not be fully quantified prior to Bidding.
- 1.2           Expend each allowance as directed by the Consultant in writing. Work covered by allowances shall be performed for such amounts and by such persons as directed by consultant.
- 1.3           Each allowance will be adjusted to actual cost as defined hereunder and the Contract Price will be amended accordingly by Contract Change Order.
- 1.4           Progress payments for Work and Products authorized under allowances will be made in accordance with the payment terms set out in Conditions of the Contract.
- 1.5           A schedule shall be prepared jointly by the Consultant and Contractor to show when items called for under allowances must be authorized by the Consultant for ordering purposes so that the progress of the Work will not be delayed.
- 1.6           Where a Cash Allowance is for work performed under a Subcontract, the Contractor shall Bid the work involved and submit the Bids received, with the Contractor's recommendations, for approval.

2           **CASH ALLOWANCE(S)**

- 2.1           Cash allowances, unless otherwise specified, cover the net cost to the Contractor of services, Products, construction machinery and equipment, freight, handling, unloading, storage, installation where indicated, and other authorized expenses incurred in performing the Work. Cash allowances shall not be included by a Subcontractor in the amount for their Subcontract work.
- 2.2           Supply only allowances shall include:
  - .1           Net cost of Products.
  - .2           Delivery to Site.
  - .3           Applicable taxes and duties, excluding HST.
- 2.3           Supply and install allowances shall include:
  - .1           Net cost of Products.
  - .2           Delivery to Site.
  - .3           Unloading, storing, handling or Products on Site.
  - .4           Installation, finishing and commissioning of Products.
  - .5           Applicable taxes and duties, excluding HST.
- 2.4           Inspection and testing allowances shall include:
  - .1           Net cost of inspection and testing services.
  - .2           Applicable taxes and duties, excluding HST.
- 2.5           Other costs related to work covered by cash allowances are not covered by the allowance but shall be included in the Contract Price.

- 2.6 Where costs under a cash allowance exceed the amount of the allowance, the Contractor will be compensated for any excess incurred and substantiated plus an allowance for overhead and profit as set out in the Contract Documents.
- 2.7 Progress payments on accounts of work authorized under cash allowances shall be included in the monthly certificate for payment.
- 2.8 Submit, before application for final payment, copies of all invoices and statements from suppliers and Subcontractors for work which has been paid from cash allowances.
- 2.9 Include in the Bid Price the following cash allowance items:
- .1 Testing & Inspection (General Contractor to procure 3 quotations and co-ordinate).
  - .2 Hydro Connection Fee and Transformer (General Contractor to apply for and co-ordinate including paying all associated fees).
  - .3 Interior & Exterior Signage - Door & Room Labels, Occupancy Restrictions etc., wall lettering & number including power requirements, if not noted on tender package. (General Contractor to procure 3 quotations and co-ordinate).
  - .4 IT/FF&E requirements of the Owner (General Contractor to procure 3 quotations and co-ordinate).
  - .5 Door Hardware. See 08 70 00 in the specifications (General Contractor to procure 3 quotations and co-ordinate).
  - .6 Window Blinds (General Contractor to procure 3 quotations and co-ordinate).
  - .7 Owner's Coordinated item.
  - .8 Installation of existing SCBA equipment (as supplied by Owner & installed by GC).

Total Cash Allowance: \$ **775,000.00**

END OF SECTION



**1 GENERAL**

- 1.1 Coordination of the Work of all Sections of the specifications as required to complete the Project is the responsibility of the Contractor.
- 1.2 Cooperate and coordinate with Other Contractors including Other Contractor's employed by Owner.
- 1.3 Ensure that Subcontractors and trades cooperate with other subcontractors and trades whose work attaches to or is affected by their own work. Ensure that minor adjustments are made to make adjustable work fit fixed work.
- 1.4 Allow access of Owner's Other Contractors on site and to areas of Work. Cooperate and coordinate with such Other Contractors. Schedule work to complement work of such Other Contractors.
- 1.5 Entry by the Owner's own forces and by Other Contractors shall not mean acceptance of the Work and shall not relieve the Contractor of their responsibility to complete the Contract.
- 1.6 Placing, installation, application and connection of work by the Owner's own forces or by Other Contractors on and to the Contractor's Work shall not relieve the Contractor of his responsibility to provide and maintain the specified warranties.
- 1.7 Coordinate with removals/installations specified in other Divisions and Other Contracts.
- 1.8 Coordinate the work of this Contract with work of designated substance removal work and demolition work under separate contract. No allowance shall be made subsequently by the Owner or Consultant for lack of coordination and no claim will be considered for circumstances and omissions which could have been coordinated, prevented or included for had these procedures been followed.
- 1.9 Coordination of the installation of systems specified in Divisions 13, 21, 22, 23 and 26, including the interrelating operation and functioning between components of a system and between systems, is the responsibility of those performing the work of those Divisions, with final coordination the responsibility of the Contractor.
- 1.10 Coordinate relocation of existing mechanical and electrical items with work specified in Divisions 13, 21, 22, 23, and 26.
- 1.11 Existing equipment shall remain in present locations unless designated otherwise. Protect from damage. Remove, store and reinstall existing fixed equipment, fixtures and components which interfere with construction and which are scheduled for relocation.

- 1.12 Pay particular attention to types of ceiling construction and clearances throughout, especially where recessed fixtures are required. Coordinate work with Other Contractors and Subcontractors wherever ventilation ducts or piping installations occur to ensure that conflicts are avoided.
- 1.13 Install ceiling mounted components in accordance with final ceiling plans. Inform Consultant of conflicting installations.
- 1.14 Install and arrange ducts, piping, tubing, conduit, equipment, fixtures, materials and product to conserve headroom and space with minimum interference and in neat, orderly and tidy arrangement. Run pipes, ducts, tubing and conduit, vertical, horizontal and square with building grid unless otherwise indicated. Install piping, ducts, and conduit as close to underside of structure as possible unless shown otherwise.
- 1.15 Make provision, without interference or restriction by items located within the ceiling space, for unrestricted relocation of light fixtures to replace ceiling panels at grid spaces of the same size.
- 1.16 Where supports or openings are to be left for the installation of various parts of the Work furnish the necessary information to those concerned in ample time so that proper provision can be made for such items. Have cutting, drilling and other remedial work, and the subsequent patching or other work required for failing to comply with this requirement, performed at a later date at no additional Cost to Owner.
- 1.17 Properly coordinate the work of the various Sections and trades, taking into account the existing installations to assure the best arrangement of pipes, conduits, ducts and mechanical, electrical and other equipment, in the available space. Under no circumstances will any extra payment be allowed due to the failure by the Contractor to coordinate the work. If required, in critical locations, prepare interference and/or installation drawings showing the work of the various Sections as well as the existing installation, and submit these drawings to the Consultant for review before the commencement of work. Proceed with work in these areas only as, and when directed by the Consultant.
- 1.18 Coordinate with mechanical and electrical trades to ensure protecting supporting, disconnecting, cutting off, capping, diverting, relocating or removing of existing services in areas of Work before commencement of alteration work.
- 1.19 Execute Work at times to ensure a minimum of disturbance to building occupants and in compliance with the Tenant Leasehold Improvement Manual.
- 1.20 In case of damage to active services on utilities, notify Consultant and respective authorities immediately and make all required repairs under direction of Consultant and respective authorities. Carry out repairs to such damaged services and utilities continuously to completion, including working beyond regular working hours. Costs to be borne by the Contractor.

- 1.21 Existing areas shall remain in use except where alteration work is actually in progress. Confine effects of Work to areas indicated on Drawings unless otherwise approved by Owner.

**2 METRIC DIMENSIONS**

- 2.1 Measurements in this specification are expressed in metric (SI) units and depending on the progress made in the various sectors of the industry are either hard or soft converted units.
- 2.2 All metric units specified shall be taken to be the minimum acceptable unless otherwise noted.
- 2.3 It is the Contractor's responsibility to check and verify with manufacturers and suppliers on the availability of materials and products in either metric or imperial sizes. Be responsible for coordinating products supplied in metric (SI) and imperial units into the overall layout.
- 2.4 Where both metric and imperial sizes or dimensions are shown, the metric size or dimension shall govern.

**3 BUILDING DIMENSIONS**

- 3.1 Take necessary job dimensions for the proper execution of the work. Assume complete responsibility for the accuracy and completeness of such dimensions, and for coordination.
- 3.2 Verify that work, as it proceeds, is executed in accordance with dimensions and positions indicated which maintain levels and clearances to adjacent work, as set out by requirements of the Drawings, and ensure that work installed in error is rectified before construction resumes.
- 3.3 Check and verify dimensions referring to the work and the interfacing of services.
- 3.4 Do not scale directly from the Drawings. If there is ambiguity or lack of information, immediately inform the Consultant. Changes required through the disregarding of this clause shall be the responsibility of the Contractor.
- 3.5 All details and measurements of any work which is to fit or to conform with work installed shall be taken at the building.
- 3.6 Advise Consultant of discrepancies and if there are omissions on Drawings, particularly reflected ceiling plans and jointing patterns for surfaces finishes, which affect aesthetics, or which interfere with services, equipment or surfaces. Do not proceed with work affected by such items without direction from the Consultant.

- 3.7 Provide written requirements for site conditions and surfaces necessary for the execution of respective work, and provide setting drawings, templates and all other information necessary for the location and installation of material, holes, sleeves, inserts, anchors, accessories, fastenings, connections and access panels. Inform respective contractors whose work is affected by these requirements and preparatory work.

**4 INTERFERENCE AND COORDINATION DRAWINGS**

- 4.1 Coordinate placement of equipment to ensure that components will be properly accommodated within the spaces provided prior to commencement of work.
- 4.2 Prepare interference and equipment placing drawings to ensure that all components will be properly accommodated within the spaces provided. Provide copies of interference drawings to consultant when requested by Consultant.
- 4.3 Prepare drawings to indicate coordination and methods of installation of a system with other systems where their relationship is critical. Ensure that all details of equipment apparatus, and connections are coordinated.
- 4.4 Take complete responsibility for any remedial work that results from failure to coordinate any aspect of the Work prior to its fabrication/installation.
- 4.5 Ensure that accesses and clearance required by jurisdictional authorities and/or for easy maintenance of equipment are provided in the layout of equipment and services.

**5 SLEEVING AND INSERT DRAWINGS AND TEMPLATES**

- 5.1 Prepare sleeving drawings for work of Divisions 13, 21, 22, 23, and 26, showing size and location of all penetrations through load bearing elements. Submit sleeving drawings in the form of digital PDF to Consultant for review not less than 15 days prior to construction of affected elements.
- 5.2 Prepare insert setting drawings for work to be cast into concrete and/or mortared into masonry elements. Submit insert setting drawings in the form of a PDF and 4 prints to consultant for review not less than 15 days prior to construction of affected elements.
- 5.3 Ensure that setting drawings, templates, and all other information necessary for the location and installation of materials, fixtures, equipment, holes, sleeves, inserts, anchors, accessories, fastenings, connections, and access panels are provided by each Section whose work requires cooperative location and installation by other Sections, and that such information is communicated to the applicable installer.

- 5.4            Provide cutting, fixing and making good to the work of Other Contractors, Subcontractors and trades as required for sleeving and inserts and make up time lost as a result of failure to comply with this requirement, at no additional cost to the Owner.

END OF DOCUMENT

1 **PRE-CONSTRUCTION MEETING**

- 1.1 Attend pre-construction meeting(s), arranged and conducted by the Contractor.
- 1.2 Arrange and conduct pre-construction meeting(s).
- 1.3 Co-ordinate and organize attendance by representatives of major Subcontractors and parties in contract with the Contractor.
- 1.4 Consultant will arrange attendance of other interested parties not responsible to the Contractor.
- 1.5 Prepare and distribute copies of Agenda prior to meeting.
- 1.6 Agenda will include but not be limited to the following topics as are pertinent to the Contract.
  - .1 Review project communications procedures.
  - .2 Review contract administration requirements including submittals, payment, and change order procedures.
  - .3 Identify all critical points on construction schedule for positive action.
  - .4 Identify any product availability problems and substitution requests.
  - .5 Establish site arrangements and temporary facilities.
  - .6 Review Consultants inspection requirements.
  - .7 Review any points which, in Owner's, Consultants, and Contractor's opinion, require clarification.
- 1.7 Be prepared to provide specific information relative to agenda items as they are pertinent to the Contract.
- 1.8 Record minutes of meeting and distribute type written copies to all participants and other interested parties, within one week of meeting date.

2 **PROGRESS MEETINGS**

- 2.1 Attend regularly scheduled progress meetings to be held on Site at times and dates that are mutually agreed to by the Owner, Consultant, and Contractor.
- 2.2 Co-ordinate and organize attendance of individual Subcontractors and material suppliers when requested. Relationships and discussions between Subcontractor participants are not the responsibility of the Consultant and do not form part of the

meetings content.

- 2.3 Ensure that Contractor representatives in attendance at meetings have required authority to commit Contractor to actions agreed upon. Assign same persons to attend such meetings throughout the contract period.
- 2.4 Inform the Consultant in advance of meetings regarding all items to be added to the agenda.
- 2.5 Prepare and distribute copies of Agenda prior to meeting.
- 2.6 Be prepared to provide specific information relative to agenda items at each meeting as they are pertinent to the Contract.
- 2.7 Agenda will include but not be limited to the following topics as are pertinent to the Contract.
  - .1 Review and agreement of previous minutes.
  - .2 Construction safety.
  - .3 Status of submittals.
  - .4 Quality control.
  - .5 Co-ordination.
  - .6 Contract Schedule.
  - .7 Work plan up to next scheduled meeting.
  - .8 Requests for information/clarification.
  - .9 Contemplated changes.
- 2.8 Record minutes of meeting and distribute type written copies to all participants and other interested parties, within one week of meeting date.

**3 MEETINGS WITH OTHER CONTRACTORS**

- 3.1 Consultant will arrange and organize coordination meetings with Other Contractors working on the Project.
- 3.2 Attend all such meetings and ensure that representative has required authority to commit Contractor to actions agreed upon.
- 3.3 Consultant will document and distribute minutes to participants.

END OF SECTION



1           **GENERAL**

1.1           Be responsible for planning and scheduling of the Work. As a minimum, prepare and update the following schedules:

.1           Contract Schedule.

.2           Detailed Construction Schedule.

1.2           Be responsible for ensuring that Subcontractors plan and schedule their respective portions of the Work. Subcontractor's schedules shall form part of the above-mentioned schedules.

2           **CONTRACT SCHEDULE**

2.1           Prepare and submit the Contract Schedule within 14 days following award of Contract. This schedule, once it is reviewed by the Consultant and if it meets the Consultant's project requirements, will form part of the Contract.

2.2           The Contract Schedule shall be developed using a logic network technique for planning and scheduling.

2.3           The Contract Schedule shall be submitted for approval in its optimum levelled form. This presentation may be in either a time scaled network or a bar chart form. It shall be subdivided into either work areas or systems as applicable.

2.4           The Contract Schedule shall include the following information:

.1           Starting and ending dates of each activity including the float periods;

.2           Manpower requirements for each activity;

.3           Order and delivery dates for major or critical equipment.

.4           Interdependency with activities of other Contractors;

.5           Dates specified in the Contract Documents;

.6           Dates on which specific data will be required for submittal, i.e., Vendor data, shop drawings, samples, etc..

2.5           This schedule shall be reviewed and updated monthly by the Contractor to reflect any Contract changes as well as major changes to the schedule.

**3 DETAILED CONSTRUCTION SCHEDULE**

- 3.1 Prepare and submit a detailed construction schedule within 14 days of final review and acceptance of the Contract Schedule. This schedule, once reviewed and accepted by the Owner, will be updated, and submitted monthly with the Contract Schedule and weekly once the Contractor starts on Site.
- 3.2 This schedule shall cover the construction period. It will show, in detail, activities daily indicating durations, manpower and constraints. The activities shown on this schedule shall further clarify or detail the activities shown on the Contract Schedule.
- 3.3 The detailed construction schedule shall be presented in a bar chart form.

**4 CASH FLOW CHART**

- 4.1 Within 7 days after award of Contract, submit, in form approved by Owner, cash flow chart broken down monthly in an approved manner. Cash flow chart shall indicate anticipated Contractor's monthly progress billings from commencement of work until completion.
- 4.2 Update cash flow chart whenever changes occur to scheduling and in manner and at times satisfactory to Owner.

END OF SECTION

**1 GENERAL**

- 1.1 Provide labour, Products, equipment, services tools and supervision necessary for submittals. Make submittals specified in this Section to Consultant unless otherwise specified.
  - .1 Verify accuracy and completeness of submittals prior to submission.
  - .2 Verify field measurements, field construction criteria, catalogue numbers and similar data.
  - .3 Co-ordinate each submittal with requirements of the Work and the Contract Documents.
  - .4 Notify Consultant in writing at time of submission, of any deviation in submittals from requirements of the Contract Documents.
- 1.2 Submit in accordance with dates established under Section 01 32 13 for shop drawings, fabrication, manufacture, erection and installation to provide adequate time for reviews, securing necessary approvals, possible revisions and resubmittals, placing orders, securing delivery and to avoid construction delays.
- 1.3 Accompany each submittal with a letter of transmittal in duplicate containing all pertinent information required for identification and checking of submittals including but not limited to the following:
  - .1 Date of initial submission and date of each subsequent submission if required.
  - .2 Project title and Consultant's project number.
  - .3 Names of:
    - .1 Contractor.
    - .2 Subcontractor.
    - .3 Supplier/manufacturer/fabricator as applicable.
  - .4 Specification section numbers to which submission is related.
  - .5 Countersigned stamp of Contractor certifying that they have reviewed the submission.
- 1.4 Allow two weeks for the Consultant's review of each submission.
- 1.5 When submittals are resubmitted, transmit under a new letter of transmission.
- 1.6 Do not carry out Work until Consultants review of submittals has been completed.
- 1.7 Be responsible for payment of charges for delivery of submissions and resubmission to Consultant.

**2 PRODUCT DATA**

- 2.1 Before delivery of Products to the Site, submit Product data as specified in each section or as requested by the Consultant.
- 2.2 Submit manufacturer's Product data for systems, materials, and methods of installation proposed for use. Such literature shall identify systems, each component, and shall certify compliance of each component with applicable/specified standards.

**3 SAMPLES**

- 3.1 Before delivery of Products to the Site, submit samples of Products as specified or as requested by the Consultant. Label samples as to origin and intended use in the Work and in accordance with the requirements of the Specification Sections. Samples must represent physical examples to illustrate materials, equipment or work quality and to establish standards by which completed Work is judged.
- 3.2 Ensure samples are of sufficient size and quantity, if not already specified, to illustrate:
  - .1 The quality and functional characteristics of Products, including integrally related parts and attachment devices.
  - .2 The full range of colours available.
- 3.3 Notify the Consultant in writing, at time of submission, of any deviations in samples from requirements of the Contract Documents and state the reasons for such deviations.
- 3.4 Identify samples with Project name, Contract number, date, Contractor's name, number and description.
- 3.5 If samples are not acceptable, both samples will be returned. If samples are acceptable, one sample will be so indicated and returned. Be responsible for the cost of samples that are not accepted and for resubmission of samples.
- 3.6 Acceptable samples shall serve as a model against which the products incorporated in the work shall be judged.
- 3.7 Each Product incorporated in the Work shall be precisely the same in all details as the acceptable sample.
- 3.8 Should there be any change to the accepted sample, submit in writing for approval of the revised characteristics and resubmit samples of the Product for approval if requested.
- 3.9 When samples are very large, require assembly, or require evaluation at the Site, they may only be delivered to the Site with approval and as directed.

**4 SHOP DRAWINGS**

- 4.1 Arrange for the preparation of Shop Drawings as called for in the Contract Documents or as may be reasonably requested by the Consultant. The Contractor and each Subcontractor shall operate as experts in their respective fields and all Shop Drawings and samples shall conform to the requirements of the Contract Documents.
- 4.2 The term "Shop Drawings" means drawings, diagrams, schematics, illustrations, schedules, performance charts, brochures and other data which are required to illustrate details of the Work.
- 4.3 In addition to Shop Drawings specified in the specification sections, submit Shop Drawings required by jurisdictional authorities in accordance with their requirements.
- 4.4 Shop Drawings for openings, sleeving and conduit
- .1 Prior to preparation of Shop Drawings, coordinate sizes of all structural openings and sleeves with respective fabricators for mechanical ducting. Adjustments to the opening sizes indicated on the Contract Drawings shall not be made without the approval of the Consultant.
  - .2 Prior to detailing structural reinforcement on Shop Drawings, arrange for the Structural Engineer to review formed holes, recesses and sleeving. Completely dimension openings, recesses and sleeves and relate to appropriate grid line(s) and elevation(s).
  - .3 Prior to forming of the structure, arrange for the preparation of Shop Drawings for review by the Consultant showing embedded conduit to be cast within the structure. Shop Drawings shall include conduit from all sources.
- 4.5 Shop Drawings shall indicate the following minimum criteria and any additional criteria indicated in the individual specification sections requiring Shop Drawings:
- .1 Clear and obvious notes of any proposed changes from the Contract Documents.
  - .2 Fabrication and erection dimensions.
  - .3 Provisions for allowable construction tolerances and deflections provided for live loading.
  - .4 Details to indicate construction arrangements of the parts and their connections, and interconnections with other work.
  - .5 Location and type of anchors and exposed fastenings.
  - .6 Materials, physical dimensions including thicknesses, and finishes.
  - .7 Descriptive names of equipment.

- .8 Mechanical and electrical characteristics when applicable.
- .9 Information to verify that superimposed loads will not affect function, appearance, and safety of the work detailed as well as of interconnection work.
- .10 Assumed design loadings, and dimensions and material specifications for load-bearing members.
- 4.6 Include in Shop Drawing submissions detailed information, templates, and installation instructions required for incorporation and connection of the Work.
- 4.7 Before submitting to the Consultant, review all Shop Drawings to verify that the Products illustrated therein conform to the Contract Documents. By this review, the Contractor agrees that it has determined and verified all field dimensions, field construction criteria, materials, catalogue numbers and similar data and that it has checked and coordinated each Shop Drawing with the requirements of the Work and of the Contract Documents. The Contractor's review of each Shop Drawing shall be indicated by stamp, date and signature of a qualified person possessing the appropriate authorization from the Contractor.
- 4.8 Be responsible for dimensions, confirmed at the Site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for coordination of the Work of all subtrades.
- 4.9 Submit Shop Drawings for the Consultant's review with reasonable promptness and in orderly sequence so as to cause no delay in the Work nor in the work of Other Contractors. At the time of submission, notify the Consultant in writing of any deviations in the Shop Drawings from the requirements of the Contract Documents. The Contractor will be held responsible for changes made from the Contract Documents which are not indicated or otherwise communicated in writing with the submission.
- 4.10 Drawings submitted by the Contractor as required herein are the property of the Owner who may use and duplicate such drawings where required in association with the Work.
- 4.11 Submit Shop Drawings signed and sealed by a licensed Professional Engineer registered in the place of the Work where indicated in individual Sections.
- 4.12 Shop Drawings shall have distinct, uniform letters, numerals and line thicknesses that will ensure the production of clear legible prints at original as well as reduced size.
- 4.13 Provide submissions in electronic Portable Document Format (PDF) format delivered via electronic means as directed by the Consultant.
- 4.14 Shop Drawings shall contain the following identification:
  - .1 Project name and Contract number.

- .2 Applicable 6-digit Contract Specification number describing the item.
- .3 Location (unit, level, room number, etc.).
- .4 Name of equipment or Product.
- .5 Name of Subcontractor or supplier/fabricator.
- .6 Signature of Contractor certifying that Shop Drawing is in conformance with Contract Documents.
- .7 On submissions subsequent to the first, the following additional identification:
  - .1 The revised submission number.
  - .2 Identification of the item(s) revised.
- 4.15 Dimensions and designations of elements shall be shown in the same system of measurement used on the applicable Contract Drawings.
- 4.16 The Consultant reserves the right to refuse acceptance of drawing submissions not meeting the above requirements.
- 4.17 The Consultant's review will be for conformity to the design concept and for general arrangement only and such review shall not relieve the Contractor of responsibility for errors or omissions in the Shop Drawings or of responsibility for meeting all requirements of the Contract Documents unless a deviation on the Shop Drawings has been approved in writing by the Consultant. Review does not mean that Consultant approves detail inherent in Shop Drawings, responsibility which shall remain with Contractor submitting same.
- 4.18 The Contractor shall make any changes in Shop Drawings which the Consultant may require consistent with the Contract Documents and re-submit unless otherwise directed by the Consultant. When re-submitting the Shop Drawings, the Contractor shall notify the Consultant in writing of any revisions other than those requested by the Consultant.
- 4.19 Only drawings noted for revision and resubmission need be resubmitted.
- 4.20 File one copy of each submitted Shop Drawing at the Site.
- 5 **CERTIFICATES**
- 5.1 Submit certificates that are required by authorities having jurisdiction or that are requested in the applicable specification sections.
- 5.2 Clearly show on each certification the name and location of the Work, name and address of Contractor, quantity and date of shipment and delivery and name of certifying company.

5.3 Certificates shall verify that Products and/or methods meet the specified requirements and shall include test reports of testing laboratories approved to validate certificates.

5.4 Submit certificates in duplicate and signed by an authorized representative of the certifying company.

## **6 CERTIFICATION OF TRADESMEN**

6.1 Provide certificates, at the request of the Consultant, to establish qualifications of personnel employed on the Work where such certification is required by authorities having jurisdiction, by the Consultant or by the Contract Documents.

## **7 EXTENDED WARRANTIES**

7.1 Submit extended warranties as requested in sections of the Specifications showing title and address of Contract, warranty commencement date and duration of warranty.

7.2 Extended warranties shall commence on termination of the standard warranty specified in the conditions of the contract and shall be an extension of these provisions. Clearly indicate what is being warranted and what remedial action is to be taken under the warranty. Ensure warranty bears the signature and seal of the Contractor.

7.3 Submit each extended warranty on a form that is acceptable to the Owner and Consultant.

## **8 INSPECTION AND TEST REPORTS**

8.1 Submit inspection and test reports as specified in the Sections of the specifications for "Source Quality Control" and "Field Quality Control" within 3 working days of inspection or testing. If immediate action is required by the Contractor inform the Consultant immediately and submit inspection and testing report within one working day.

8.2 Submit 3 copies of reports submitted with certificates of compliance indicating but not limited to the following:

- .1 Project name and number.
- .2 Date of inspection or test and date report is issued.
- .3 Name and address of inspection and testing company.
- .4 Name and signature of inspector or tester.
- .5 Identification of Product and Specification Section covering inspected or tested work.



- .6 Specified requirements for which the inspection or testing was performed and results of inspections or tests.
  - .7 Location of inspection or from which tested material was derived.
  - .8 Overview of inspection and testing methods and procedures.
  - .9 Remarks and observations on compliance with Contract Documents.
- 8.3 Inspection and test reports shall be signed by a responsible officer of the inspection and testing company.

9 **PROGRESS PHOTOGRAPHS**

- 9.1 Concurrently with monthly application for payment submit PDF files or zipfile via digital transfer services such as dropbox, wetransfer, or other software of digital pictures illustrating the progress of the Work as follows:
- .1 A minimum of 20 pictures that best illustrate the progress on the site.
  - .2 Pictures shall be in focus and properly illuminated; view shall be unobstructed.
  - .3 Pictures shall be taken with a minimum 8 megapixel camera or better such that quality and details can be discerned from photo.
  - .4 The Pictures shall either have an accurate date-stamp present in the photo, or be numbered and dated in the digital filename.
  - .5 The PDF files containing the photo's shall be labeled with the following information: The project name, the period the pictures are taken in, the monthly application number which the pictures are associated with.

10 **PROGRESS REPORTS**

- 10.1 Prepare a monthly progress report current to the last Friday of each month. The report shall indicate the period covered and include but not be limited to the following:
- .1 Executive Summary.
  - .2 Areas of Concern/Action Required.
  - .3 Work Accomplished This Period.
  - .4 Work Planned Next Period.
  - .5 Schedule Status.
  - .6 Budget Status.

.7 Status of Submittals.

.8 Quality Control.

.9 Contract Changes.

.10 Outstanding Actions.

10.2 Submit the monthly progress report such that it is received by the Owner & Consultant no later than the Wednesday following the last Friday of the month, regardless of whether or not the Monday is a public holiday.

**11 OPERATION AND MAINTENANCE MANUALS**

11.1 Submit Operation and Maintenance Manuals in accordance with Section 01 78 23.

**12 RECORD DOCUMENTS**

12.1 Submit record documents in accordance with Section 01 78 39.

END OF SECTION

1 **CONSTRUCTOR**

- 1.1 For the purposes of the Contract, the term "Constructor", as defined in the Occupational Health and Safety Act, shall mean the Contractor who shall be responsible for ensuring that the provisions of the statutes, regulations and by-laws pertaining to the safe performance of the Work are to be observed. The "Constructor" shall submit the Notice of Project.
- 1.2 In the event of conflict between any of the provisions of Statutes, Regulations and By-laws, and other requirements of authorities, the most stringent provision applies.
- 1.3 The Contractor's representative shall be responsible for ensuring that the provisions of statutes, regulations and by-laws pertaining to safe performance of the Work and the work of Other Contractors and Owner's own forces working on the Site are observed and that the methods of performing the Work do not endanger the personnel employed thereon nor the general public, and are in accordance with the latest edition of the Occupational Health and Safety Act. Include on the Joint Health and Safety Committee representatives of Other Contractors working on Site.
- 1.4 Prior to the Contractor's representative being absent from the Site for an extended period during execution of the Work, the Contractor's representative will name, in writing to the Consultant, another person who is competent to assume these responsibilities. The Contractor shall advise the Consultant of change of the individual identified as the Contractor's representative.
- 1.5 At the discretion of the Consultant, the "Constructor" designation may be transferred to/from a Contractor at any time at no additional cost to the Owner.

2 **PROJECT RESPONSIBILITIES**

- 2.1 The Contractor's representative shall ensure that:
- 2.2 All measures and procedures prescribed by the following Acts and Regulations are carried out on Site:
- .1 The Occupational Health and Safety Act;
  - .2 The Regulations for Construction Projects;
  - .3 WHMIS Regulations;
  - .4 The Environmental Protection Act and regulations,
  - .5 All other legislation, regulations and standards as applicable.
- 2.3 Every employer and every worker performing Work on the Site must comply with the requirements referred to above.

- 2.4 Ensure that the health and safety of workers, employees of the Owner and the general public are protected in relation to the Work performed on the Site.

3 **WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM (WHMIS)**

- 3.1 Be familiar with and comply with WHMIS regulations.
- 3.2 Properly label controlled products. Provide proper warning labels and training at the Site.
- 3.3 Maintain on site for duration of Contract a hazardous materials log containing all required MSDS. Log shall be open for inspection by Owner, Consultant and all personnel on Site.
- 3.4 Provide copies of material safety data sheets (MSDS) for any controlled products prior to delivery to the Site.
- 3.5 Be responsible for all applicable requirements of the regulations.
- 3.6 Before commencing any Work on Site, attend the pre-construction meeting and provide the Consultant with a proposal as to how hazardous materials will be stored and dispensed on Site. In addition, specifically outline the measures which will be undertaken to prevent damage or injury in the event of an accidental spill.
- 3.7 Provide "Handling Procedure for Hazardous Materials".

4 **JOINT HEALTH AND SAFETY COMMITTEE**

- 4.1 The Contractor shall be responsible for the establishment and operation of the Joint Health and Safety Committee as required by the Occupational Health and Safety Act.

5 **DELIVERABLES**

- 5.1 The Contractor shall deliver to the Consultant:
- .1 The Contractor's Occupational Health and Safety Policy.
  - .2 The Contractor's safety program to implement the Occupational Health and Safety Policy for the Contract, which will effectively prevent and control accidents for the Contract.
  - .3 A copy of all communications with, and including all orders by, the Ministry of Labour or other occupational health and safety enforcement authority.

- .4 A copy of all accident/injury investigation reports, not just the WSIB Form 7. Each report must contain a statement of actions that will be taken to prevent a recurrence.
  - .5 A copy of all inspection reports made by the Contractor in compliance with the employer's responsibility under the Occupational Health and Safety Act.
  - .6 A copy of all safety information pertaining to the Contract made and furnished by the Contractor's own "Safety Personnel" or outside consultants/advisers engaged for the purpose of inspecting the workplace for occupational health and safety.
  - .7 A verification that all workers in the employment of the Contractor on Site, have had a WHMIS training or refresher course within the last twelve months.
  - .8 A verification that all workers in the employ of the Contractor have had "Explosive Activated Tool Training" on the type of tools being used.
  - .9 A verification that the instruction manuals are on Site for all tools and equipment being used.
  - .10 A copy of the most recent workers compensation experience rating account, i.e. CAD-7, NEER, and/or an insurance carrier's experience rating account.
  - .11 Statistical information for the purpose of determining injury frequency and severity rates (hours worked, first-aid injuries, medical aid injuries, lost time injuries, restricted workday injuries, near-miss accident/incident and significant occurrence data), in a timely manner as required by the Owner/Consultant.
  - .12 The immediate reporting to the Owner/Consultant of all instances that are defined in the Occupational Health and Safety Act as "Notices of Injuries" and "Occurrences" and any occasion that a worker exercises their "Right to Refuse Unsafe Work".
- 5.2 The Consultant reserves the right to require additional or amended deliverables pertaining to safety during the duration of the Work at no additional cost to the Owner.
- 5.3 Items specified above shall be delivered to the Consultant prior to the Contractor commencing Work on the Site.
- 6 **DUE DILIGENCE**
- 6.1 The Contractor acknowledges that it has read and understands the measures and procedures relating to occupational health and safety as prescribed above. The Contractor acknowledges and understands its duties as therein set out and hereby expressly undertakes and agrees to comply with all such requirements and standards in their entirety and at the Contractor's expense.

- 6.2 The Contractor further agrees to fully cooperate with all health and safety requirements, rules, regulations, standards, and criteria set out in the Contract Documents, which agreement is in furtherance of the Contractor's duties and responsibilities under occupational health and safety legislation.
- 6.3 The Contractor agrees that if, in the opinion of the Consultant or Owner, the health and safety of a person or persons is endangered or the effective operation of the system put in place to ensure the health and safety of workers on the Site is not being implemented, the Consultant or Owner may take such action as it deems necessary and appropriate in the circumstances, including, without limitation, the following:
- .1 Require the Contractor to remedy the condition forthwith at its own expense;
  - .2 Require that the Site be shut down in whole or in part until such time as the condition has been remedied;
  - .3 Remedy the problem and the Owner shall back-charge the Contractor for the cost of such remedial work, together with an appropriate overhead factor as determined by the Owner in its sole discretion; and
  - .4 Terminate the Contract without further liability in the event the Contractor fails to comply with these provisions.
- 7 **SITE SAFETY PERSONNEL**
- 7.1 In the event the Consultant deems it necessary, because of the Work, the Contractor shall assign a "Competent Safety Person" to assist the Contractor's representative in the discharging of safety responsibility, at no additional cost to the Owner.

END OF SECTION

1 **GENERAL**

- 1.1 Be responsible for inspection and testing as required by the Contract Documents, statutes, regulations, by-laws, standards or codes or any other jurisdictional authority. Give the Consultant timely notice of the readiness for inspection, date and time for such inspection for attendance by the Consultant.
- 1.2 Verify by certification that specified products meet the requirements of reference standards specified in the applicable specification sections.
- 1.3 Conduct testing, balancing and adjusting of equipment and systems specified in applicable mechanical and electrical specifications sections by independent testing company.

2 **INSPECTION AND TESTING BY THE OWNER**

- 2.1 The Consultant, on behalf of the Owner may appoint an independent inspection and testing company to carry out inspection and testing of the Work for conformance to the Contract Documents. Such costs for inspection and testing will be paid by the Owner. However, any additional inspection and testing due to non-conformance to the Contract Documents shall be at the Contractor's expense.
- 2.2 A list of inspection and testing agencies shall be submitted by the Contractor for approval by the Owner and Consultant. Inspection and testing services will be tendered by the Contractor and the results submitted to the Consultant for review and approval.
- 2.3 Inspections and testing by the independent inspection and testing company will be promptly made. Uncover for examination any Work covered up prior to inspection or without approval of the Consultant. Make good such Work at no cost to the Owner.
- 2.4 The Owner may inspect and test Products during manufacture, fabrication, shop testing, installation, construction and testing phases of the Contract. The Consultant will ascertain the quantity and quality of testing to be performed. Inspection and testing may be performed at the place of manufacture/fabrication, storage, or at the Site as designated by the Consultant. Where inspection and testing is done either during manufacture, fabrication, or at Site, ensure that proper facilities and assistance are provided.

3 **INSPECTION AND TESTING**

- 3.1 Source and Field Quality Control specified in Other Sections:
  - .1 This Section includes requirements for performance of inspection and testing specified under Source Quality Control and Field Quality Control in other Sections of the specifications.

- .2 Do not include in work of this Section responsibilities and procedures that relate solely to an inspection and testing company's functions that are specified in another Section which is paid for directly by the Owner. Such information is included in this Section for Contractor's information only.

- 3.2 Do not limit responsibility for ensuring that products and execution of the work meet Contract requirements, and inspection and testing required to this end, to specified inspection and testing.

#### 4 **QUALIFICATIONS OF INSPECTION AND TESTING COMPANIES**

- 4.1 Inspection and testing companies to be certified by the Standards Council of Canada (SCC) or Canadian Council of Independent Laboratories (CCIL).
- 4.2 Companies engaged for inspection and testing shall provide equipment, methods of recoding and evaluation, and knowledgeable personnel to conduct tests precisely as specified in reference standards.
- 4.3 If requested, submit affidavits and copies of certificates of calibration made by an accredited calibrator to verify that testing equipment was calibrated and its accuracy ensured within the previous twelve months.

#### 5 **RESPONSIBILITIES OF THE CONTRACTOR**

- 5.1 Be responsible for quality control methods and procedures to ensure performance of the work in accordance with the Contract Documents.

#### 6 **RESPONSIBILITIES OF INSPECTION AND TESTING COMPANIES**

- 6.1 Determine from specifications and Drawings the extent of inspection and testing required for Work of the Contract. Subcontractors shall notify Consultant of any omissions or discrepancies in the work inspected and/or tested.
- 6.2 Perform applicable inspection and testing described in the Specifications and as may be additionally directed.
- 6.3 Provide competent inspection and testing personnel when notified by the Contractor that applicable work is proceeding. Inspection personnel shall cooperate with the Consultant and Contractor to expedite the Work.
- 6.4 Subcontractors shall notify the Consultant and Contractor of deficiencies and irregularities in the Work immediately when they are observed in the course of inspection and testing.
- 6.5 Inspection and testing companies shall not perform or supervise any of the Contractor's work, and shall not authorize:

- .1 Performance of work that is not in strict accordance with the Contract Documents.



- .2 Approval or acceptance of any part of the Work.

## 7 INSPECTION AND TESTING PROCEDURES

- 7.1 Perform specified inspection and testing only in accordance with specified reference standards, or as otherwise approved.
- 7.2 Observe and report on compliance of the Work to requirements of Contract Documents.
- 7.3 Ensure that inspectors are on site or at fabricator's operations for full duration of critical operations, and as otherwise required to determine that the Work is being performed in accordance with the contract Documents.
- 7.4 Identify samples and sources of materials.
- 7.5 Review and report on progress of the work. Report on count of units fabricated and inspected at fabricator's operations.
- 7.6 Observe and report on conditions of significance to work in progress at time of inspection or at fabricator's operations. Include where applicable and if critical to the work in progress:
  - .1 Time and date of inspection.
  - .2 Temperature of air, materials, and adjacent surfaces.
  - .3 Humidity of air, and moisture content of materials and adjacent materials.
  - .4 Presence of sunlight, wind, rain, snow and other weather conditions.
- 7.7 Include in reports all information critical to inspection and testing.
- 7.8 Ensure that only materials from the work and intended for use therein are tested.
- 7.9 Determine locations for work to be tested.

## 8 TOLERANCES FOR INSTALLATION OF WORK

- 8.1 Unless specifically indicated otherwise, all work of all contractor and subcontractors' work shall be installed plumb, level, square and straight.
- 8.2 Unless acceptable tolerances are otherwise specified in specification sections or are otherwise required for proper functioning of equipment, site services, and mechanical and electrical systems:
  - .1 "Plumb and level" shall mean plumb or level within 1 mm in 1 m.
  - .2 "Square" shall mean not in excess of 10 seconds lesser or greater than 90 degrees.

.3 "Straight" shall mean within 1 mm under a 1 m long straightedge.

.4 "Flush" shall mean within:

.1 6 mm for exterior concrete, masonry, and paving materials.

.2 1 mm for interior concrete, masonry, tile and similar surfaces.

.3 0.05 mm for other interior surfaces.

8.3 Allowable tolerances shall not be cumulative.

## **9 REFERENCE STANDARDS**

9.1 Perform inspection and testing in accordance with Standards quoted and as required by procedures described in specified reference standards that are applicable to the work being inspected and tested.

## **10 DEFECTS**

10.1 Defective products, materials and workmanship found at any time prior to Contract Completion will be rejected regardless of previous inspections, testing, and reviews of the Work. Inspections, testing, and reviews shall not relieve the Contractor from their responsibility but are a precaution against oversight or error. Remove and replace defective and rejected products, materials, systems, and workmanship. Be responsible for delays and expenses caused by rejection.

## **11 MOCK UPS**

11.1 Where required by Contract Documents construct, unless indicated herein, mock-ups of work on Site, in size and at location directed by Consultant.

11.2 Construct mock-ups prior to start of affected work. Allow sufficient time for Consultant's review. Work affected by mock-ups may not commence prior to acceptance of mock-ups.

11.3 Construct mock-ups to include all related specified materials and workmanship. Make revisions as directed by Consultant, in accordance with the intent of the Contract Documents, until mock-ups are acceptable.

11.4 Mock-ups, reviewed and accepted by Consultant, shall become the standard of quality against which installed work will be measured.

11.5 Mock-ups, by prior arrangement, may be incorporated into finished work if approved by Consultant only.

## **12 EXTERIOR WALL MOCK-UP**

12.1 For exterior wall elements, construct a 1 m<sup>2</sup> (1.0m x 1.0m) mock-up of wall system incorporating all wall components specified. Construct mock-up on Site in a location acceptable to Consultant.

- 12.2 The mock-up shall include the work of all trades involved in exterior wall elements, complete in all respects including masonry, air/vapour retarders, zinc cladding, aluminium work, sealants, etc., and shall establish a minimum standard for the work of the exterior wall elements, clear up any misunderstandings and point out any possible problems.
- 12.3 Upon completion of mock-up, and after being notified by the Contractor, Consultant will inspect mock-up and if necessary, prepare and issue a list of deficiencies. Once mock-up has been accepted, it will form the minimum standard of quality for exterior wall elements.
- 12.4 Mock-up will not form part of the work and will be independent of building. Remove and dispose of mock-up from Site during final clean-up, or when directed by Consultant.

**13 DOCUMENTS ON SITE**

- 13.1 Maintain at job site, one copy of each of the following:
- .1 Contract Documents including Drawings, Specifications, Addenda, and other modifications to the Contract.
  - .2 'Reviewed' or 'Reviewed as Modified' Shop Drawings.
  - .3 Project Construction and Shop Drawing Schedules.
  - .4 Site Instructions and Change Orders.
  - .5 Field Test Reports.
  - .6 Reports by Authorities having Jurisdiction.
  - .7 Building and other applicable permits.
  - .8 Daily log including:
    - .1 Weather conditions.
    - .2 Excavation conditions
    - .3 Start and finish date of each Trade Contractor.
    - .4 Erection and removal dates of formwork.
    - .5 Date, quantities and particulars of each concrete pour.
    - .6 Dates and quantities and particulars of roofing and waterproofing work.
    - .7 Visits to the Site by Owner, Consultants, Jurisdictional Authorities, Testing and Inspection companies, and material and equipment supplier representatives.
  - .9 Material Safety Data Sheet pursuant to WHMIS (Occupational Health & Safety Act).

- .10 As-built drawings recording as-built conditions, instructions, changes for structure, equipment, wiring, plumbing, etc., as called for in Section 01 78 39 and Divisions 22 and 26, prior to being concealed.

- .11 Copies of applicable codes.

13.2 The above material shall be made available to the Consultant at their request.

#### 14 **BUILDING ENVELOPE**

14.1 Requirements specified herein apply to all elements of the exterior building envelope.

14.2 Continuity of air barrier/vapour retarder and insulation components is critical and must be maintained at all locations. Where different systems meet, ensure proper interface and continuity between adjacent components by implementing suitable construction sequences and by using compatible materials only.

14.3 Maximum air leakage shall be 0.10 L/(sAm<sup>2</sup>) when measured with a warm-side relative humidity of 27-55% at 21°C and a measured air pressure difference of 75Pa.

14.4 Anchor exterior cladding components to structure in manner suitable to accommodate structural deflection and creep and to withstand loads from expected temperature gradients. Design anchorage to withstand expected wind loads, positive and negative, in accordance with applicable regulations.

14.5 Ensure that air spaces within exterior building components are fire stopped in accordance with applicable regulations.

14.6 Ensure that air spaces on the outside of vertical air barrier/vapour retarder (walls), window systems, and curtain wall systems are constructed with adequate drainage provisions to the exterior.

14.7 Owner may complete a thermographic scan upon completion of the building envelope. Contractor will be responsible to correct identified thermal anomalies.

#### 15 **DRAINAGE**

15.1 Layout and construct work to ensure that positive drainage is provided to floor drains, ditches, site drains and catch basins, as set in their final position, preventing undrained areas and ponding.

15.2 Ensure that allowable construction tolerances and structural deflection do not cause ponding of water.

15.3 Report to Consultant in writing prior to executing work affected, in case adequate drainage cannot be provided.

END OF SECTION

1 **GENERAL**

- 1.1 Provide Labour, Products, equipment, services, tools and Supervision to ensure that Work complies with minimum acceptable standards of materials and performance of Work in accordance with codes and standards referenced in the Specification.
- 1.2 Consider contract forms, codes, Specifications, standards, manuals, and installation and application instructions referred to in these specifications to be the latest published editions at the date of submission of the bid unless otherwise stated in the Specifications or otherwise required by the authorities having jurisdiction.

2 **BY-LAWS, PERMITS, AND FEES**

- 2.1 The Building Code - Ontario Regulation 332/12, including all amendments and updates current as of the date of Application for Building Permit identified on the official stamped & issued Building Permit drawing set, shall govern the construction of the Work. Any changes to the Building Code which take effect after the application for building permit, but prior to completion of construction, which are required by law to be incorporated, shall be added by way of Change Order to the Contract.
- 2.2 Comply with all By-Laws and regulations of authorities having jurisdiction. These codes and regulations constitute an integral part of the Contract Documents..
- 2.3 If required, pay for construction damage deposit required by authorities having jurisdiction.
- 2.4 Where permits, licences, and inspection fees are required by authorities having jurisdiction for specific trade functions, they shall be obtained by particular subtrade responsible for that work.
- 2.5 Arrange for inspection, testing of Work and acceptance required by the authorities having jurisdiction. Be responsible for necessary preparations, provisions and pay all associated costs.
- 2.6 Be responsible for ensuring that no work is undertaken which is conditional on permits, approvals, reviews, licences, fees, until all applicable conditions are met. No time extension will be allowed for delay in obtaining necessary permits.
- 2.7 Any additional work or changes to the materials due to Work not complying with the Ontario Building Code and Regulations as indicated by the Building Inspector shall be changed. All costs involved shall be borne by Contractor.
- 2.8 Obtain permit required to work on Municipal rights of way. Provide damage deposits for sidewalks, roads and services work, as applicable.
- 2.9 Give notice of completion of project prior to occupancy, as required by applicable legislation.

**3 RIGHT OF WAY PERMIT**

- 3.1 The Site Servicing Sub-Contractor and/or General Contractor will be required to obtain approval from the Transportation Services Division for any work within the public right-of-way.
- 3.2 In order to obtain approval for work in the City's right-of-way the Site Servicing Sub-Contractor and/or General Contractor will be required to provide up to date stake out information for most construction related work.
- 3.3 The Site Servicing Sub-Contractor and/or General Contractor is required to obtain building location and access permits prior to constructing this project. Other permits associated with construction activities (such as hoarding, piling/shoring, etc.) may also be required.

**4 SITE SERVICING CONNECTIONS**

- 4.1 The Site Servicing Sub-Contractor and/or General Contractor will be required to make an application to the Municipality's Water Division for the installation of any proposed services within the right-of-way after acceptance of the stormwater management report and site servicing plan.

**5 CONSTRUCTION MANAGEMENT PLAN**

- 5.1 The Site Servicing Sub-Contractor and/or General Contractor will be required to provide the Municipality with a Construction Management Plan outlining the following:

- .1 Dust/mud control on and offsite;
- .2 Location of truck loading points, trailer parking;
- .3 Location of temporary material storage areas;
- .4 Access/truck routing;
- .5 Provision of hoarding, temporary fencing & covered walkways;
- .6 Location and extent of aerial crane operations; and
- .7 Parking for construction trades;

**6 OFF-STREET VEHICULAR LOADING AND PARKING FACILITIES AND ACCESS/DRIVEWAYS**

- 6.1 Provide and maintain off-street vehicular loading and parking facilities and access driveways in accordance with the approved plans and drawings, to the satisfaction of the Municipality.

- 6.2 All on-site driveways and parking areas must be surfaced and maintained with asphalt, concrete or interlocking stone.

7 **FACILITIES FOR THE LANDSCAPING OF THE LANDS OR THE PROTECTION OF ADJOINING LANDS**

- 7.1 The Site Servicing Sub-Contractor and/or General Contractor shall maintain the sod covered portion within the City's Right-of-Way fronting and/or flanking the site in accordance with the approved plans and drawings to the satisfaction of the Municipality.

8 **EXISTING PUBLIC SERVICE LINES**

- 8.1 Where existing public services are indicated to be removed and/or relocated, perform Work in compliance with authorities having jurisdiction.
- 8.2 The Site Servicing Sub-Contractor and/or General Contractor is required to make good public roads, walkways and curbs soiled or damaged due to construction to the requirements of local authorities.

9 **CODES**

- 9.1 Reference is made to standards in the specifications to establish minimum acceptable standards of materials, products and workmanship. Ensure that materials, products and workmanship meet or exceed requirements of the reference standards specified.
- 9.2 In the event of conflict between documents specified herein, execute the Work in accordance with the most stringent requirements.

10 **STANDARDS**

- 10.1 Where a material or product is specified in conjunction with a referenced standard, do not supply the material or product if it does not meet the requirements of the standard. Supply another specified material or product, or an acceptable material or product of other approved manufacture which does meet the requirements of the standard, at no additional cost to the Owner.
- 10.2 Where no standard is referred to, provide materials, products and workmanship which meet requirements of the applicable standards of the Canadian Standards Association, Canadian General Standards Board, Ontario Provincial standard specifications (OPSS), Ontario Provincial Standard Drawings (OPSD) and the applicable building code. References to "Measurement for Payment" and "Basis of Payment" in OPSS standard documents are not applicable to this Contract.
- 10.3 If there is question as to whether a material, product or system is in conformance with applicable standards, the Consultant reserves the right to have such materials, products or systems tested to prove or disprove conformance. The cost for such

testing will be paid by the Owner in the event of conformance with contract Documents or by the Contractor in the event of non-conformance.

- 10.4 Where application, installation and workmanship standards are cited, it is intended that referenced standards form the basis for minimum requirements of the specified item and specifications supplement the standards unless specified otherwise.
- 10.5 Matters may be dealt with in part by these specifications which are also dealt with, under the same or similar headings in cited standard. It is not intended that these specifications take the place of the standards but supplement them, unless specified otherwise.
- 10.6 Where reference is made to manufacturer's directions, instructions or specifications they shall include full information on storing, handling, preparing, mixing, installing, erecting, applying, or other matters concerning the materials pertinent to their use and their relationship to materials with which they are incorporated.
- 10.7 Where standards, specifications, associations, and regulatory bodies are listed in the Specifications by their abbreviated designations. These are but not limited to the following:
- |        |   |
|--------|---|
| AA     | The Aluminum Association  |
| AAMA   | Architectural Aluminum Manufacturers Association                          |
| AASHTO | American Association of State Highway and Transportation Officials        |
| ACI    | American Concrete Institute   |
| AFBMA  | Anti-Friction Bearing Manufacturer's Association                          |
| AIEE   | American Institute of Electrical Engineers                                |
| AISI   | American Iron and Steel Institute   |
| AMCA   | Air Movement and Control Association                                      |
| AMEU   | Association of Municipal Electric Utilities                               |
| ANSI   | American National Standards Institute                                     |
| ARI    | Air-Conditioning and Refrigeration Institute                              |
| ASA    | American Standards Association  |
| ASHRAE | American Society of Heating, Refrigeration and Air Conditioning Engineers |
| ASME   | American Society of Mechanical Engineers                                  |
| ASTM   | American Society of Testing and Materials                                 |
| AWMAC  | Architectural Woodwork Manufacturers Association of Canada                |
| AWWA   | American Water Works Association  |
| CEMA   | Canadian Electrical Manufacturer's Association                            |
| CGA    | Canadian Gas Association  |
| CGSB   | Canadian General Standards Board  |
| CISC   | Canadian Institute of Steel Construction                                  |
| CMHC   | Canadian Mortgage and Housing Corporation                                 |
| COMPA  | Canadian Paint Manufacturers Association                                  |
| COFI   | Council of Forest Industries of British Columbia                          |
| CRCA   | Canadian Roofing Contractors Association                                  |
| CSA    | Canadian Standards Association  |



CSSBI	Canadian Sheet Steel Building Institute
CWB	Canadian Welding Bureau
CWC	Canadian Wood Council
EEMAC	Electrical and Electronic Manufacturers Association Canada
FM	Factory Mutual
IEEE	Institute of Electrical and Electronic Engineers
MFMA	Maple Flooring Manufacturers Association
MIL	Military Standards
MSS	Manufacturer's Standardization Society
MTO	Ministry of Transportation Ontario
NAAMM	National Association of Architectural Metal Manufacturers
NFPA	National Fire Protection Association
NEMA	National Electrical Manufacturer's Association (U.S.A.)
NLGA	National Lumber Grades Authority
NRC	National Research Council of Canada
OCBA	Ontario Concrete Block Association
OHESC	Ontario Hydro Electrical Safety Code
OPSS	Ontario Provincial Standard Specification
PEI	Porcelain Enamel Institute
PDI	Plumbing Drainage Institute
PHA	Public Health Act
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SSPC	Steel Structures Painting Council
TEMA	Tubular Exchange Manufacturer's Association
TTMAC	Terrazzo, Tile and Marble Association of Canada
UL	Underwriters Laboratories Inc. (U.S.)
ULC	Underwriters Laboratories of Canada

## 11 **FIRE RATINGS, ASSEMBLIES AND SEPARATIONS**

11.1 Where a material, component, assembly, or separation is required to be fire rated, the fire rating shall be as determined or listed by one of the following testing authorities acceptable to the authorities having jurisdiction:

- .1 Underwriters' Laboratories of Canada.
- .2 Underwriters' Laboratories Inc.
- .3 Factory Mutual Laboratories.
- .4 The National Research Council of Canada.
- .5 The National Board of Fire Underwriters.
- .6 Intertek Testing Services.

11.2 Where reference is made to only one testing authority an equivalent fire rating as determined or listed by another of the aforementioned testing authorities is acceptable

if approved by authorities having jurisdiction. Obtain and submit such approval of authorities, in writing when requesting acceptance of a proposed equivalent rating or test design.

- 11.3 Fire rated door assemblies shall include doors, frame, anchors, and hardware and shall bear label of fire rating authority showing opening classification and rating.
- 11.4 Material having a fire hazard classification shall be applied or installed in accordance with fire rating authorities printed instructions.
- 11.5 Fire rated assemblies shall be constructed in accordance with applicable fire test report information issued by fire rating authority. Deviation from fire test report will not be allowed.
- 11.6 Construct fire separations as continuous, uninterrupted elements except for permitted openings. Extend fire rated walls and partitions from floor to underside of structural deck above.
- 11.7 Fire separations may be pierced by openings for electrical and similar service outlets provided such boxes are non-combustible and are tightly fitted and sealed with a ULC approved sealant for the assembly being sealed.
- 11.8 Construction that abuts on or is supported by a non-combustible fire separation shall be constructed so that its collapse under fire conditions will not cause the collapse of the fire separation.
- 11.9 Do not use combustible members, fastenings, attachments and similar items to anchor electrical, mechanical or other fixtures to fire separations.
- 11.10 At penetration through fire rated walls, ceilings or floors, completely seal voids with ULC approved firestopping material; full thickness of the construction element. In locations that require a smoke seal, provide appropriate ULC approved system installed in accordance with the manufacturer's recommendations.

END OF SECTION

**1 TEMPORARY CONTROLS**

**1.1 Hoarding and barriers:**

- .1 Before commencing operations, supply, erect and maintain hoarding around entire perimeter of Site. Paint outside of hoarding in a colour selected by the Owner and mark with "POST NO BILLS" signs.
- .2 Provide temporary enclosures as required to protect the building in its entirety or in its parts, against the elements, to maintain environmental conditions required for work within the enclosure, and to prevent damage to materials stored within.
- .3 Provide lockable gates through hoarding and barriers for access to Site by workers and vehicles.

1.2 Prevent unauthorized entry to the Site. Barricade, guard or lock access points to the satisfaction of the Owner and post "NO TRESPASSING" signs.

1.3 Provide hoarding, barriers and covered walkways required by governing authorities for public safety, public rights-of-way and for access to buildings. Snow fencing is not allowed as protection for sidewalk.

1.4 Install signs for the movement of people around Work Site as required and directed by the Owner.

1.5 Provide secure, rigid guide rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs as required for protection of Work, workers, and the public.

1.6 Remove hoarding, barriers, building enclosures, guide rails and barricades upon Contract Completion unless otherwise noted on the Contract Drawings or as directed by the Owner.

**2 SERVICE AND UTILITY SYSTEMS**

2.1 Consult with utility companies and other authorities having jurisdiction to ascertain the locations of existing services on or adjacent to site.

2.2 Information as to the location of existing services, if shown on the Drawings, does not relieve the Contractor of his responsibility to determine the exact number and location of existing services.

2.3 Give proper notices of new services as may be required. Make arrangements with authorities and utilities for service connections required.

2.4 Pay any charges levied by utilities or authorities for work carried out by them in connection with this Contract, unless specified otherwise.

2.5 Operate and maintain all utility systems affected by work of this Contract, until the building or specific portions thereof have been accepted by the Owner.

2.6 Report existing unknown services encountered during excavation to Consultant for instructions; cut back and cap or plug unused services. Be responsible for the protection of all active services encountered and for repair of such services if damaged.

### **3 SCAFFOLDING AND HOISTS**

3.1 Select, operate, and maintain scaffolding, hoisting equipment and cranes as may be required.

3.2 Do not erect or operate equipment that will endanger existing structures, local municipalities hydro installations, or traffic signals.

3.3 Design and construct scaffolding in accordance with CAN/CSA S269.2-M or updated version.

### **4 TEMPORARY WORKS**

4.1 Installation and Removal: Provide temporary utilities, facilities and controls in order to execute the Work expeditiously. Remove from Site all such Work after use.

4.2 Arrange for connections with appropriate utility company and pay all costs for installation, maintenance, and removal.

4.3 Arrange for connections with Owner and pay all costs for installation, maintenance, and removal.

4.4 Be responsible for the careful and reasonable use of Owner supplied water and power.

4.5 Temporary Power and Lighting Systems:

.1 Supply, install and maintain electrical power and necessary electrical equipment including overhead and underground feeders, transformers, motors, starters, panels, protective devices and equipment. Connections will be made available to any part of the Work within distance of a 30 m extension.

.2 Provide temporary lighting inside and outside structure of adequate intensity to illuminate construction activities. Provide temporary pedestrian lighting for sidewalk areas affected by the Work.

.3 Supply and install the type and quantity of minimum lighting equipment in each location to ensure adequate, continual illumination 24 hours per day, 7 days per week for the following:

.1 Emergency evacuation, safety and security throughout the Project at intensity levels required by jurisdictional authorities.

- .2 General lighting for performance of the Work throughout the Project, evenly distributed, and at intensities to ensure that proper installations and applications are achieved.
  - .3 Performance of finishing trades in area as required evenly distributed, and of an intensity of at least 50 Lux.
  - .4 In locations approved by the Owner. install and support the electrical plant, distribution and temporary lighting systems including service equipment and local hydro authority meter energized by the local hydro circuits. Installations shall be approved by the Consultant and shall be carried out in a neat manner to avoid interference with the application of the finished material and to facilitate removal when the installed permanent lighting system is in operation.
  - .5 Make all necessary arrangements for and pay all costs for a temporary electrical service of sufficient capacity to supply temporary lighting, operation of power tools, cranes and equipment for all construction, implementation, and inspection and testing purposes. Supply and install necessary temporary cables and other electrical equipment and make all temporary connections as required.
  - .6 Temporary power distribution wiring shall comply with Ontario Hydro Electrical Safety Code. Obtain inspection certificates for temporary electrical work.
  - .7 Maintain the lighting systems in operation during the life of the Contract. Replace burned or missing lamps immediately.
  - .8 Upon Contract Completion, remove electrical plant and temporary lighting from the Site.
- 4.6 Water Supply:
- .1 Provide and pay for a continuous supply of potable water for construction use. Provide as a minimum one water connection on each floor level.
  - .2 Provide and maintain all temporary lines, extensions and hoses as required. Remove all temporary connections and lines on completion of the Work and make good any damage.
- 4.7 Temporary Heating:
- .1 Provide temporary heating required during construction period, including attendance, maintenance, and fuel.
  - .2 Construction heaters used inside buildings must be vented to the outside or be flameless type. Solid fuel salamanders are not permitted.
  - .3 Maintain temperatures of minimum 10°C in areas where construction is in progress unless otherwise indicated in the Contract Documents. Protect exposed and adjacent services from freezing. Repair at no cost to the Owner any such services, buildings or other utilities disrupted by freezing.

- .4 Ventilate heated areas and keep structures free from exhaust combustion gases.
- .5 The permanent heating system of the building or portions thereof may be used when available only upon written permission by Owner. If permission to use heating system is obtained:
  - .1 Before using air handling systems, ensure that dust/debris is removed from the premises and install temporary filters to prevent construction dust/debris from entering via return air or intake openings. keep unused ducts sealed to prevent entry of dust/debris. Replace filters frequently during construction.
  - .2 On completion of work remove temporary filters and install new filters in accordance with Division 23. After temporary use of air handling system is complete and before turning over system to Owner, vacuum internally to ensure all dust/debris is removed.
- 4.8 Elevators: Elevators may not be used by construction personnel.
- 4.9 Temporary Telephone and facsimile: Provide and pay for separate telephones and facsimile services, for local call only, as required for own use and use of the Consultant and Owner. Long distance call shall be paid by party making call.
- 4.10 Sanitary Facilities: Provide sanitary facilities in accordance with occupational health and safety requirements in the place of the Work. Use of Owner's existing sanitary facilities or new sanitary facilities is not allowed.
- 5 **PROTECTION**
- 5.1 Protection of Public Area: Protect surrounding private and public property from damage during performance of the Work.
- 5.2 Take all necessary precautions to prevent damage to work affected by temperature, water, weather, and other environmental conditions.
- 5.3 Protection of Building Finishes and Equipment:
  - .1 Provide protection for existing structure, finished, and partially finished building finishes, waterproofing systems, and equipment during performance of the Work.
  - .2 Cover Owner's equipment and plant within the Site with 6 mil PVC sheet, or equal, taped to make it dust-tight. Equipment and existing work moved or altered to facilitate construction, movement of Products or equipment shall be stored, protected with dust-tight covers, and subsequently returned to its original location.
  - .3 Obtain approval from the Consultant prior to the installation of temporary supporting devices into existing roof, ceiling, or wall members for the erecting of equipment or machinery. Repair roof, ceiling, and wall members used for this purpose to the satisfaction of the Consultant.
  - .4 Provide necessary screens, covers and hoarding as required.

- .5 Provide temporary weather tight, dust tight, and lockable partitions within the building where work is performed. Provide weather tight closures to unfinished door and window openings, top of shafts and other openings in floors and roofs.
  - .6 Any Products or equipment damaged while carrying out the Work shall be restored with new Products or equipment matching the original equipment. Damage shall include harm resulting from all construction work, such as falling objects, wheel and foot traffic, failure to remove debris, operation of machinery and equipment, and scaffolding and hoisting operations.
  - .7 Protect finished surfaces of new work from damage by restriction of access or by use of physical means suitable to the material and surface location. Where construction operations must be performed or traffic routed over finished floors, lay 6 mm plywood coverings tightly fitted and secured over surface in such areas.
- 5.4 Fire Protection:
- .1 Take precautions to prevent fires. Provide and maintain temporary fire protection equipment of a type appropriate to the hazard anticipated in accordance with authorities having jurisdiction, governing codes, regulations, by-laws and to the satisfaction of the Consultant and insurance authorities.
  - .2 Excessive storage of flammable liquids and other hazardous materials is not allowed on Site. Flammable liquids must be handled in approved containers. Remove combustible wastes frequently.
  - .3 Inspect temporary wiring, drop cords, extension cables for defective insulation or connections frequently.
  - .4 Open burning of rubbish is not permitted on the Site.
  - .5 Handle, transport, store, use and dispose of gasoline, benzene or other flammable materials with good and safe practice as required by authorities having jurisdiction.
  - .6 Provide fire extinguishers of the non-freezing chemical type in each temporary building, enclosure and trailer. Use only fire-proofed tarpaulins.
  - .7 A fire watch shall be required for each of the following activities regardless of the number, duration or size of the activity in operation:
    - .1 any open flame activities (e.g., soldering and welding);
    - .2 shutdown of fire detection system;
    - .3 shutdown of sprinkler system.
- 5.5 Maintain adequate cover over services as required by Utility Authorities.
- 5.6 Report any discharge of a contaminant to the Authorities having jurisdiction.

**6 TEMPORARY BUILDINGS**

- 6.1 Provide, and maintain until contract completion, a temporary office as required for work, large enough to accommodate site administrative activities and site meeting, complete with lighting, heating, and air conditioning equipment to maintain 21 °C. Ventilation, telephone, facsimile machine on a separate line, copier (not combination fax/copier), table and chairs. Do not store materials, tools and/ or equipment in meeting area; keep clean and tidy.
- 6.2 For all trailers and temporary buildings, provide wood stairs, platform, and boardwalk, painted and repainted as required with non-skid abrasive paint.
- 6.3 Do not locate any buildings, structures or equipment in a manner that interferes with surveys along the control line and reference line tangents.
- 6.4 Remove temporary buildings upon Contract Completion. Restore area(s) to match the existing surrounding area.

**7 PEST CONTROL**

- 7.1 Be responsible for providing control measures, restraining procedures, and treatments to prevent infestation and spread of insects, rodents and other pests deemed to be present at Site and/or noticed during course of the Work. Carry out fumigation, pest control procedure, and posting of warning signs, notices including contents of such notices in accordance with requirements of Pesticides Act and any other authorities having jurisdictions. Pesticides used shall be in accordance with Canada Pest Control Products Act, and provincial and municipal regulations.

**8 FIRST-AID FACILITIES**

- 8.1 Provide site equipment and medical facilities necessary to supply first-aid service to injured personnel in accordance with regulations of the Workmen's Compensation Act. Maintain facilities for duration of Contract.

**9 USE OF NEW PERMANENT SERVICE & EQUIPMENT**

- 9.1 Do not use any new permanent service or equipment without Owner's written approval.
- 9.2 Where permission is granted to use permanent services and equipment provide competent people to operate services and equipment; inspect frequently and maintain facilities in proper operating condition at all times.
- 9.3 Permanent services and equipment shall be turned over to the Owner in "as new" and perfect operating condition.



- 9.4 Use of permanent systems and equipment as temporary facilities shall not affect the warranty conditions and warranty period for such systems and equipment. Make do allowance to ensure that Owner will receive full benefits of equipment manufacturers warranty after project takeover.

**10 PROJECT IDENTIFICATION (ARCHITECT'S SIGN)**

- 10.1 If required, obtain approvals from jurisdictional authorities for temporary signs.
- 10.2 Prior to submitting the first claim for payment, provide minimum 8' x 16' x 5/8" aluminum/foam panel composite sign, complete with aluminum framing, supports, and foundations. Graphics, in electronic format, for sign to be provided by Consultant. Sign background and rear face of sign shall be white. Submit a sign sketch for Consultant's approval before fabrication. Sign shall be executed with exhibit lettering produced by a professional sign manufacturer/painter. Locate sign as directed by Consultant.
- 10.3 Maintain sign in good condition for duration of work. Clean periodically. Remove immediately after Substantial Performance of the Contract, or at Completion of Contract as defined in applicable lien legislation as directed by the Consultant.
- 10.4 No other signs or advertisements, other than warning signs, or signs required by law, are permitted on site, without Owner's consent.

**11 SITE MAINTENANCE**

- 11.1 Maintain the Site and adjacent premises in a clean and orderly condition, free from debris and other objectionable matter. Immediately remove rubbish and surplus Products, equipment, and structures from the Site. If the Site is not cleaned (within 48 hours after the Contractor has been instructed to do so), the Consultant may clean the Site and retain the cost from monies due, or to become due, to the Contractor.
- 11.2 When the Work is substantially performed, remove surplus Products, tools, construction machinery and equipment not required for the performance of the remaining Work.

**12 SITE STORAGE AND OVER LOADING**

- 12.1 Confine the Work and operations of employees to limits indicated by the Contract Documents. Do not unreasonably encumber the Site with Products.
- 12.2 Products shall be stored only in areas designated or approved by the Consultant, and shall not be left lying on streets, sidewalks, boulevards or elsewhere within public view. Products which the Consultant may permit to be stored elsewhere than in the Contractor's storage areas shall be neatly stacked or otherwise disposed of and shall be so maintained.

- 12.3 Fabrication shops shall not be set up within the structure except as directed by or with the permission of the Consultant.
- 12.4 Do not load or permit to be loaded any part of the Work with a weight or force that it is not calculated to bear safely. Be solely responsible and liable for damages resulting from violation of this requirement. Provide temporary support as strong as permanent support.
- 12.5 Do not cut, drill, or sleeve load bearing members unless shown on drawings or otherwise approved by the Consultant in writing for each location.
- 12.6 Site storage and loading requirements to be in accordance with the Ontario Occupational Health and Safety Act and Regulations for Construction Projects.

13 **PUBLIC CONVENIENCE AND SAFETY**

- 13.1 Maintain sidewalks at and adjacent to the Site in a safe condition throughout the Contract. Promptly remove ice and snow.
- 13.2 Keep haul routes free at all times from Products spilled on highway or street surfaces and clean highways and streets of deposits due to performance of the Work to the satisfaction of the Consultant and the highway and street authorities. Clean highways and streets within 24 hours of Consultant's instruction.
- 13.3 The Consultant may inspect haul routes, the Site, and adjacent premises daily and may halt operations, withhold payment or carry out such additional operations as necessary, deducting the cost from monies due, or to become due, to the Contractor.

14 **ACCESS AND EGRESS TO SITE**

- 14.1 Where construction requirements demand, construct access roads capable of withstanding construction equipment and haul traffic. Maintain access roads in good condition at all times. Remove access roads prior to completion of the Work unless otherwise noted and restore area as shown on the Contract Drawings.

15 **PUBLIC TRAFFIC FLOW**

- 15.1 Provide and maintain flag persons, Police Officers, traffic signals, barricades and illumination as required by Authorities having jurisdiction and/or as necessary to perform the Work and protect the public.

16 **PUBLIC UTILITIES AND SERVICES**

- 16.1 Verify limitations imposed on project work by presence of utilities and services, and ensure no damage occurs to them.
- 16.2 Notify service authorities concerned so that they protect, remove, relocate, or discontinue them, as they may require.

- 16.3 Make arrangements and pay for connection charges for services required for project work.
- 16.4 Locate poles, pipes, conduit, wires, fill pipes, vents, regulators, meters, and sanitary services work in inconspicuous locations. If not shown on Drawings, verify location of service work with Consultant before commencing installation.
- 17 **ROADS, CURBS, GUTTERS, AND WALKS**
- 17.1 Include all curb cuts and making good of existing curbs, walks and paving on Municipal property to provide fully paved and finished approaches to requirements of authorities having jurisdiction.
- 18 **CONSTRUCTION PARKING**
- 18.1 Parking may be permitted on Site provided it does not disrupt the performance of Work, Site safety or the movement of vehicular or pedestrian traffic and is acceptable to the Consultant.
- 19 **SITE VISITORS**
- 19.1 During the progress of the Work, afford access to visitors duly authorized by the Consultant and facilitate inspections or tests they may desire to make. Record site visitors in log book maintained on site.
- 19.2 Ensure Site visitors wear appropriate safety apparel.
- 20 **EROSION AND SEDIMENTATION CONTROL**
- 20.1 Control drainage on site to prevent flooding, erosion and run-off onto adjacent properties as a result of construction operations.
- 20.2 Dispose of water containing silt in suspension in accordance with requirements of jurisdictional authorities.
- 20.3 Conform to sedimentation and erosion control requirements of the conservation and/or municipal authority having jurisdiction. Provide and maintain until completion of work or until directed by Consultant to be removed, sediment control devices at catch basins, drainage courses and at other locations on site as directed. Comply with requirements of the local Conservation Authority.
- 20.4 Provide storm drain inlet protection consisting of a sediment control barrier or an excavated ponding area around storm drain inlet or curb inlet; add bracing where necessary to withstand high flow volumes and depth. Inspect inlet protection after each rainfall and repair damage. Sweep up accumulated sediment and dispose of in a controlled area. Remove inlet protection after area has been stabilized with permanent vegetation.

- 20.5 Prevent tracking of mud and dirt from site onto paved roads. Provide stabilized vehicle access/egress points, constructed of coarse granular material. Place additional granular material as required to maintain access/egress points in proper working order. Clean mud and dirt from paved roads at end of each day by shoveling or sweeping and subsequent washing. Dispose of mud dirt in a controlled disposal area.

**21 TEMPORARY DRAINAGE AND DEWATERING**

- 21.1 Drainage lines and gutters shall be kept open at all times. No flow of water shall be directed across or over pavements except through pipes or properly constructed troughs. Keep all portions of Work properly and efficiently drained during construction and until completion. Be responsible for all disturbances, dirt and damage which may be caused by or result from water backing up or flowing over, through, from or along any part of Work, or due to operations which may cause water to flow elsewhere.
- 21.2 Keep trenches and other excavations free of water at all times. Employ adequate means to remove water in a manner that will prevent loss of soil and maintain the stability of excavation.
- 21.3 Dispose of such water in a manner that will not be dangerous to public health, private property or to any portion of Work completed or under construction, nor which causes an impediment to the use of streets by the public.
- 21.4 Drainage of trenches or other excavation through newly laid storm drainage pipe will be allowed only with the express permission of the authority having jurisdiction.
- 21.5 When drainage is directed to existing catch basins, regularly inspect and clean such catch basins of debris and sediment.

**22 SNOW REMOVAL**

- 22.1 Allow no accumulation of ice and snow on Site, and on roof deck when roofing operations are scheduled to take place.
- 22.2 Remove snow from access road, Site circulation paths and elsewhere as required to permit access to Work, parking and uninterrupted construction progress.

**23 POLLUTION (DUST, DEBRIS, AND NOISE) CONTROL**

- 23.1 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.
- 23.2 Keep premises free of waste material.
- 23.3 Arrange and pay for removal of all waste generated by the work in manner acceptable to authorities having jurisdiction.

- 23.4 Limit noise levels in accordance with requirements of authorities having jurisdiction.
- 23.5 Maintain temporary erosion and pollution control features installed under this contract.
- 23.6 Control emissions from equipment to local authorities' emission requirements.
- 23.7 Prevent abrasive-blasting and other extraneous materials from contaminating air beyond application area, by providing temporary enclosures.

**24 TREE PROTECTION**

- 24.1 Within Contractor's assigned work and storage areas and adjacent to designated access routes, protect existing trees and other plants scheduled to remain. Provide minimum 1.8 m high chain link fencing outside of dripline of trees or groups of trees and other plants.
- 24.2 Leave fenced areas undisturbed; do not use areas for storage, stockpiling, or any other purpose. Do not dump or flush any contaminants in areas of tree feeder roots.
- 24.3 Do not attach rigging cables to trees.
- 24.4 Where limbs or portions of plants are required to be removed to accommodate new work, they shall be removed in accordance with accepted arboricultural practice.
- 24.5 Where root systems of protected trees adjacent to construction are exposed or damaged, they shall be neatly trimmed, and the area backfilled with suitable material to prevent desiccation.
- 24.6 Where necessary give plants an overall pruning to restore the balance between roots and top growth and/or to restore appearance.
- 24.7 Except at locations where specific procedures are included in Contract Documents do not alter grades around existing trees/plants without first obtaining Consultant's consent and directions.

END OF SECTION

**1 SPECIFIED PRODUCTS**

- 1.1 Work of this Contract is based on Products specified by:
- .1 Manufacturer's catalogued trade names and/or;
  - .2 References to standards (i.e. CAN, CGSB, CSA, ASTM) or;
  - .3 Prescriptive Specifications or;
  - .4 Performance Specifications.
- 1.2 When one or more manufacturer's trade name is specified for a Product, any one of the specified Products will be acceptable. Products by other manufacturers are subject to the Consultant's acceptance as an equivalent substitution in accordance with the specified requirements of substitutions.
- 1.3 When more than one manufacturer's catalogued trade name Product is specified along with a referenced standard, any one of the specified Products will be acceptable on condition the Product complies with the referenced standard.
- 1.4 When a Product is specified by reference to a standard only, the Contractor may select any Product that meets or exceeds the specified standard for the intended purpose. The onus shall be on the Contractor to establish that such Products meet the reference standard requirements. Products exceeding minimum requirements established by reference standards will be accepted for the Work if such Products are compatible with the Work with which they are incorporated.
- 1.5 When a Product is specified by prescriptive or performance Specification, any Product meeting or exceeding the Specification will be accepted.
- 1.6 When a Product is specified by reference to a standard or by prescriptive or performance Specification, upon request of the Consultant, obtain from the manufacturer, an independent testing laboratory report showing that the Product meets or exceeds the specified requirements.
- 1.7 Unless otherwise indicated in the Specifications, maintain uniformity of manufacture for any particular or like item throughout the Work.

**2 SUBSTITUTIONS**

- 2.1 Requests for substitutions will not be accepted prior to the Notification of Award. Substitutions will be considered by the Consultant provided that:
- .1 The proposed substitutions have been investigated and complete data are submitted which clearly includes highlighting all aspects that meet the specifications. Consultant will only review data submitted. Incomplete data will be grounds for non-acceptance.

- .2 Data relating to changes in the Contract Schedule, if any, and relation to other Work have been submitted.
  - .3 Same warranty is given for the substitution as for the original Product specified.
  - .4 All claims are waived for additional costs related to the substitution which may subsequently arise.
  - .5 Installation of the accepted substitution is co-ordinated into the Work and that full responsibility is assumed when substitutions affect other work. Make any necessary changes required to complete the Work. Revisions to the drawings for incorporation of the substitutions shall be made by the Consultant and all costs associated with the revisions shall be borne by the Contractor.
- 2.2 Substitutions to methods or process described in the Specifications or drawings, may be proposed for the consideration of the Consultant. Ensure that such substitutions are in accordance with the following requirements:
- .1 Time spent by the Consultant in evaluating the substitution shall not be the basis for a claim by the Contractor for extensions to the Contract Time.
  - .2 Clearly indicate how the proposed substitutions would be advantageous to the Owner or in the opinion of the Contractor would improve the operation of the installation.
  - .3 Be responsible for substitutions to methods or processes concerning such Work and ensure that the warranty covering all parts of the Work will not be affected.
  - .4 The cost of all changes in the work of Other Contractors, necessitated by the substituted methods or processes, if accepted, is borne by the Contractor.
  - .5 The substituted methods or processes fit into space allotted for the specified methods or processes. Revisions to the drawings for incorporation of the substitutions shall be made by the Consultant and all costs associated with the revisions shall be borne by the Contractor.
- 2.3 Substitutions will not be considered if:
- .1 They are indicated or implied on shop drawings or Product data without formal request.
  - .2 Acceptance will require substantial revision of the Specifications and Drawings.
- 2.4 Do not substitute Products or methods or processes into the Work unless such substitutions have been specifically approved for the Work by the Consultant.
- 2.5 Approved substituted Products shall be subject to the Consultant's inspection and testing procedures. Approved substituted Products shall only be installed after receipt of the Consultant's written approval.

- 2.6 The Contract Price will be adjusted accordingly to any and all credits arising from the substitutions mentioned above.

**3 APPROVAL OF PRODUCTS AND INSTALLATION METHODS**

- 3.1 Wherever in the Specifications it is specified that Products and installation methods shall meet approval of Authorities having Jurisdiction, underwriters, the Consultant, or others, such approval shall be in writing.

**4 PRODUCT DELIVERY CONTROL**

- 4.1 It is the responsibility of the Contractor to ensure that the supplier or distributor of materials specified, or alternatives accepted, which he intends to use, has materials on the site when required. The Contractor shall obtain confirmed delivery dates from the supplier.
- 4.2 The Contractor shall contact the Consultant immediately upon receipt of information indicating that any material or item, will not be available on time, in accordance with the original schedule, and similarly it shall be the responsibility of all subcontractors and suppliers to so inform the Contractor.
- 4.3 The Consultant reserves the right to receive from the Contractor at any time, upon request, copies of actual purchase or work orders of any material or products to be supplied for the work.
- 4.4 If materials and products have not been placed on order, the Consultant may instruct such items to be placed on order, if direct communication in writing from the manufacturer or prime suppliers is not available indicating that delivery of said material will be made in sufficient time for the orderly completion of the Work.
- 4.5 The Consultant's review of purchase orders or other related documentation shall in no way release the Contractor, or his subcontractors and suppliers from their responsibility for ensuring the timely ordering of all materials and items required, including the necessary expediting, to complete the work as scheduled in accordance with the Contract Documents.
- 4.6 In the event of failure to notify the Consultant at commencement of Work and should it subsequently appear that Work may be delayed for such reason, the Consultant reserves the right to direct the Contractor to take the following measures at no increase in Contract Price:
- .1 Substitute more readily available Products of similar or better quality and character, or
  - .2 Temporarily install another Product until such time as the specified Product becomes available, at which time the temporarily installed product shall be removed and the specified Product installed.



**5 TRADEMARKS AND LABELS**

- 5.1 Permanent labels, trademarks and nameplates on Products are not acceptable in the finished Work, except where required by authorities having jurisdiction, for operating instructions, or when located in service rooms.
- 5.2 Remove trademarks and labels by grinding, if necessary, painting out where the particular surface is being painted, or if on plated parts, replace with new plain plated or non-ferrous metal parts.

**6 DELIVERY, STORAGE, HANDLING AND PROTECTION**

- 6.1 Be responsible for handling and delivery of Products. Protect Products from damage during handling, storage and installation. Deliver store and handle items in accordance with manufacturer's instructions and as specified. Be responsible for all costs of delivery, loading and off-loading, and for transportation back to its origin for correction, if required, due to damage or defect. Reject materials and Products delivered to the Site which are damaged.
- 6.2 Manufacture, pack, ship, deliver, and handle Products so that no damage occurs to structural qualities and finish appearance, nor in any other way which is detrimental to their function and appearance.
- 6.3 Ensure that Products, while transported, are not exposed to an environment which would increase their moisture content beyond the maximum specified.
- 6.4 Organize delivery of materials, Products and equipment to, and removal of debris and equipment from, the site and surrounding property.
- 6.5 Schedule early delivery of Products to enable Work to be executed without delay. Before delivery, arrange for receiving at the Place of the Work.
- 6.6 Coordinate mechanical and electrical equipment and apparatus deliveries with the manufacturers and suppliers such that equipment and apparatus is delivered to the site when it is required, or so that it can be stored within the building and protected from the elements.
- 6.7 Shop assemble work for delivery to site in size easily handled and to ensure passage through building openings.
- 6.8 Deliver packaged Products, in original unopened wrapping or containers, with manufacturer's seals and labels intact.
- 6.9 Label packaged products to describe contents, quantity, and other information as specified.

- 6.10 Labels attesting that materials conform to specified reference standards will be acceptable as verification that contents meet specified requirements. In the absence of labels, submit affidavits to validate conformance of Product to reference standards, as requested by the Consultant.
- 6.11 Label fire-rated Products to indicate Underwriters' Laboratories approval.
- 6.12 Handle and store materials and products in such a manner that no damage is caused to the materials and products, the Work, the site and surrounding property.
- 6.13 Do not obstruct or disrupt local traffic flow during construction period.
- 6.14 Allocate an area within the limits of the Work acceptable to the Owner for storage of Products brought to the site by all trades. Keep storage area tidy at all times and do not use other parts of the property for storage. Arrange and pay for off-site storage when required.
- 6.15 Locate products on site in a manner to cause minimal interference with the Work and building activities.
- 6.16 Store Products off the ground, in a manner to prevent damage, adulteration, deterioration and soiling to the Products, other building components, assemblies, other products, the structure, the site and surrounding property, and in accordance with manufacturer's instructions when applicable.
- 6.17 Store packaged or bundled Products in original and undamaged condition complete with written application instructions. Keep manufacturer's seals and labels intact. Do not remove from packaging or bundling until required in the Work.
- 6.18 Do not place or store materials and Products in corridors, public areas, streets, lanes, passageways or similar locations.
- 6.19 Store Products so as not to create any overloading conditions to any part of the building, structure, falsework, form work and scaffolding.
- 6.20 Store Products subject to damage from weather in weatherproof enclosures.
- 6.21 Store cementitious Products clear of earth or concrete floors, and away from walls.
- 6.22 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- 6.23 Store sheet materials and lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.
- 6.24 Store and handle flammable liquids and other hazardous materials in approved safety containers and as otherwise prescribed by safety authorities. Store no flammable liquids or other hazardous material in bulk within the Work.

- 6.25 Store and mix paints in a heated and ventilated room or area assigned for this purpose. Keep this room or area locked when unattended. Remove oily rags and other combustible debris from the Place of the Work daily. Take every precaution necessary to prevent spontaneous combustion.
- 6.26 Protect prefinished metal surfaces by protective coatings or wrappings until time of final clean-up specified in Section 01 74 00. Protection shall be easily removable under work of Section 01 74 00 without damage to finishes. Do not permit strippable tape or coatings to become baked on surfaces which they protect.
- 6.27 Touch-up damaged factory finished surfaces to Consultant's satisfaction. Use primer and paint to match original.
- 6.28 Protect glass and other finishes against heat, slag and weld splatter by provision on adequate shielding. Do not apply Visible markings to surfaces exposed to view in finished state or that receive transparent finishes.
- 6.29 Protect surfaces of completed work exposed to view from staining, disfigurement, and all other damage by restriction of access or by use of physical means suitable of the material and surface location.
- 6.30 Adequately protect trowelled concrete floors from damage. Take special measure when moving heavy loads or equipment on them.
- 6.31 Keep finished concrete floors free from oils, grease or other material likely to damage or discolour them or affect bond of applied finishes. Once building is enclosed, keep floors as dry as possible after curing.
- 6.32 Protect finished flooring from pedestrian traffic with reinforced kraft paper as a minimum, secured in place and with joints sealed by reinforced pressure sensitive tape. Maintain protection in place until contract completion.
- 6.33 Protect finished flooring from continuing construction work and delivery of products with plywood panels of minimum 6 mm thickness with joints between panels sealed with reinforced pressure sensitive tape. Maintain protection in place until work and deliveries are complete.
- 6.34 Make good or replace damaged materials to the satisfaction of the Consultant.
- 6.35 Hazardous Materials Information:
  - .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of material safety data sheets (MSDS) in accordance with jurisdictional authorities.
  - .2 Deliver copies of Material Safety Data Sheets (MSDS) to the Consultant on all Products intended for use in the Work and designated as a "controlled product."

**7 MANUFACTURER'S INSTRUCTIONS**

- 7.1 Unless otherwise indicated in the Specifications, fabricate, install, apply, connect, install, erect, use, clean, and condition Products in accordance with manufacturer's instructions except where more stringent requirements are specified. Do not rely on labels or enclosures provided with Products. Obtain written instructions directly from manufacturers.
- 7.2 Notify the Consultant in writing, of conflicts between the Specifications and manufacturer's instructions, so that the Consultant may establish the course of action. If requested, make a copy of those instructions available at the site.
- 7.3 In cases of improper installation or erection of Products, due to failure in complying with these requirements, the Consultant may direct removal and re-installation at no increase in Contract Price.

**8 WORKMANSHIP**

- 8.1 Do not employ any unfit person or anyone unskilled in their required duties. The Consultant reserves the right to require the dismissal from the Place of the Work, workers deemed incompetent, careless, insubordinate, or otherwise objectionable.
- 8.2 Decisions as to the quality or fitness of workmanship in cases of dispute rest solely with the Consultant, whose decision is final.
- 8.3 Give particular attention to finished dimensions and elevations of the Work. Make finished Work fit indicated spaces accurately. Make finished Work flush, plumb, true to lines and levels and accurate in all respects.
- 8.4 In finished areas, conceal pipes, ducts, conduit and wiring in floors, walls, ceilings, chases, or behind furring except where indicated otherwise.
- 8.5 Ensure that service poles, fill-pipes, vents, regulators, meters and similar service installations are located in inconspicuous locations. If not indicated on drawings, verify location of service installations with Consultant prior to commencing installation.
- 8.6 Ensure that integrity of fire separations is maintained where they are penetrated.
- 8.7 Finish access panels and doors to match adjacent wall and/or ceiling finish unless otherwise specified or indicated.
- 8.8 Keep surfaces, on which finished materials will be applied, free from grease, oil, and other contamination which would be detrimental in any way to the application of finish materials.

8.9 Enforce fire prevention methods at site. Do not permit fires, open flame heating devices or accumulation of debris. Use flammable materials only if all safety precautions are taken. Provide and maintain in working order ULC labelled fire extinguishers of types suitable for fire hazard in each case and locate them in prominent location and to approval of jurisdictional authorities.

8.10 Where flammable materials are being applied, ensure that adequate ventilation is provided, spark-proof equipment is used, and smoking and open flames are prohibited.

## 9 **DIMENSIONS**

9.1 Check all dimensions at the site before fabrication and installation commences and report discrepancies to the Consultant.

9.2 Where dimensions are not available before fabrication commences, ensure that dimensions required are agreed upon between the parties concerned.

9.3 Prior to commencing work, ensure that clearances required by jurisdictional authorities can be maintained.

9.4 Wall thicknesses and openings shown on the drawings may be nominal only; ascertain actual sizes at the site.

9.5 Verify dimensions of shop fabricated portions of the Work at the site before shop drawings and fabrications are commenced. The Owner will not accept claims for extra expense by reason of non-compliance with this requirement.

9.6 Fabricate and erect manufactured items, shop fabricated items, and items fabricated on or off site, to suit site dimensions and site conditions.

9.7 In areas where equipment is to be installed, check dimensional data on equipment to ensure that area and equipment dimensions are compatible with necessary access and clearance provided. Ensure that equipment supplied is dimensionally suitable for space provided.

9.8 The mechanical and electrical drawings are intended to show approximate locations of mechanical apparatus, fixtures, equipment, piping and duct runs, electrical apparatus, fixtures, outlets, equipment, units, and conduit in diagrammatic form and wherein the mechanical and electrical items are not dimensioned, consider their locations to be approximate. Check the drawings and confer with the Consultant to settle the actual locations of these items as may be required to suit aesthetic and site conditions. Such relocation shall be done without change to the Contract Price.

9.9 Leave areas clear where space is indicated to be reserved for future equipment, including access to such future equipment.

- 9.10 Whether shown on the Drawings or not, leave adequate space and provision for servicing of equipment and removal and reinstallation of replaceable items such as motors, coils and tubes.
- 10 **RELOCATION OF MECHANICAL AND ELECTRICAL ITEMS**
- 10.1 The Owner and the Consultant reserve the right to relocate outlets at a later date, but prior to installation, without additional cost to Owner, assuming that the relocation per outlet does not exceed 3000 mm from the original location. No credits will be anticipated where relocation per outlet of up to and including 3000 mm reduces materials, products and labour.
- 10.2 Should relocations per outlet exceed 3000 mm from the original location the Contract Price will be adjusted in accordance with the provisions for changes in the Contract Documents.
- 10.3 Alter the location of pipes and other equipment, without additional cost to the Owner, if approved, provided the change is made before installation.
- 10.4 Make necessary changes, due to lack of coordination, as required and when approved, at no additional cost, to accommodate structural and building conditions.
- 11 **EXPANSION, CONTRACTION, AND DEFLECTION**
- 11.1 Conform to manufacturer's recommended installation temperatures. If items, components, assemblies, systems, and finishes are installed at temperatures different from operation or service temperatures, make provisions for expansion and contraction in service as acceptable to manufacturer and consultant. Repair all resulting damage should expansion and contraction provisions provide inadequate.
- 11.2 Make provisions for expansion and contraction due to temperature changes within components, Products and assemblies, and between adjacent components, Products and assemblies, and due to building movements including but not limited to creep, column shortening, deflection, sway and twist. Ensure provisions for expansion, contraction and building movements prevent damages from occurring to and within components, Products and assemblies.
- 11.3 Make adequate allowance at wall and partition heads for deflection of the structure above. Determine requirements from consultant where additional information is required. Where partitions butt to underside of floor assembly, or structural framing, the clearance shall be based on the span of the members supporting the floor or structural framing. In making such allowance use methods which maintain the integrity of the wall or partition as a sound, and/or fire barrier.
- 11.4 Make provisions in pipes, plenums, ducts, and vessels containing air and fluids as is necessary to prevent damage due to fluid and air induced pressure, surges and vibrations, to pipes, plenums, ducts and vessels and to adjacent components, assemblies and construction to which pipes, ducts, plenums and vessels are attached or pass through.

12            **DIELECTRIC SEPARATION**

- 12.1           Ensure that a dielectric separator is provided in a permanent manner over entire contact surfaces to prevent electrolytic action (galvanic corrosion) between dissimilar materials. Similarly, prevent corrosion to aluminium in contact with alkaline materials such as contained in cementitious materials.

13            **PRODUCTS AT SOUND ATTENUATING PARTITIONS**

- 13.1           Avoid sound transfer at sound attenuating partitions by careful location and treatment of mechanical and electrical equipment, ducts, grilles, diffusers, electrical outlets and boxes, and similar items. Where electrical boxes are back-to-back, serving each side, locate them at least 250 mm apart laterally and, if interconnected, use flexible connections.

14            **FASTENINGS**

- 14.1           Include in the work of each section necessary fastenings, anchors, inserts, attachment accessories, and adhesives. Where installation of devices is in work or other sections, deliver and locate devices in ample time for installation.
- 14.2           Do not install fibre, plastic or wood plugs or blocking for fastenings in masonry, concrete, or metal construction, unless specified or indicated on drawings.
- 14.3           Install work with fastenings or adhesives in sufficient quantity to ensure permanent secure anchorage of materials, construction, components and equipment under static conditions, and to resist building thermal movement, creep and vibration.
- 14.4           Provide metal fastenings and accessories in same material, texture, colour, sheen and finish as metal on which they occur, unless indicated otherwise.
- 14.5           Prevent electrolytic action between dissimilar metals and materials.
- 14.6           Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior Work, and where attached to, or contained within, exterior walls and slabs, unless stainless steel or other material is specified. Leave steel anchors bare where cast in concrete.
- 14.7           Space anchors within their load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.
- 14.8           Conceal fasteners where indicated. Keep exposed fastenings to a minimum, space evenly and in an organized symmetrical pattern.
- 14.9           Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

14.10 Powder Actuated Fastenings:

- .1 Do not use powder actuated fasteners for the support of ceilings.
- .2 Do not use powder actuated fastenings on any portion of the Work, unless written consent for a specific use is obtained from the Consultant.
- .3 Only low velocity tools will be permitted under any condition. Operators to be qualified and to be in possession of a valid operator's certificate.

15 **ADJUSTING**

- 15.1 Ensure that all components of assemblies fit snugly, accurately and in true planes, and that moving parts operate positively and freely, without binding and scraping..
- 15.2 Verify that work functions properly and adjust it accordingly to ensure satisfactory operation. Lubricate Products as recommended by manufacturer.

END OF SECTION



**1 DEMONSTRATION AND INSPECTION OF PRODUCTS AND SYSTEMS**

- 1.1 Arrange for a demonstration of systems and operating Products upon the 100% completion of their installation and prior to certification for Substantial Performance.
- 1.2 Include in the arrangements for the attendance of the Consultant, Owner, jurisdictional authorities, and personnel assigned by the Owner for the operation of the systems and/or Products.
- 1.3 Demonstrations shall be conducted by the Subcontractor responsible for the installation of the systems and/or Product, assisted by representatives of the manufacturer or supplier. All personnel conducting the demonstration shall be completely knowledgeable of all conditions of the operating, functioning and maintenance of the systems and/or Products.
- 1.4 Owner's representative will acknowledge the successful completion of each demonstration on a form provided by the Contractor. The form shall be agreed to by the Owner, Consultant and Contractor prior to demonstration and testing.
- 1.5 Submit copies of letters from manufacturers of Systems and/or Products before making application for certificate of Substantial Performance to verify that the Products has been installed and connected correctly, and that it is operating in a satisfactory manner. The certification shall be based upon inspection and testing of the Products by competent technical personnel. Include in letter of certification the names of personnel conducting the testing and inspection, the methods of inspection utilized, and the location in the building of the Products certified.
- 1.6 Following submission of letters of certification and their acceptance by the Owner, the owner shall have the right to use the Products on a trial basis and for instructing their personnel in its use.

**2 FINAL INSPECTIONS AND CLOSE OUT**

- 2.1 Submit proposed closeout procedures and schedule of inspection to Owner & Consultant for approval before final demonstrations and inspections commence.
- 2.2 Submit layout and survey requirements required by Owner and Authorities having jurisdiction.
- 2.3 Arrange for, conduct, and document final demonstrations, inspections, close-out, and take-over at completion of the Work in accordance with procedures described in OAA/OGCA TAKE-OVER PROCEDURES, OAA/OGCA Document No. 100. Where "Architect" is referred to in Document No. 100 it shall mean Consultant.

**3 CERTIFICATE OF COMPLIANCE**

- 3.1 Submit Certificates of Compliance, prior to the application for Substantial Performance, for each of the following items.
- .1 An affidavit relative to the use of lead-free solder for all domestic water lines, regardless of location.
  - .2 Products for which Material Safety Data Sheets have been submitted and accepted.
  - .3 Other Work/Products identified in the Contract Documents as requiring a Certificate of Compliance.
- 3.2 Each Certificate of Compliance shall indicate names and addresses of the project, the Owner, the date of issue, product description including name, number, manufacturer, with a statement verifying that the Work/Product installed meets specified requirements and, if applicable, complies with the submitted and accepted Material Safety Data Sheets.
- 3.3 Each Certificate of compliance shall be issued on the subcontractor's letterhead, properly executed, under whose work the prospective Work/Product has been provided.
- 3.4 Each Certificate of Compliance shall be endorsed by the Contractor with his authorized stamp/signature. Ensure that submissions are made to allow sufficient time for review without delaying progress of scheduled completion.

END OF SECTION

**1 LAYOUT AND SURVEY**

- 1.1 Existing grades, lines, and site conditions shown on drawings were taken from survey information established by persons engaged directly by the Owner. The accuracy of survey information is not the Consultant's responsibility. The Contractor will establish location of property lines.
- 1.2 Be responsible for setting out the Work. Prior to setting out the Work, verify dimensions and elevations shown on the Contract Documents and report to the Consultant any unsatisfactory conditions that may adversely affect the proper completion of the Work.
- 1.3 Set up and maintain permanent reference points and be responsible for the accuracy of such reference points. Establish lines and levels required for the performance of the Work.
- 1.4 Accurately set out the Work from levels and lines. Where Work of this Contract is dependent upon grades and elevations of existing structures or facilities, such grades or elevations shall take precedence over those determined by reference to established elevations. Advise the Consultant of any discrepancies.
- 1.5 During any activity of the Work, employ a Land surveyor licensed to practice in the place of Work to layout and check all features, including but not limited to the following:
  - .1 Lay out building on the Site.
  - .2 Establish a permanent benchmark, or markers as widely separated as possible.
  - .3 Establish and maintain temporary benchmarks set in suitable locations.
  - .4 Provide general dimensions, lines and elevations required by Subcontractors.
  - .5 Verify elevations of floor and roof levels as construction proceeds and relate to benchmark datum.
  - .6 Verify that present or known future restrictions are not violated by construction on the site or lines of traverse to all public utilities.
  - .7 Correlate geodetic elevation of benchmark datum with elevations in use by public utilities adjacent to Project.
  - .8 Verify accuracy of site dimensions shown on Drawings.
  - .9 Provide a survey to verify location of footings immediately adjacent to property lines before construction of footings proceeds.
  - .10 Provide a survey to verify location of building related to property lines when foundation walls are completed to grade level.

- .11 Provide a survey prior to placement of asphalt and concrete paving to confirm that grades conform to grades indicated on drawings.
- .12 Provide a survey to verify location of completed building on Site.
- 1.6 Examine, preserve, and protect established benchmarks. Re-establish a lost or displaced benchmark by a Land Surveyor licensed to practice in the place of Work at no cost to the Owner. Accept responsibility for setting out the Work.
- 1.7 In the event of a discrepancy between the Owner and the Contractor regarding horizontal and/or vertical alignment conditions, that are beyond allowable specified tolerance, the Owner may engage the services of an independent Land Surveyor. The surveyor shall investigate the disputed condition, and the results of the independent investigation shall determine the bearer of costs for this service, being either the Owner or the Contractor.
- 1.8 If the Contractor is found to be in error, all costs incurred to correct the condition shall be assumed by the Contractor.

END OF SECTION

**1                    PROGRESS CLEANING**

- 1.1                Remove from finish work, spatters, droppings, soil, labels, and debris, before they set up.
- 1.2                Ensure that only cleaning materials are used which are recommended for the purpose by both the manufacturer of the surface to be cleaned and of the cleaning material.
- 1.3                Maintain building work areas "broom clean" at least daily but shall also be done immediately before finishing work.
- 1.4                No waste material may be burned or buried at site. Remove as often as required to avoid accumulation, no less than, at the end of each working day.
- 1.5                Remove packaging materials and debris from the site immediately after product and equipment is unwrapped or uncrated.
- 1.6                Ensure that volatile fluid wastes are not disposed of in storm or sanitary sewers, in open drain courses, or anywhere on site.
- 1.7                Do not allow waste material and debris to accumulate in an unsightly or hazardous manner. Sprinkle dusty accumulations with water. Provide containers in which to collect waste material and debris. Dispose of hazardous products in accordance with requirements of jurisdictional authorities.
- 1.8                Conform to Regulatory Requirements article, in Quality Requirements, Section 01 40 00.
- 1.9                Ensure that cleaning operations are scheduled to avoid deposits, of dust or other foreign matter on surfaces during finishing work and until wet or tacky surfaces are cured.
- 1.10              Provide instructions for final cleaning of finishing work, and for inclusion in Maintenance and Operating Manuals.

**2                    FINAL CLEANING**

- 2.1                Before final inspection, replace glass and mirrors broken, damaged, and etched during construction, or which are otherwise defective.
- 2.2                In addition to requirements for progress cleaning, Work shall include final cleaning by skilled cleaning specialists on completion of construction.
- 2.3                Remove temporary protections and make good defects before commencement of final cleaning.

- 2.4 Final cleaning shall remove dust, stains, paint spots, soil, grease, fingerprints, and accumulations of construction materials, interior and exterior to the building for all new work throughout new and existing Building. Work shall be done in accordance with manufacturer's instructions for each material. This work shall include:
- .1 Washing of exterior paved surfaces, and of interior stone, brick, and concrete floors.
  - .2 Cleaning and polishing of glass, mirrors, porcelain, enamel, and finish metals.
  - .3 Vacuum cleaning of ceilings, walls, and floors.
  - .4 Cleaning and polishing of terrazzo and ceramic and/or quarry tile floors.
  - .5 Cleaning of resilient flooring.
  - .6 Buffing of resilient flooring followed by two light coats of wax, each buffed.
  - .7 Washing clean of glazed wall surfaces.
  - .8 Cleaning of hardware, mechanical fixtures, plumbing fixtures, lighting fixtures, cover plates, and equipment, including polishing of their finish metal, porcelain, vitreous, and glass components.
  - .9 Cleaning of windows and entrances, both interior and exterior surfaces.
- 2.5 Maintain cleaning until Owner has taken possession of building or portions thereof.

END OF SECTION

1 **GENERAL**

- 1.1 Hand over to the Consultant three (3) copies of a comprehensive operations and maintenance manual and material suitable for the Owner's maintenance employees. Manuals shall cover all Products supplied and installed under the Contract.
- 1.2 Submit draft of the operation and maintenance manuals for the Owner's review at least 15 days before testing systems and equipment. Incorporate alterations and additions, as found to be necessary during testing, and prepare the final version of the manual from the corrected draft.
- 1.3 Submit final version of operation and maintenance manuals prior to Contract Completion.
- 1.4 Testing of systems and equipment will not be deemed to be complete until the requisite number of copies of the final version of the manuals has been handed over to the Owner.
- 1.5 If standard literature is incorporated into the operations and maintenance manual, any irrelevant information shall be deleted, or suitably noted.
- 1.6 The manuals shall have sufficient detail in order that the Owner can totally maintain the equipment without outside help.
- 1.7 Submit all material in English.

2 **FORMAT**

- 2.1 Organize data in the form of an instructional manual. (The Owner may accept a digital copy of all data in PDF format)
- 2.2 Binders: Commercial quality, 219 x 279 mm, maximum "D" ring size. See above exemption in 2.1, if Owner accepts digital copy.
- 2.3 When multiple binders are used, correlate data into related consistent groupings.
- 2.4 Cover: Identify each binder with type or printed title "Contract Record Documents"; list title of Contract, identify subject matter of contents.
- 2.5 Arrange content by systems or process flow, under Section numbers and sequence of Table of Contents.
- 2.6 Provide tabbed fly leaf for each separate Product and system, with typed description of Product and major component parts of equipment.
- 2.7 Text: Manufacturer's printed data, or typewritten data on 20-pound paper.
- 2.8 Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

### 3 CONTENTS

- 3.1 Operation and maintenance manuals shall contain the following minimum information and data:
- .1 Table of contents: Provide title of Contract; names, addresses, and telephone numbers of Consultants and Contractor with name of responsible parties; schedule of Products and systems, indexed to content of the volume.
  - .2 For each Product or system: List names, addresses and telephone numbers of Subcontractors, suppliers and service representatives, including local source of replacement supplies and parts including telephone numbers.
  - .3 Warranties: Warranties are between the Contractor and Owner. Warranties shall include, as a minimum:
    - .1 Description of warranty coverage.
    - .2 Date warranty starts (being date of Contract Completion).
    - .3 Date warranty expires.
    - .4 Contact name, address and phone number (the Contractor shall also be responsible for advising the Owner of changes in contact information during the warranty period).
    - .5 Equipment and components performance curves.
    - .6 Hydro certificates.
  - .4 Reports: For each Product or system provide the following:
    - .1 Manufacturer's certified reports
    - .2 Factory test reports.
    - .3 Field testing reports.
  - .5 Details of design, construction and/or fabrication features, component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of the installation.
  - .6 Technical data, Product data, supplemented by bulletins, component illustrations, detailed views, technical descriptions of items and parts lists.
  - .7 Schematics, interconnection lists: Manuals shall be complete with schematic and wiring diagrams, wiring interconnection lists and diagrams fully cross referenced and coordinated, printed circuit board layouts including the component identification, component parts list with electronic substitution equivalent. Provide cross referenced components lists and sequence of operations.
  - .8 Trouble shooting and fault location guide: Instructions to facilitate quick return of malfunctioning equipment to operation.
  - .9 Routine servicing and preventative maintenance schedule for Products and/or estimated hours required for routine servicing and preventative maintenance tasks.



- .10 List of recommended spare parts and recommended quantity of each item to be stocked based on spare part availability and re-order time.
- .11 Complete set of reviewed shop drawings.
- .12 Product data: Mark each sheet to clearly identify specific Products and component parts, and data applicable to installation; delete inapplicable information.
- .13 Drawings: Supplement Product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams and as required in the Specifications.
- .14 Typed text: As required to supplement Product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions and as required in the Specification.

#### **4 DRAWINGS**

- 4.1 Prepare all required drawings on CAD, using AutoCAD/Revit. AutoCAD/Revit version to suite Owner's CAD/Revit requirements.
- 4.2 Prepare CAD drawings to meet the requirements of the Owners or Consultant's CAD/Revit Standards and Procedures.
- 4.3 Supply and hand over to the Consultant, one original photographic reproduction for each final drawing prepared under this Contract, including but not limited to circuit drawings, equipment layout drawings, and shop drawings.
- 4.4 Prior to Contract Completion, supply and hand over to the Consultant, one complete set of CAD Drawing Files in AutoCAD/Revit format on compact disk (CD), or USB stick, or electronic means (zip file), for each final drawing prepared under this Contract and one complete 11" x 17" hard copy set, including but not limited to circuit drawings, equipment layout drawings, and shop drawings.
- 4.5 Text files shall be written in word processing program acceptable to Owner.

#### **5 TRANSMITTAL**

- 5.1 Forward storage media to the Owner through the Consultant with a transmittal form. Transmittal shall contain the list of file names contained on the storage media.
- 5.2 Data forwarded to the Owner shall contain the following files in addition to the design information:
  - .1 Library parts/cells used in the design files.
  - .2 Level convention used for each design file.

- .3 Plotting instructions used to prepare hard copies including colour tables, pen tables and plot scale.
- .4 Working units of the design files.
- .5 Font library, if the standard is not used.

END OF SECTION

**1                    PROGRESS RECORDS**

- 1.1                Maintain on site, permanent written records of daily progress of the Work. Records shall be always open to review by Consultant and Owner and a copy shall be furnished to the Consultant on a weekly basis.
- 1.2                Records shall show dates of commencement, progress and completion of various trades and items of work. Particulars pertaining to number of employees of various trades and type and quantity of equipment employed daily, temperature, protection methods and other such data shall be noted.

**2                    AS-BUILT DRAWINGS**

- 2.1                Authorized deviations from drawings shall be marked in red accurately on one set of drawing prints in a neat, legibly printed manner and shall be dated. Prior to final inspection, neatly transfer the recorded information to a second set of drawing prints of the most recent revision to the drawings and submit both sets to the Consultant.
- 2.2                Maintain as-built drawings up to date as Work progresses. Status of maintained as-built drawings may be considered as a condition for validation of applications for payment.
- 2.3                Identify each as-built drawing as "As-Built Copy" and maintain the as-built drawings in good condition. Make as-built drawings available to the Consultant at all times.
- 2.4                As-built drawings shall include accurate dimensioned record of deviations and changes in Work from drawings.
- 2.5                As-built drawings shall be signed and dated by Contractor.
- 2.6                Submit as-built drawing to consultant for review and make corrections as directed by Consultant.
- 2.7                Record accurately all deviations in the Work.
- 2.8                Accurately record locations of concealed structure, mechanical and electrical services, and similar Work not clearly in view, the location of which is required for maintenance, alteration Work and future additions. Do not conceal such Work until the location has been recorded.
- 2.9                Accurately record locations of equipment bases, anchors, concrete pads and roof curbs, sleeves, piping, conduits, ducts, maintenance holes and valves, etc. located either below, outside or within structure.
- 2.10              Where piping, conduits and ducts are underground, underfloor, embedded in concrete or otherwise in inaccessible locations, accurately record with respect to structure column lines or walls and elevations with respect to finished floor levels or grades referenced to the centre line of components.

- 2.11 Accurately record any components which will be in inaccessible locations for Consultant's review before the component is covered, or buried, or made inaccessible.
- 2.12 CAD or REVIT drawings of Contract Drawings can be obtained/purchased from Architect at a cost of \$1,500 plus HST per set of consultants individual set of plans as determined by the Architect.  
Floor plans, elevations and sections are considered as 3 separate sets of plans.
- 2.13 Clearly and prominently mark each drawing "AS-BUILT DRAWING prepared by \_\_\_\_\_ (name of Contractor)"

END OF SECTION

1 **GEOTECHNICAL INFORMATION AND REPORTS**

- 1.1 A copy of the following detailed geotechnical information is appended to this Document:
- .a Report On  
Geotechnical Investigation  
Proposed Orangeville Fire Station  
Located at 10 Commence Road, Orangeville, Ontario  
Prepared by: Fisher Engineering Limited  
Report No. FG 24-14036\_V4  
Dated: March 20<sup>th</sup>, 2025
  - .b Report On  
Geotechnical (water balance analysis)  
Proposed Orangeville Fire Station  
Located at 10 Commence Road, Orangeville, Ontario  
Prepared by: Fisher Engineering Limited  
Report No. FH24-14037V1  
Dated: June 24<sup>th</sup>, 2025
  - .c Report On  
Geotechnical (field infiltration test)  
Proposed Orangeville Fire Station  
Located at 10 Commence Road, Orangeville, Ontario  
Prepared by: Fisher Engineering Limited  
Report No. FG24-14044  
Dated: July 26<sup>th</sup>, 2024
- 1.2 This geotechnical information records properties of subsurface conditions and recommendations for the design of foundations, pavements and soil remediation as outlined in the information provided.
- 1.3 The geotechnical information by its nature, cannot reveal all conditions that exist or can occur on the Site. Should subsurface conditions be found to vary substantially from the report, immediately notify Consultant in writing and await instructions.
- 1.4 Contractor shall not be entitled to extra payment or extension of Contract Time for work, which is required, and which is reasonably inferable in the geotechnical information as being necessary.
- 1.5 In case of discrepancies between recommendations contained in geotechnical information and requirements of Contract Documents, the latter shall govern. Advise Consultant in writing of any discrepancies discovered.

2                **REPORT**

2.1            A copy of the following report is appended to this Document:

**.d**        Storm Water Management Design Brief  
              New Development Drainage System  
              10 Commence Road, Orangeville, Ontario  
              Prepared by: Hallex Engineering Ltd.  
              Dated: August 18<sup>th</sup>, 2025 - Rev 4.

2.2            The report, by its nature, cannot reveal all conditions that exist or can occur on the site. Should conditions be found to vary substantially from the report, immediately notify Consultant in writing and await instructions.

2.3            Contractor shall not be entitled to extra payment or extension of Contract Time for work, which is required, and which is reasonably inferable in the report as being necessary.

END OF DOCUMENT

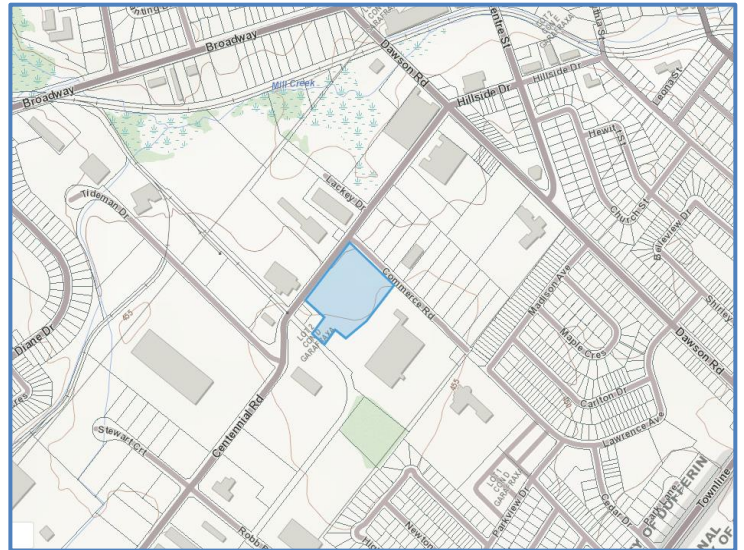
ENGINEERING



LABORATORY



## GEOTECHNICAL INVESTIGATION



## PROPOSED NEW FIRE STATION, 10 COMMERCE ROAD, ORANGEVILLE, ONTARIO

Prepared for:  
**Town of Orangeville**

400 Esna Park Drive, Unit 15  
Markham, ON  
L3R 3K2

Tel: (905) 475-7755  
Fax: (905) 475-7718  
[www.fishereng.com](http://www.fishereng.com)

Project No. FG 24-14036\_V4

December 7, 2022

**Revised: March 20, 2025**



**Issued to:** Town of Orangeville  
87 Broadway,  
Orangeville, ON L9W 1K1

**Contact:** Charles Cosgrove,  
Manager Facilities and Parks  
[ccosgrove@orangeville.ca](mailto:ccosgrove@orangeville.ca)

**Project Name:** Proposed New Fire Station

**Project Address:** 10 Commerce Road,  
Orangeville, ON.

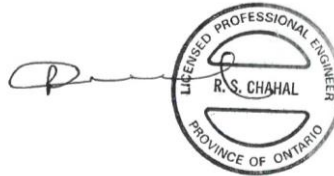
**Project Number:** FG 24-14036\_V4

**Issued on:** December 7, 2022  
Revised March 20, 2025

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## 1. INTRODUCTION

Fisher Engineering Limited (Fisher) was retained by the Town of Orangeville to carry out a geotechnical subsurface investigation for the proposed new fire station at 10 Commerce Road (formally 30 Centennial Road) (Part of lot 23, RCP 335, Part 2 RP 7R-6688), Orangeville, Ontario.

The purpose of the investigation was to determine general subsurface conditions in the proposed building area and across the site and to provide geotechnical recommendations for the design/construction of the proposed building/development.

This report presents the results of tests performed in accordance with the general terms of reference outlined in the Invitation to Quote – Town of Orangeville RFQ-2022-054 Geotechnical Services.

The report has been prepared specifically and solely in regards to geotechnical aspects of design and construction based on the site plan of the proposed development provided at the time of investigation.

The initial report was revised to include additional subsurface exploration for the proposed training area.

Changes to the report relative to the previous versions are as follows:

- i. Eight (8) additional boreholes and three (3) test pits were drilled in the proposed training area.
- ii. Groundwater levels were taken in three (3) new monitoring wells, installed during the latest field investigation.

The report was further revised to include results of shear wave velocity tests carried out to determine seismic classification in accordance with the 2024 OBC and National Building Code of Canada 2020 (NBC 2020). Site Designation of  $X_{603}$  is recommended based on shear wave velocity tests.



## 2. SITE AND PROJECT DESCRIPTION

### Site Settings

The subject property is located at the southwest corner of the intersection of Centennial Road and Commerce Road in a predominantly industrial/commercial area (Orangeville Business Park) west of Dawson Road in Orangeville, Ontario. The site is bounded generally by Commerce Road to the east, beyond which is Georgian College Orangeville Campus, an industrial building to the south (The Taylor Group), an empty lot to the west, beyond which is a Railway Spur, and Centennial Road to the north. The site has an approximate area of 14,902.51m<sup>2</sup> and was vacant during the investigation. Site and Location Plans are presented in Appendix A.

### Topography

Site grades drop by more than 6m mostly in the northerly direction with the highest borehole elevation of 456.94m at BH108 and lowest of 450.04m at BH5 as shown on the topographic survey plan for the site.

### Proposed Development

It was understood that the proposed development will consist of the construction of a single-storey fire hall to be located towards the front/north to middle-east portion of the site. The proposed building will have a gross floor area of 2,778.46m<sup>2</sup> as per Site Plan Overall by Alaimo Architecture Inc dated July 5, 2024 provided to Fisher during the updated investigation. Finished floor elevations for the proposed building are 450.95m (lower level) for the north wing and 453.68m (higher level) for the south eastern wing.

The remaining portion of the site will be covered by asphalt paved driveways/parking, landscaping, concrete pads/paved areas and outdoor training areas (gravel area).

## 3. SCOPE OF GEOTECHNICAL WORK

The geotechnical scope of work includes the following:

- Investigation of subsurface conditions at the site by advancing boreholes, soil sampling and visual evaluation/classification of the soil samples.
- Preparing a geotechnical report with comments and recommendations regarding:
  - Appropriate foundation depths, type and bearing pressures (SLS & ULS).



- Seismic Site Classification.
- Slab on grade construction
- Pavement construction
- Re-use of on-site excavated soils
- Pipe bedding material
- Lateral earth pressures
- Excavation & groundwater control etc.

#### **4. METHOD OF INVESTIGATION**

Public and private utilities clearances were carried out by Ontario One-Call and Utility Marx, on behalf of Fisher, prior to drilling.

##### **Subsurface Investigation**

Subsurface soil exploration for the initial Geotechnical Investigation was carried out on November 21, 22 and 23, 2022, during which a total of thirty-five (35) boreholes (BH1 – BH35) were drilled to approximate depths of 1.98m to 8.08m below prevailing grades. Boreholes BH9, BH22, BH26 and BH34 were instrumented as monitoring wells on completion of drilling to be used for groundwater testing and sampling if required. The wells were constructed using 50mm diameter PVC pipes with 3.05m (10') long screens.

A track mounted drill rig equipped with solid stem augers, supplied by Terra Firma Services, was used for all drilling work under direct supervision of Fisher Engineering personnel. Soil samples were taken at regular intervals using a split-spoon sampler advanced by means of the Standard Penetration Test (SPT) which was conducted in general accordance with ASTM Specification D1586. All recovered soil samples were placed in clear, sealable plastic bags in the field and transported to Fisher Engineering laboratory for further examination, characterization and laboratory analyses.

A description of the subsurface conditions encountered at each borehole location is presented in Appendix B - Log of Boreholes.

##### **Laboratory Analyses**

Twenty-three (23) representative soil samples from different boreholes were selected and submitted to Fisher Engineering Laboratory for moisture content tests and seventeen (17)



samples for grain size analyses. Two (2) soil samples were submitted for pH, chloride and sulphate tests. The laboratory results, which are presented in Appendix C, are consistent with the field description for subsurface soils discussed in Section 5.0.

The soil samples recovered during the investigation will be stored in the Fisher Engineering laboratory for a period of 30 days after submitting this report and will be discarded thereafter unless otherwise instructed by the client.

### **Site Survey**

Elevations at borehole/monitoring well locations were interpolated from an undated topographic survey plan, presented in Appendix A, which was provided to Fisher during the investigation.

## **5. SUBSURFACE CONDITIONS**

Surface and subsurface conditions encountered at borehole locations are shown in Appendix B - Log of Boreholes and are summarized in the following sections. The logs include stratification at borehole locations along with detailed soil descriptions. Variations in soil stratification may occur and should be expected between borehole locations and elsewhere on the site.

### **FILL**

Topsoil/roots were encountered at the surface of all boreholes. Estimated thickness of the topsoil at borehole locations varied from 4" (0.10m) to 24" (0.61m) but generally was approximately 6" (0.15m). It should be noted however that, for contractual purposes, the depth/thickness of topsoil should be confirmed by excavating large number of test pits uniformly distributed across the site, prior to or during construction.

Fill soils were encountered generally below the surficial topsoil/roots in the boreholes. The fill soils consisted mainly of dark brown to brown silty sand to sandy silt, occasionally silt with some to trace of roots and trace of gravel. Pockets/layers/seams of topsoil/topsoil mixed soils were observed in the fill of boreholes BH2, BH8, BH10, BH12, BH15, BH17 to BH25, BH29, BH30, BH35, BH102 and BH104 to BH107. The fill layers extended to approximate depths / elevations below prevailing grades as shown in Table 1. Boreholes BH16, BH17 and BH20 were terminated in the fill at approximate depth of 1.98m.



**Table 1: Fill depths/elevations**

Borehole No.	Surface Elevation (m asl)	Depth of Borehole (m)	Elevation at Bottom of Borehole (m asl)	Depth of Fill (m)	Elevation at Bottom of Fill (m asl)
BH1	452.44	1.98	450.46	0.69	451.75
BH2	450.95	1.98	448.97	0.69	450.26
BH3	451.03	8.08	442.95	0.38	450.65
BH4	450.84	8.08	442.76	0.69	450.15
BH5	450.04	1.98	448.06	0.69	449.35
BH6	450.86	8.08	442.78	0.53	450.33
BH7	450.48	1.98	448.50	0.69	449.79
BH8	450.20	1.98	448.22	0.53	449.67
BH9(MW)	450.88	8.08	442.80	1.37	449.51
BH10	451.34	1.98	449.36	1.14	450.20
BH11	451.95	8.08	443.87	1.37	450.58
BH12	452.80	8.08	444.72	1.07	451.73
BH13	452.97	1.98	450.99	0.69	452.28
BH14	453.78	1.98	451.80	0.69	453.09
BH15	454.61	1.98	452.63	1.37	453.24
BH16	455.89	1.98	453.91	1.98+	453.91
BH17	456.67	1.98	454.69	1.98+	454.69
BH18	456.35	1.98	454.37	1.75	454.60
BH19	455.10	1.98	453.12	1.68	453.42
BH20	455.50	1.98	453.52	1.98+	453.52
BH21	453.79	8.08	445.71	1.68	452.11
BH22(MW)	453.16	8.08	445.08	0.91	452.25
BH23	452.88	7.90	444.98	0.91	451.97
BH24	452.37	8.08	444.29	0.69	451.68
BH25	451.72	8.08	443.64	0.69	451.03
BH26(MW)	451.60	7.87	443.73	0.91	450.69
BH27	452.36	7.87	444.49	0.69	451.67
BH28	452.51	1.98	450.53	0.69	451.82
BH29	453.36	1.98	451.38	0.69	452.67
BH30	454.02	1.98	452.04	0.99	453.03
BH31	453.61	1.98	451.63	0.69	452.92
BH32	452.81	7.72	445.09	0.30	452.51
BH33	452.55	7.75	444.80	0.84	451.71
BH34(MW)	451.78	7.90	443.88	0.69	451.09
BH35	452.27	1.98	450.29	0.91	451.36
BH101	456.74	5.03	451.71	0.15	456.59



Borehole No.	Surface Elevation (m asl)	Depth of Borehole (m)	Elevation at Bottom of Borehole (m asl)	Depth of Fill (m)	Elevation at Bottom of Fill (m asl)
BH102(MW)	456.89	5.03	451.86	1.68	455.21
BH103	455.34	5.03	450.31	0.61	454.73
BH104(MW)	456.91	5.03	451.88	1.95	454.96
BH105	456.97	5.03	451.94	1.91	455.06
BH106(MW)	456.80	5.03	451.77	2.35	454.45
BH107	456.83	5.03	451.80	1.19	455.64
BH108	456.94	5.03	451.91	1.19	455.75

### **BROWN/REDDISH BROWN SILTY SAND TO SANDY SILT/SAND**

The fill soils in boreholes BH2, BH7, BH8, BH11 to BH13, BH28 to BH30, BH32, BH107 and BH108 were underlain by brown to reddish brown, moist to wet, loose to compact, silty sand to sandy silt/sand extending to approximate depths of 1.07m (BH13 & BH28) to 2.90m (BH11). Boreholes BH2 and BH30 were terminated in the sandy silt/silt and sand at approximate depth of 1.98m below prevailing grade.

### **BROWN/REDDISH BROWN SILT/CLAYEY SILT**

The fill/topsoil layers in boreholes BH1, BH3 to BH6, BH9, BH10, BH14, BH15, BH18, BH19, BH21 to BH27, BH31, BH33 to BH35, BH101 to BH106 and the brown silty sand to sandy silt/sand of BH7, BH8, BH11 to BH13, BH28 to BH30, BH32 and BH107 were underlain by native soils consisting of brown/reddish brown, moist to wet, firm to very stiff, silt/clayey silt extending to approximate depths of 2.90m (BH4, BH107) to 6.86m (BH11 & BH12). Boreholes BH1, BH5, BH7, BH8, BH10, BH13 to BH15, BH18, BH19, BH28, BH29, BH31 and BH35 were terminated in the brown silt at approximate depth of 1.98m below prevailing grades.

### **BROWNISH GREY/GREY SILT**

The brown/reddish brown silt/clayey silt/fine sand layers were underlain by brownish grey/grey, moist to wet, stiff to hard, silt in BH4, BH6, BH9, BH12, BH21 to BH27, BH32 to BH34, BH104 to BH107 extending to depths varying from 5.49m to 6.86m.

### **BROWN/REDDISH BROWN/GREY SILTY SAND TILL/SANDY SILT TILL**

The brown silt layers of BH3 and brownish grey/grey silt of BH4, BH6, BH9, BH11, BH12, BH21 to BH27 and BH32 to BH34 were underlain by brown/reddish brown and/or grey, moist, compact



to very dense silty sand to sandy silt till extending to depths of 7.01m in BH22. Boreholes BH4, BH6, BH9, BH11, BH12, BH21, BH23 to BH27 and BH32 to BH34 were terminated in these soils between depths of 7.72m and 8.08m.

### **GREY SAND**

A layer of grey, wet, compact sand was encountered towards the bottom of BH22 extending to termination depth of 8.08m.

## **6. GROUNDWATER CONDITIONS**

The boreholes were advanced using dry solid stem auguring. The boreholes were found to be generally dry on completion of respective soil boring operations except BH101 and BH104 to BH108 in which standing water was encountered at depths of 1.22m to 4.27m below prevailing grade. Monitoring wells were installed in BH9, BH22, BH26, BH34, BH102, BH104 and BH106 to observe groundwater levels.

Groundwater depths/elevations as measured on completion of boreholes and from the monitoring wells are summarized in Table 3a & 3b.

Based on the information in Table 3 and visual examination of the soil samples, it can be concluded that groundwater was encountered in some locations. The water bearing soils consist generally of sandy silt/silty sand/silt. It would also be expected that groundwater or perched water may/will likely be encountered from the wet seams/pockets/layers trapped inside the fill and or in the native silt to till soils.

*It is recommended that groundwater levels be further evaluated during excavation for footings or by means of test pits prior to construction.*





**Table 3: Groundwater depths/elevations****a. GWL for Dec 2, 2022 and July 17 & 24, 2024**

Borehole/MW No.	Surface Elevation (m asl)	Depth of Well, m bgs	Elevation at well base, m asl	In open borehole on Completion		2-Dec-22		17-Apr-24		17-Jul-24		24-Jul-24					
				GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl				
BH1	452.44	n/a		Dry		n/a				Monitoring wells were decommissioned							
BH2	450.95																
BH3	451.03			1.83	449.20												
BH4	450.84			2.13	448.71												
BH5	450.04			Dry													
BH6	450.86			3.35	447.51												
BH7	450.48			Dry													
BH8	450.20																
BH9(MW)	450.88	4.57	446.31	2.74	448.14	Dry		3.07	445.07								
BH10	451.34	n/a		Dry		n/a											
BH11	451.95			Dry													
BH12	452.80			4.57	448.23												
BH13	452.97			Dry													
BH14	453.78																
BH15	454.61																
BH16	455.89																
BH17	456.67																
BH18	456.35																
BH19	455.10																
BH20	455.50																
BH21	453.79			3.96	449.83												
BH22(MW)	453.16	4.57	448.59	3.66	449.50	Dry		3.24	446.26								



Borehole/MW No.	Surface Elevation (m asl)	Depth of Well, m bgs	Elevation at well base, m asl	In open borehole on Completion		2-Dec-22		17-Apr-24		17-Jul-24		24-Jul-24	
				GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl
BH23	452.88	n/a		3.66	449.22	n/a		n/a					
BH24	452.37			4.27	448.10								
BH25	451.72			3.96	447.76								
BH26(MW)	451.60	4.57	447.03	2.44	449.16	Dry		2.78	446.38				
BH27	452.36	n/a		2.44	449.92	n/a							
BH28	452.51			Dry									
BH29	453.36												
BH30	454.02												
BH31	453.61												
BH32	452.81			2.13	450.68								
BH33	452.55			2.44	450.11								
BH34(MW)	451.78	4.57	447.21	3.35	448.43	4.40	447.38	4.17	443.04				
BH35	452.27	n/a		Dry		n/a							
BH101	456.74			4.27	452.47								
BH102(MW)	456.89	4.57	452.32	Dry		n/a							
BH103	455.34	n/a											
BH104(MW)	456.91	4.57	452.34	3.96	452.95					1.91	455.00	1.90	455.01
BH105	456.97	n/a		1.22	455.75					n/a		n/a	
BH106(MW)	456.80	4.57	452.23	4.27	452.53					1.63	455.17	2.50	454.30
BH107	456.83	n/a		3.96	452.87					n/a			
BH108	456.94			4.27	452.67								



## b. GWL for August 9 to October 16, 2024.

Borehole/MW No.	Surface Elevation (m asl)	Depth of Well, m bgs	Elevation at well base, m asl	9-Aug-24		21-Aug-24		4-Sep-24		18-Sep-24		2-Oct-24		16-Oct-24	
				GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl
BH1	452.44	n/a		Monitoring wells were decommissioned											
BH2	450.95														
BH3	451.03														
BH4	450.84														
BH5	450.04														
BH6	450.86														
BH7	450.48														
BH8	450.20														
BH9(MW)	450.88	4.57	446.31												
BH10	451.34	n/a													
BH11	451.95														
BH12	452.80														
BH13	452.97														
BH14	453.78														
BH15	454.61														
BH16	455.89														
BH17	456.67														
BH18	456.35														
BH19	455.10														
BH20	455.50														
BH21	453.79														
BH22(MW)	453.16	4.57	448.59												
BH23	452.88	n/a													



Borehole/MW No.	Surface Elevation (m asl)	Depth of Well, m bgs	Elevation at well base, m asl	9-Aug-24		21-Aug-24		4-Sep-24		18-Sep-24		2-Oct-24		16-Oct-24													
				GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl												
BH24	452.37	4.57	447.03																								
BH25	451.72																										
BH26(MW)	451.60																										
BH27	452.36	n/a																									
BH28	452.51																										
BH29	453.36																										
BH30	454.02																										
BH31	453.61																										
BH32	452.81																										
BH33	452.55																										
BH34(MW)	451.78	4.57	447.21																								
BH35	452.27	n/a																									
BH101	456.74																										
BH102(MW)	456.89	4.57	452.32	Dry	n/a	Dry	n/a	3.75	453.14	3.56	453.33	3.41	453.48	3.39	453.50												
BH103	455.34	n/a		n/a		n/a		n/a		n/a		n/a		n/a													
BH104(MW)	456.91	4.57	452.34	Dry	n/a	Dry	n/a	2.97	453.94	2.95	453.96	2.61	454.30	2.58	454.33												
BH105	456.97	n/a		n/a		n/a		n/a		n/a		n/a		n/a													
BH106(MW)	456.80	4.57	452.23	Dry	n/a	Dry	n/a	2.68	454.12	2.83	453.97	2.56	454.24	2.53	454.27												
BH107	456.83	n/a		n/a		n/a		n/a		n/a		n/a		n/a													
BH108	456.94																										



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### **6.1 Estimated Infiltration Rates**

Soil conditions below the surficial fill/topsoil layers vary across the site and may be described as C.L (Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays) to S.M (silty sands, sand-silt mixtures) in some areas. Coefficient of Permeability  $k$  values for C.L soils, based on the 'Supplementary Guidelines to the Ontario Building Code 1997, SB-6 Percolation Time and Soil Description', are generally less than  $10^{-6}$  cm/s with percolation time  $T$  of over 50 mins/cm. Coefficient of permeability for S.M soils are in the range  $10^{-3}$  to  $10^{-5}$  cm/s with Percolation Time  $T$  of 8 - 20 mins/cm indicating medium to low permeability.

It should be noted that percolation tests were conducted in the location of the proposed training area. A report, outlining field conditions, percolation tests and recommended infiltration rates is presented under Fisher Project 24-14044 dated, July 26, 2024.

## **7. GEOTECHNICAL DISCUSSION AND RECOMMENDATIONS**

### **7.1 General Discussion**

It is understood that the proposed development will consist of the construction of a single-storey fire hall building without basement in the areas covered by boreholes BH3, BH4, BH6, BH9, BH11, BH12, BH21 to BH27 and BH32 to BH34. Various structures, including an outdoor training area (gravelled area), concrete pad for auto extrication, storage garage and concrete pad for modular training structure, are proposed in the area covered by BH101 to BH108.

Site plan provided indicates that two finished floor elevations, 450.95m (lower level) for the north wing of building and 453.68m (upper level) for the south-eastern wing of building are proposed.

Finished exterior grades were not available at the time of this investigation. Assuming that the exterior finished grades will be the same or 0.20m below finished floor levels at the perimeter walls, anticipated founding levels for the exterior wall/column footings will be as follows:

- Lower level                      449.75m or 449.55m
- Upper level                        452.48m or 452.28m

The following sections provide general geotechnical recommendations for design and construction.



## 7.2 Foundation Considerations

The subsurface investigation showed that natural soils can be used for foundation support using conventional strip and/or spread footing foundations.

Soil bearing pressures for footings placed over undisturbed native soils and approximate/corresponding founding depths & elevations, based on variation in soil strength across the site and with depth, are presented in the Table 4:

**Table 4: Existing Grades and Approximate Footing Founding Depths/Elevations**

Borehole No.	Existing Grade/Elevation, m	Approximate Footing Founding		Soil Bearing Pressure, kPa	
		Depth, m	Elevation, m	SLS	ULS
BH3	451.03	0.76-2.10	450.27 - 448.93	100	150
		2.10-3.20	448.93 - 447.83	200	300
BH4	450.84	1.40-3.20	449.44 - 447.64	150	225
BH6	450.86	0.76-3.20	451.62 - 454.06	100	150
BH9(MW)	450.88	1.52-2.80	449.36 - 448.08	100	150
		2.80-3.50	448.08 - 447.38	150	225
BH11	451.95	1.52-3.20	450.43 - 448.75	150	225
BH12	452.8	1.22-1.98	451.58 - 450.82	100	150
		1.98-3.20	450.82 - 449.60	200	300
BH19	455.1	1.7	453.40	100	150
BH21	453.79	1.83-3.30	451.96 - 450.49	150	225
BH22(MW)	453.16	1.21-3.20	451.95 - 449.96	150	225
BH23	452.88	1.11-3.50	451.77 - 449.38	150	225
BH24	452.37	0.89-3.40	451.48 - 448.97	150	225
BH25	451.72	0.89-2.10	450.83 - 449.62	100	150
		2.10-3.20	449.62 - 448.52	200	300
BH26(MW)	451.6	1.11-1.50	450.49 - 450.10	100	150
		1.50-3.20	450.10 - 448.40	150	225
BH27	452.36	0.89-1.40	451.47 - 450.96	100	150
		1.40-3.20	450.96 - 449.16	150	225
BH32	452.81	0.76-3.20	452.05 - 449.61	150	225
BH33	452.55	0.99-3.20	451.56 - 449.35	150	225
BH34(MW)	451.78	1.30-2.20	450.48 - 449.58	150	225
		2.20-3.20	449.58 - 448.58	200	300



Borehole No.	Existing Grade/Elevation, m	Approximate Footing Founding		Soil Bearing Pressure, kPa	
		Depth, m	Elevation, m	SLS	ULS
BH101	456.74	2.4	454.34	150	225
BH102	456.89	2.5	454.39	150	225
BH103	455.34	2.5	452.84	150	225
BH104	456.91	2.2	454.71	150	225
BH105	456.97	2	454.97	100	150
BH106	456.8	2.4	454.4	100	150
BH107	456.83	1.5	455.33	120	180
BH108	456.94	3	453.94	100	150

### 7.3 General Comments about Footing Construction

- For footings founded at different levels in the vicinity of each other or located adjacent to excavated and backfilled areas, such as sewer trenches/other excavations etc., the slope of the imaginary line joining the bottom of two footings or the bottom of footing and excavation should not be steeper than 10H:7V as shown in Figure A5.
- Subsoil conditions at the footing founding levels should be inspected by soils engineer from our office prior to pouring concrete, to ensure that the design soil bearing pressures are being attained.
- Footings subjected to seasonal winter weather, such as exterior wall and column footings, should be founded at least 1.2m below the adjacent finished grades to prevent damage due to frost penetration.
- For foundations designed/constructed in accordance with the preceding recommended bearing pressures/criteria, total & differential settlements should be limited to 25mm and 16mm respectively.
- During cold/freezing weather conditions founding soils should be adequately protected to prevent any damage due frost penetration.



---

## **7.4 Earthquake Considerations**

Ontario Building Code 2024, Subsection 4.1.8 stipulates that a building be designed to meet the requirements of the Earthquake Load and Effects. Site Classification for Seismic Hazard Index (Table 4.1.8.4.A) is determined from the average Standard Penetration Resistance ( $N_{60}$ ) and/or the undrained shear strength ( $S_u$ ) of the soils within the upper 30m.

Shear wave velocity tests were carried out on the site on March 12, 2025 to determine Site Designation and are presented in Appendix E.

The average shear wave velocity ( $V_{s30}$ ) value calculated from in situ shear wave velocity measurements was 603 m/s. Based on Sentence 4.1.8.4.(2b) of the National Building Code of Canada 2020 (NBC 2020) Site Designation of  $X_{603}$  is applicable for this site.

## **7.5 Slab-on-Grade Construction**

Existing grades in the proposed building location appears to be higher than the proposed ground floor level, hence grade cuts will generally be required. The following should be noted:

- It is recommended that the existing fill be further evaluated by excavating test pits prior to, or from footing/service trenches at the time of construction after the grades have been cut down to the proposed subgrade levels. All loose fill and any unsuitable compressible fill such as organic/topsoil mixed soils etc. should be removed from the areas to be slabbed and replaced with inorganic compacted/engineered fill.
- Exposed subgrade should be proof-rolled in the presence of Fisher Engineering soils personnel to detect any compressible, spongy or unstable areas. If any isolated pockets of such materials are detected, they should be sub-excavated to competent subsoils and backfilled with approved inorganic materials compacted to at least 95% of their Standard Proctor Maximum Dry Density (S.P.M.D.D.) in thin layers.
- Any new fill should consist of approved compactable inorganic soils, placed in thin layers (not exceeding 300mm), and each layer should be compacted to at least 98% of its S.P.M.D.D. under dry and frost-free conditions.
- For normal light duty slab-on-grade construction, a 200mm thick bedding layer consisting of granular 'A' or 20mm crusher run material should be specified under the slab-on-grade to serve as a moisture barrier. The bedding layer should be compacted to a minimum of 98% of its S.P.M.D.D.





- Modulus of subgrade reaction of 20MN/m<sup>3</sup> can be used for slab-on-grade design provided the subgrade is undisturbed/engineered as recommended and granular bedding is well compacted.
- Foundation wall drainage along with damp/water proofing should be provided in the lower floor slab and elevator pit areas (if any) and where exterior grades will be higher than the granular bedding under the floor slab. Alternatively, they should be water tight and designed to resist any uplift/lateral pressures due to potential rise in the water level.
- Drainage should also be provided behind the retaining walls and free draining materials should be used for backfilling. Alternatively, they should also be designed to resist applicable lateral loads.

### **7.6 Pavement Design**

The functional life of a pavement depends directly on the soil subgrade conditions and the load carrying capacity of the pavement structure.

Minimum flexible pavement structure thicknesses are presented in the Table 5.

**Table 5: Minimum Flexible Pavement Structure Thicknesses**

Pavement Layer	Compacted Thicknesses	
	Light Duty Parking	Driveways & Heavy-Duty Parking
Asphalt top course, HL-3	40mm	40mm
Asphalt base course, HL-8	40mm	60mm
Granular 'A' or 20mm crusher run limestone base	150mm	150mm
Granular 'B' or 50mm crusher run limestone sub-base	200mm	350mm

The pavement structure should also meet the minimum municipal/local/regional design requirements, if any/where applicable, for the proposed development.

Pavement thicknesses in Table 5 are applicable for dry and stable subgrade conditions during summer season construction only. If construction is carried out during winter and for unstable subgrade conditions, the thicknesses of granular materials may have to be increased.



The granular base materials should conform to O.P.S.S. Form 1010 specifications and be compacted to at least 98% of their SPMDD's. Similarly, asphaltic concretes should meet O.P.S.S. Form 1150 requirements for specified grades and be compacted to at least 97% of their Marshall Densities.

Following minimum rigid pavement thicknesses are recommended:

- Portland Cement Concrete (Class C-2) 200mm
- Granular "A" Base (98-100% compaction) 200mm

Subgrade may be prepared as described in subsection 7.5. All loose/compressible organic fill should be removed from the subgrade areas to be paved. Prior to placement of granular bases, the finished sub-grade should be contoured to eliminate depressions and sloped at a minimum of 2% towards catch basins/drains to facilitate drainage of subgrade and base materials. If a 2% slope is not feasible or provided, subdrains should be provided to adequately drain the subgrade/granular materials.

Typically, a subgrade drain should be provided where the rigid and flexible pavements meet due to the different granular base material thicknesses. Weeper drains should be provided around catch basins and extend to at least 3m in all directions. A field review should be carried out during construction for additional drainage requirements.

It is also recommended that drains/swales be provided behind the curbs where the grades will be higher than the pavement levels or slope towards paved areas.

Top of the drain/invert of the swale should be below the pavement subgrade levels. Perforated drains assembly should be encased in filter cloth to prevent soil migration/erosion.

Water should not be allowed to accumulate at the edges of pavement and regular monitoring/maintenance should be carried out as required.

### ***7.7 Re-Use of On-site Excavated Soils***

Native soils consisting of silt/sandy to clayey silt were encountered below the surficial fill. It is anticipated that these materials will be suitable for reuse for backfilling service/utility trenches, provided that these activities are not undertaken in wet or freezing weather conditions. If the on-site native soils are or become wet, moisture conditioning to reduce the moisture content will be required before specified compaction can be achieved in trenches or excavation areas. The



preceding may be achieved by spreading and air drying the high moisture materials under dry weather conditions. Alternatively, imported granular materials or other geotechnically and environmentally approved soils can be used.

Based on the subsurface information available, existing fill appears to be heterogenous and will require further assessment to determine its suitability for re-use by excavating test pits at or prior to the time of construction. Deleterious materials such as topsoil/topsoil mixed soils, construction rubble or soils mixed with these, if present, should not be used for backfilling.

Native soils are considered susceptible to frost action; therefore, these soils should not be reused in any applications where a volume change, as a result of exposure to freezing conditions, would be detrimental to the serviceability of the planned building and/or infrastructure. These soils may be suitable for use in landscaping areas.

Deleterious materials, if present, should be removed/sorted.

### ***7.8 Underground Utilities/Sewer Pipes***

For the subject site, it is expected that the underground services would be founded above the real groundwater table. 20mm crusher run limestone or Granular 'A' material is considered well suited to be used as bedding/cover material. However, it should be noted that the recommended type of bedding is to be placed on undisturbed natural subgrade.

Pipe bedding and cover materials specifications, thicknesses and compaction criteria for water and sewer services should be in accordance with the pipe designer's recommendations and/or local/municipal/regional requirements.

Existing fill appears to be heterogenous in nature and may need to be removed subject to field review at the time of construction. It can be replaced with inorganic engineered fill or 50mm crushed clear stone wrapped in filter cloth.

Approved on-site excavated compactable inorganic fill materials/native soils are considered to be suitable for re-use in trench backfilling. All organics/construction debris mixed soils must be removed or sorted out. Their moisture contents should be within 2 to 3% of the optimum moisture contents.

In normal sewer construction practice, the problem of settlement generally occurs adjacent to manholes, catch basins and service crossings. In these areas, granular materials are generally required/used for backfill and compaction.



### 7.9 Lateral Earth Pressure Considerations

Retaining walls under free drainage conditions, can be designed for a lateral earth pressure  $P$ , given by the following expression:

$$P = k (Yh + q)$$

where  $k$  = Coefficient of earth pressure

$Y$  = Unit weight of soil

$q$  = Surcharge load, if any

For walls without drainage, the lateral earth pressures acting on retaining/basement walls may be calculated from the following expression:

$$p = k (Yh_1 + Y' h_2 + q) + Y_w h_2$$

where  $p$  = lateral earth pressure in kPa acting at depth  $h$

$k$  = earth pressure coefficient, assumed to be 0.4 for vertical walls and horizontal backfill

$Y'$  = submerged unit weight of backfill of 12kN/m<sup>3</sup> may be assumed

$Y_w$  = Unit weight of water, a value of 10kN/m<sup>3</sup> can be used

$h_1$  = depth to the highest groundwater table in metre

$h_2$  = depth below water table in metres

$q$  = surcharge on the ground surface in kPa

Soil parameters in Table 6 may be used in the evaluation of lateral earth pressures.

**Table 6: Soil parameters for lateral earth pressures**

Parameters	Fill	Silt/Sandy Silt
Unit weight, $\gamma$ , kN/m <sup>3</sup>	18	21.0
Coefficient of earth pressure at rest ( $k_0$ )	0.50	0.38
Coefficient of active earth pressure ( $k_a$ )	0.40	0.33
Coefficient of passive earth pressure ( $k_p$ )	2.50	3.00

For on-site native soils and compacted/engineered inorganic fill, the angle of internal friction can be taken as 32°.



---

### **7.10 Excavation and Groundwater Control Considerations**

It is understood that excavation for the proposed structure/services may extend to depths of 1.5m or more. According to the Ontario Occupational Health and Safety Act, all excavations deeper than 1.2m should be adequately supported against ground collapse. Caving of any loose fill or wet pockets/layers should be taken into consideration during excavation.

- Moist fill and weathered/firm to stiff/compact native silt/clayey silt/sand/silty sand/sandy silt soils are Type 3 Soils.
- Very stiff to hard/dense native till soils can be considered as Type 2 Soils.
- However, the presence of wet seam/layers/pockets may require flattening of the side slopes. Field review should be carried out at the time of construction to evaluate the impact of site/soil and perched groundwater conditions.
- Excavations extending into water bearing soils should not proceed until the dewatering has been carried out to bring the wet soil into a moist state.
- Excavation sides should be protected to prevent erosion from surface water or water bearing wet pockets/layers.

Groundwater was encountered at some borehole locations at depths ranging generally from 1.83m to 4.57m below existing ground surface (elevations varying from 452.95m to 447.51m asl). The higher water levels were observed in the area of BH32, BH33 and BH34. It should be noted that standing water was observed at 1.22m bgs (455.75m asl) in BH105 on completion of drilling. The monitoring wells, in the area of the proposed building, were generally dry approximately two weeks after installation excepting for MW34 in which groundwater was measured at 447.38m asl. further groundwater level measurements in April to October 2024 show water levels varying from 1.25m to 3.41m bgs (455.64m to 453.50m in the gravelled training area. These higher water levels may be attributed to excessive rainfall. It should also be noted that the presence of water on completion of drilling means that some amount of groundwater/perched water would be expected during excavation for footings and services depending on the time of year that construction takes place. Provisions should therefore be made to lower the groundwater levels, where encountered, to approximately 1m below design footing grades to prevent hydraulic disturbance during construction.

Based on the two different finished floor elevations the lower FFE of 450.95m asl is relatively close to the observed standing water on completion of drilling particularly in the areas of BH32, BH33



and BH34. Drainage may be required for any retaining structure at the step up/down between the two FFE.

It is expected that the higher water levels observed at some locations are due to perched water conditions in the silty soils or soils overlying less pervious silt. As most of the excavations are anticipated to be less than 3m, significant groundwater issues are not anticipated. Provisions should however be made to rid the excavated areas of seepage/groundwater by conventional sump pump methods.

It should be noted that the above recommendations are based on the actual borehole locations. Should any unusual soil conditions be encountered beyond the location of the boreholes, it may be necessary to revise these recommendations.

## **8. SULPHATE, CHLORIDE AND PH ANALYSES**

Two soil samples from BH22 and BH26 between depths of 0.76m and 1.22m were submitted to Fisher Environmental laboratories for chemical analyses related to potential sulphate attack on buried concrete. Test results are presented in Appendix C and are summarized below:

- The pH values of soil samples tested are 8.31 and 8.44 and are within the expected range for subsurface soils (5-11).
- Chloride content in soil samples tested are 33.9 and 33.6 µg/g (0.00339 to 0.00336% indicating potential mild corrosion of exposed ferrous metals.
- Sulphate concentration in the soil samples tested are 26.1mg/kg and 34.9mg/kg or 0.00261% and 0.00349% respectively. According to CSA-A23. 1-09 Table 3, these results indicate negligible degree of exposure to sulphate attack.



---

## 9. GENERAL CONSIDERATIONS

- This report is limited in scope to those items specifically referenced in the text. No other testing and design calculations have been performed except as specifically reported.
- Discussions and recommendations presented in this report are intended for the sole guidance of the client named and the design consultants. It should not be relied upon for any other purpose.
- The information on which these recommendations are based is subject to confirmation by engineering personnel at the time of construction.
- The fact that localised variations in subsurface conditions may be present between and beyond the boreholes and that those conditions may be significantly different from the general description provided for design purposes should be understood.
- Contractors bidding on or undertaking the work should decide on their own investigations, as well as their own interpretations of the factual borehole results. This concern specifically applies to classification of subsurface soils and the potential reuse of these soils on/off Site. Contractors must draw their own conclusions as to how the near surface and subsurface conditions may affect them.
- It is strongly recommended that Fisher be contacted to provide assistance in the interpretation of the borehole records by anyone undertaking work on/or below the ground surface at this site prior to this work being carried out.
- The client expressly agrees that Fisher's employees and principals shall have no personal liability to the client in respect of a claim, whether in contract, tort and/or any other cause of action in law. Accordingly, the client expressly agrees that it will bring no proceedings and take no action in any court of law against any of Fisher's employees or principals in their personal capacity.

## 10. CLOSING

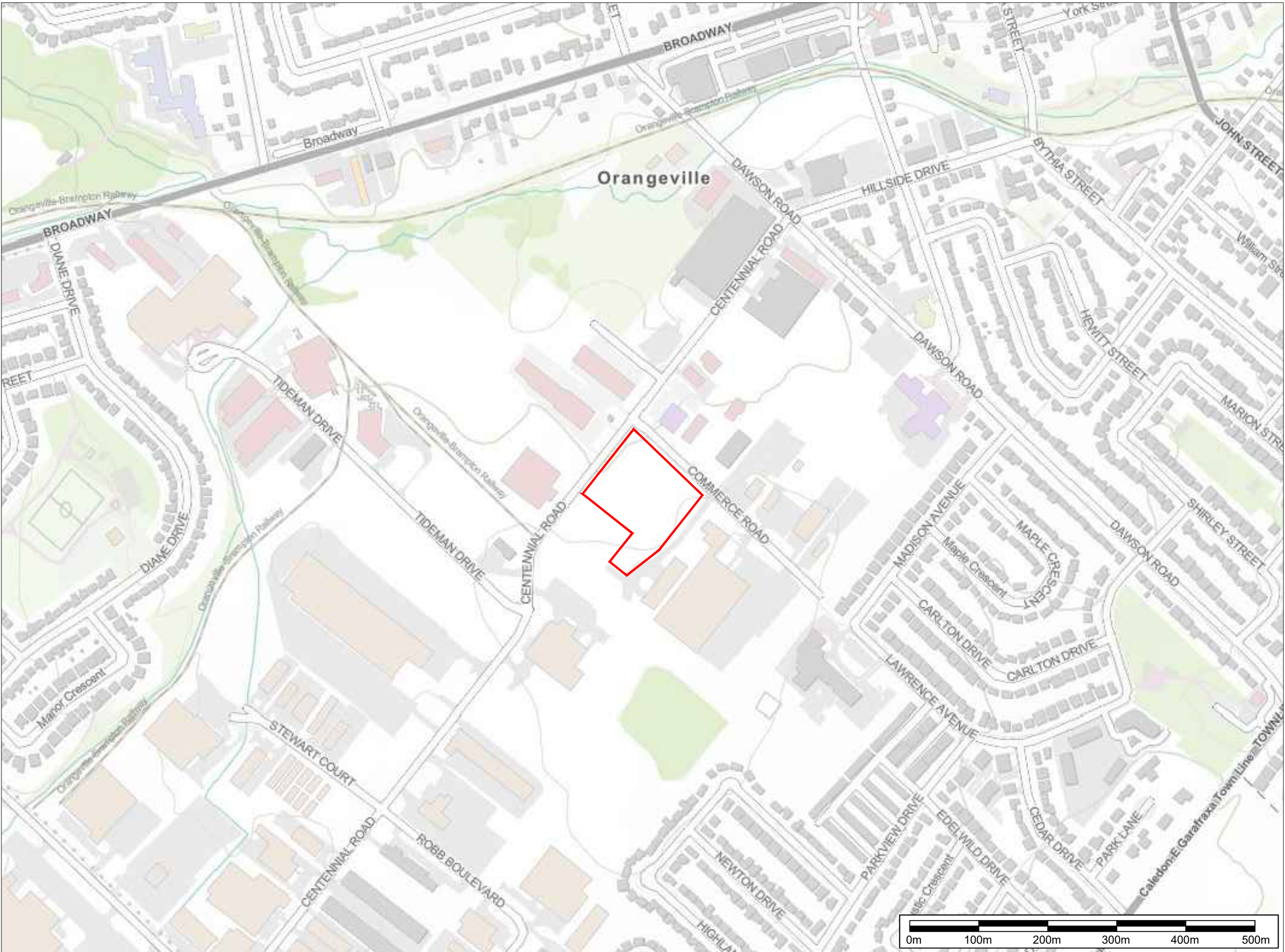
We trust that the foregoing information is sufficient for your present needs and will be pleased to review the contents of this report in greater detail should you so require. Should you require our services further in this regard, please do not hesitate to contact our office.



## **APPENDIX A – SITE & LOCATION PLANS**



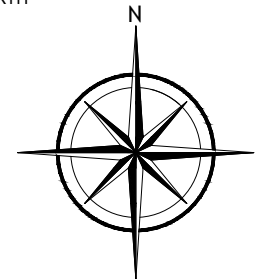




400 Esna Park Dr., #15  
Markham, Ontario  
L3R 3K2

Tel: 905 475-7755

NORTH



LEGEND

— SITE BOUNDARY

PROJECT NAME AND ADDRESS

**GEOTECHNICAL  
INVESTIGATION**

30 Centennial Road,  
Orangeville, ON

FIGURE A1:

**SITE LOCATION MAP**

PROJECT NO.

FE 24-14036

DATE

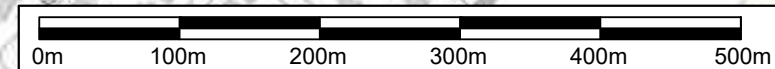
12 July 2024

SCALE

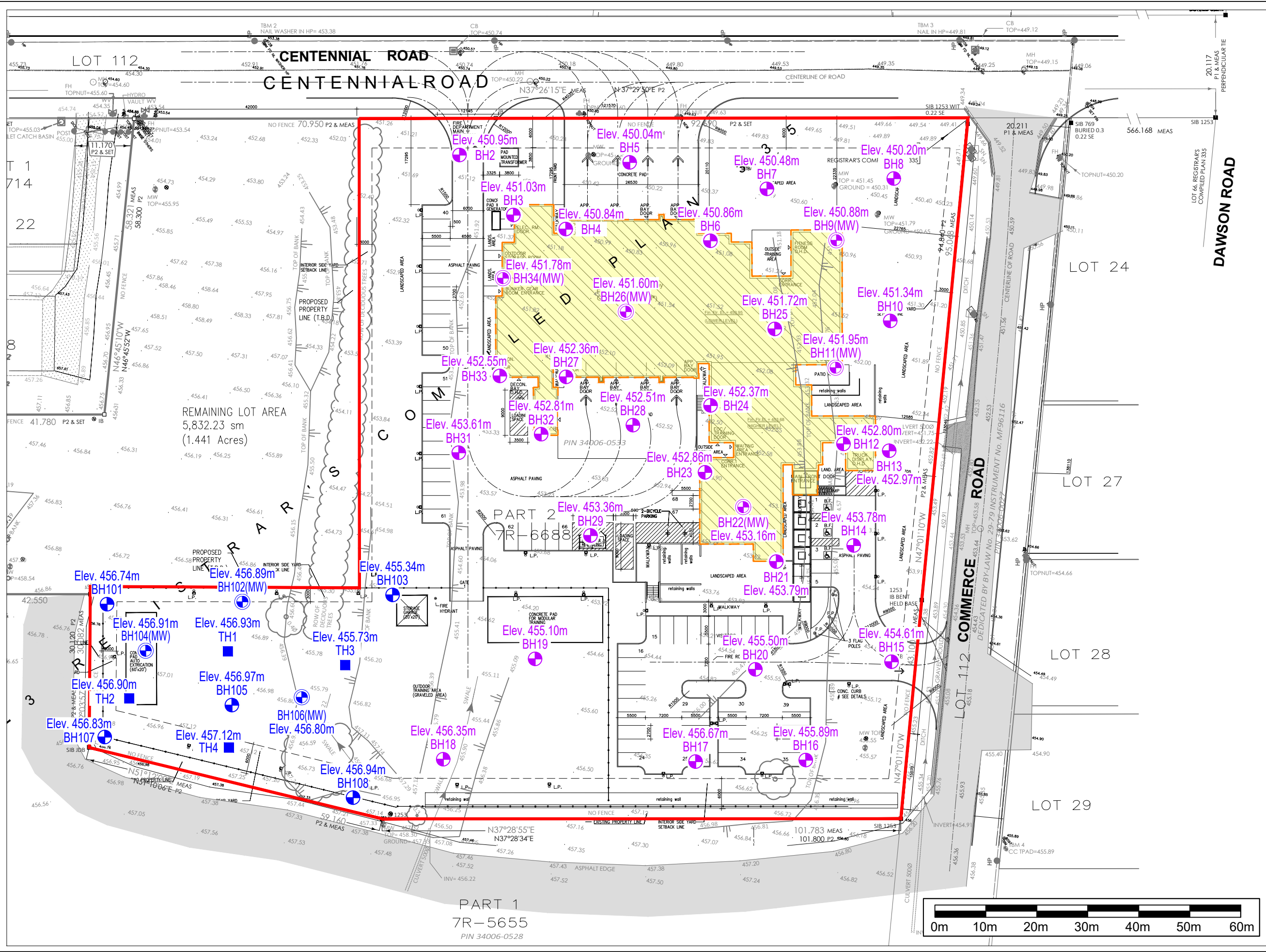
AS SHOWN

SHEET NO.

**A1**

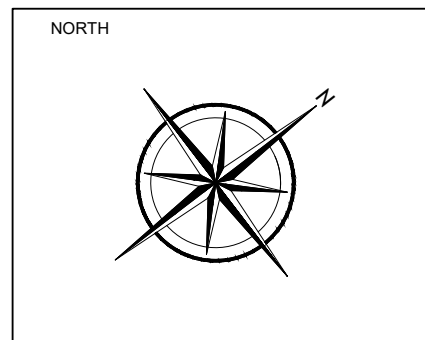






400 Esna Park Dr., #15  
Markham, Ontario  
L3R 3K2

Tel: 905 475-7755



- LEGEND
- SITE BOUNDARY
  - BOREHOLE LOCATION
  - TEST HOLE LOCATION
  - EXISTING BOREHOLE WITH MONITORING WELL LOCATION
  - EXISTING BOREHOLE LOCATION
  - PROPOSED BUILDING FOOTPRINT

PROJECT NAME AND ADDRESS

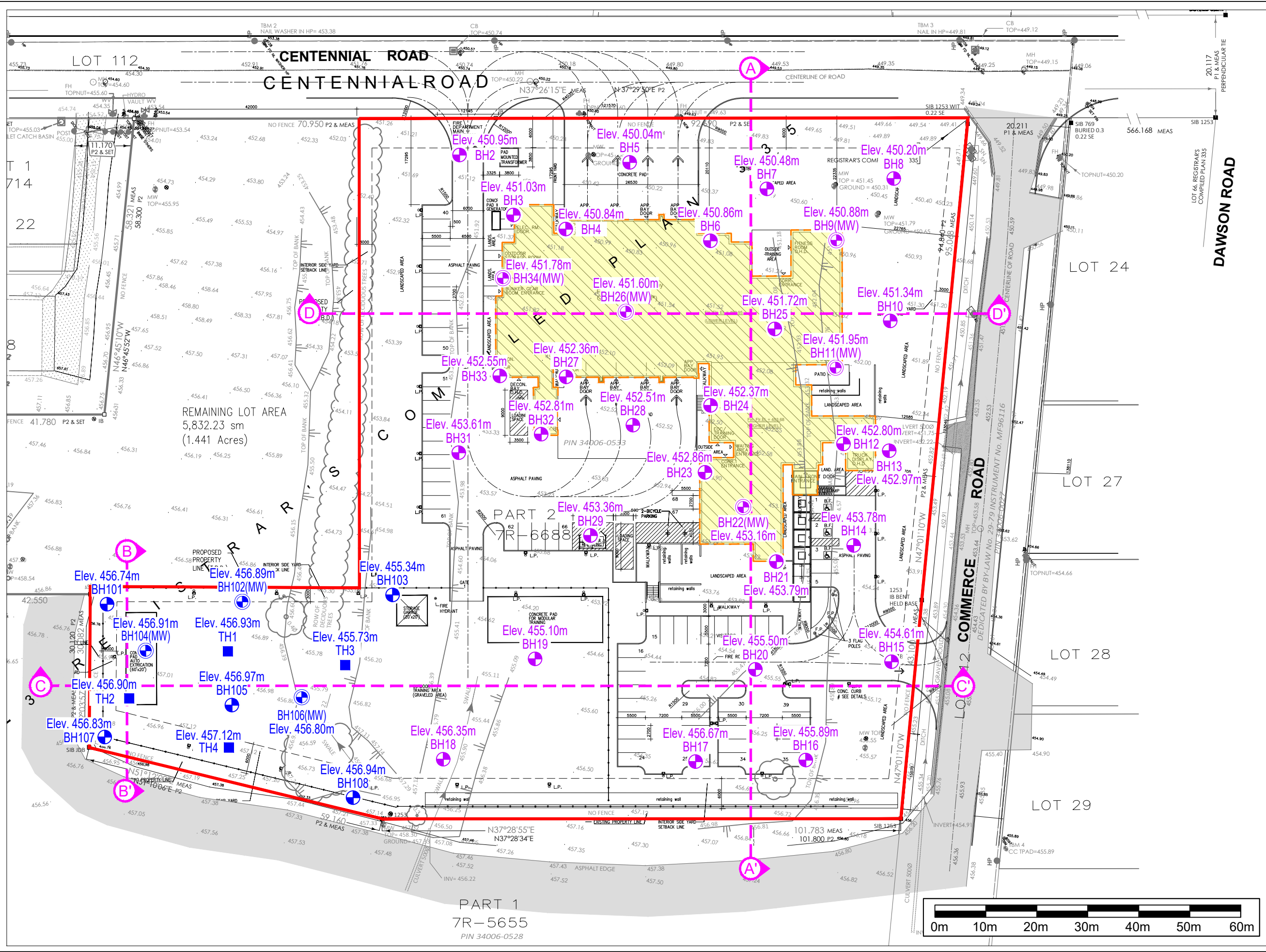
**GEOTECHNICAL INVESTIGATION**

30 Centennial Road,  
Orangeville, ON

FIGURE A2:

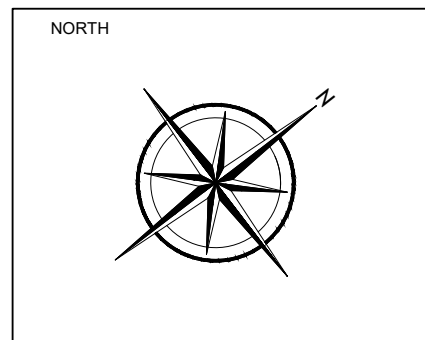
**SITE PLAN**

PROJECT NO. FE 24-14036	SHEET NO. <b>A2</b>
DATE 12 July 2024	
SCALE AS SHOWN	



400 Esna Park Dr., #15  
Markham, Ontario  
L3R 3K2

Tel: 905 475-7755



- LEGEND
- SITE BOUNDARY
  - BOREHOLE LOCATION
  - TEST HOLE LOCATION
  - EXISTING BOREHOLE WITH MONITORING WELL LOCATION
  - EXISTING BOREHOLE LOCATION
  - CROSS SECTION MARK
  - PROPOSED BUILDING FOOTPRINT

PROJECT NAME AND ADDRESS

**GEOTECHNICAL INVESTIGATION**

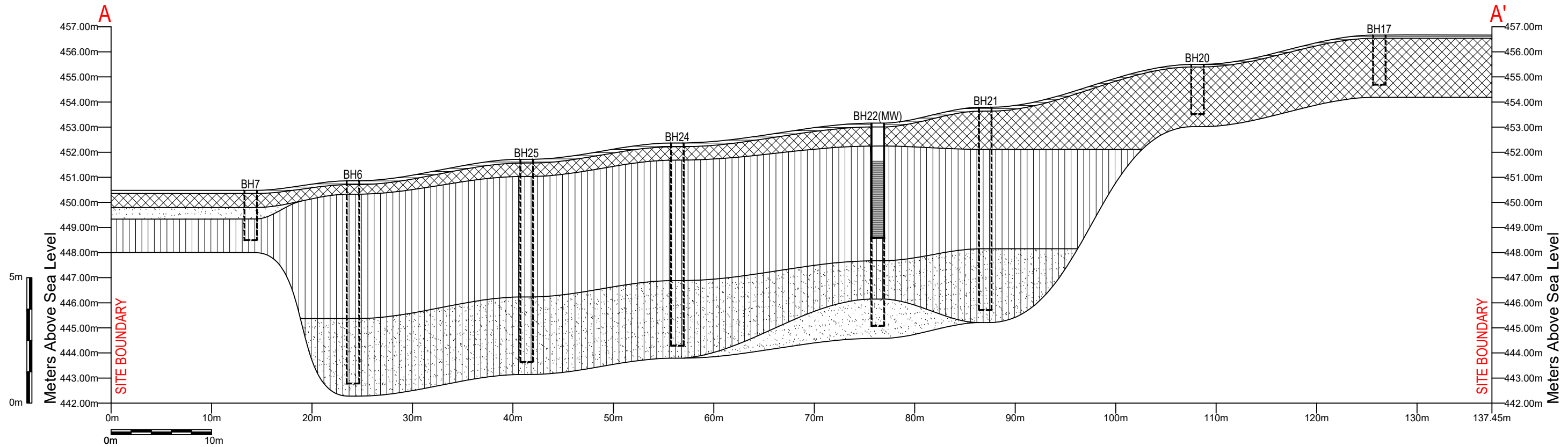
30 Centennial Road,  
Orangeville, ON

FIGURE A3:

**OVERALL SITE PLAN**

PROJECT NO. FE 24-14036	SHEET NO. <b>A3</b>
DATE 12 July 2024	
SCALE AS SHOWN	







400 Esna Park Dr., #15  
Markham, Ontario  
L3R 3K2

Tel: 905 475-7755

NORTH



LEGEND

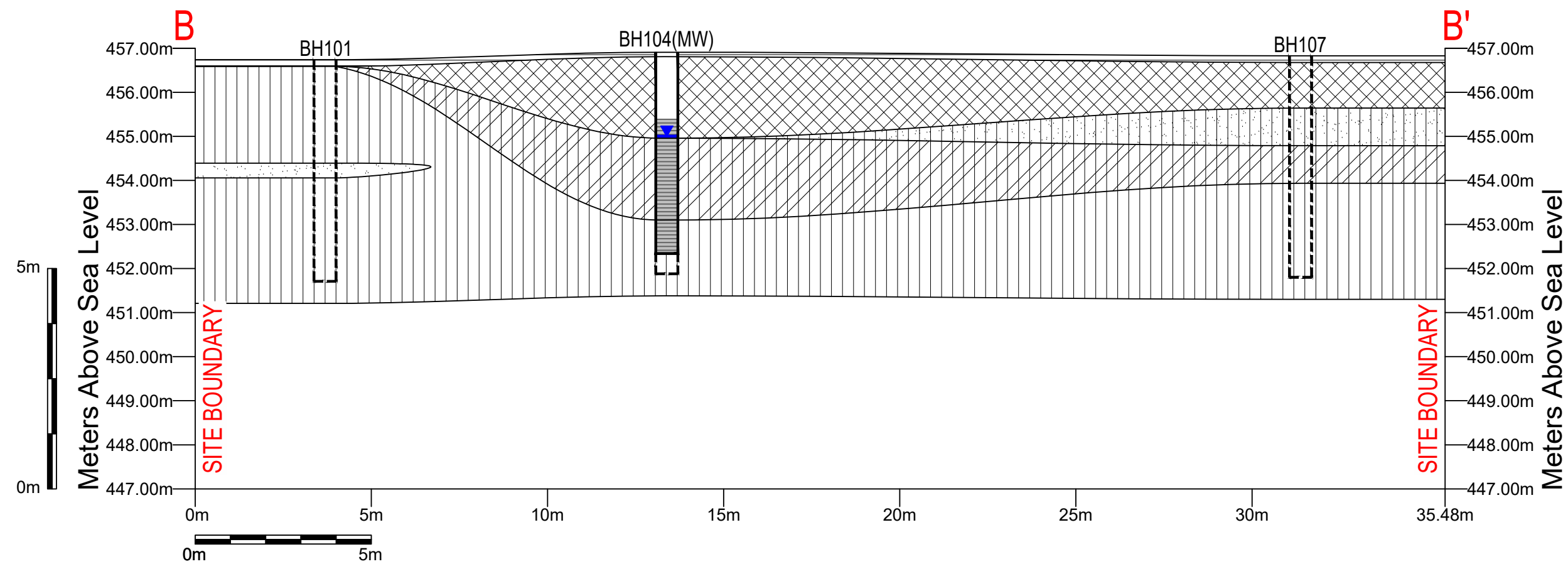
	TOPSOIL
	FILL
	SAND
	SILT

PROJECT NAME AND ADDRESS

GEOTECHNICAL  
INVESTIGATION

30 Centennial Road,  
Orangeville, ON

PROJECT NO. FE 24-14036	FIGURE A4.1:  <b>CROSS-SECTION A - A'</b>	SHEET NO.  <b>A4.1</b>
DATE. 24 July 2024		
SCALE. AS SHOWN		











400 Esna Park Dr., #15  
Markham, Ontario  
L3R 3K2


Tel: 905 475-7755

NORTH



LEGEND

	TOPSOIL
	FILL
	SAND
	SILT
	CLAY



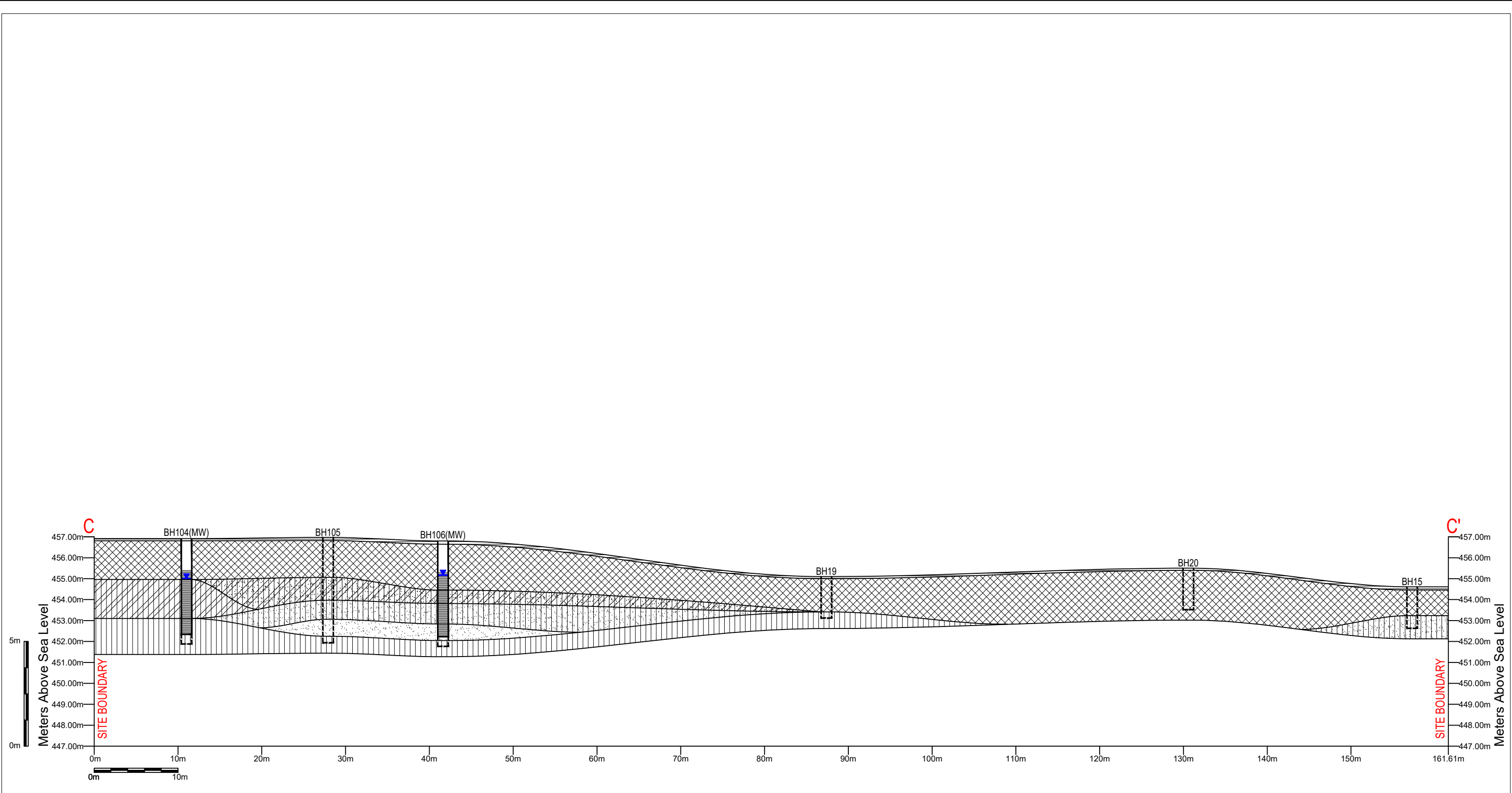
GROUNDWATER POTENTIOMETRIC LEVEL

PROJECT NAME AND ADDRESS

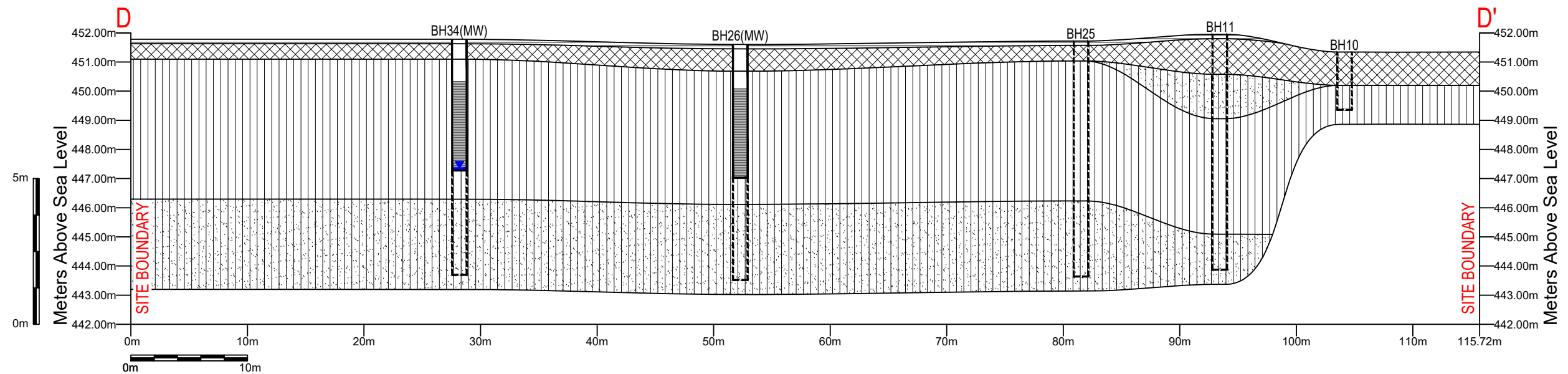
GEOTECHNICAL INVESTIGATION

30 Centennial Road,  
Orangeville, ON

PROJECT NO. FE 24-14036	FIGURE A4.2:  <b>CROSS-SECTION B - B'</b>	SHEET NO.  <b>A4.2</b>
DATE. 24 July 2024		
SCALE. AS SHOWN		



 <b>FISHER ENGINEERING</b> 400 Esna Park Dr., #15 Markham, Ontario L3R 3K2 Tel: 905 475-7755	NORTH	<b>LEGEND</b> TOPSOIL FILL SAND SILT CLAY GROUNDWATER POTENTIOMETRIC LEVEL	PROJECT NAME AND ADDRESS		PROJECT NO. FE 24-14036	FIGURE A4.3: <b>CROSS-SECTION C - C'</b>	SHEET NO. <b>A4.3</b>
			GEOTECHNICAL INVESTIGATION		DATE. 24 July 2024		
			30 Centennial Road, Orangeville, ON		SCALE. AS SHOWN		



400 Esna Park Dr., #15  
Markham, Ontario  
L3R 3K2

Tel: 905 475-7755

NORTH

LEGEND

- TOPSOIL
- FILL
- SAND
- SILT



GROUNDWATER POTENTIOMETRIC LEVEL

PROJECT NAME AND ADDRESS

GEOTECHNICAL  
INVESTIGATION

30 Centennial Road,  
Orangeville, ON

PROJECT NO.

FE 24-14036

DATE.

24 July 2024

SCALE.

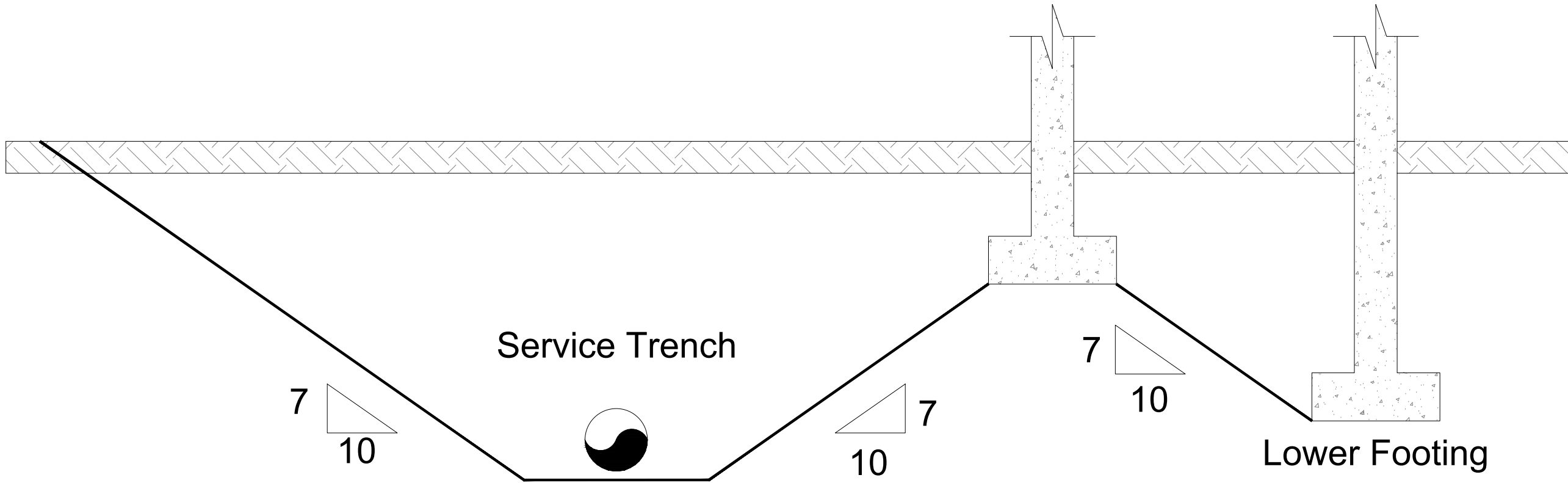
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FIGURE A4.4:

CROSS-SECTION D - D'

SHEET NO.

A4.4



400 Esna Park Dr., #15  
Markham, Ontario  
L3R 3K2

Tel: 905 475-7755

NORTH

LEGEND

PROJECT NAME AND ADDRESS

**GEOTECHNICAL  
INVESTIGATION**

30 Centennial Road,  
ORANGEVILLE, Ontario

FIGURE A5:

**FOOTING NEAR SERVICE TRENCHES  
OR AT DIFFERENT ELEVATIONS**

PROJECT NO.

FG24-14036

DATE

JULY 2024

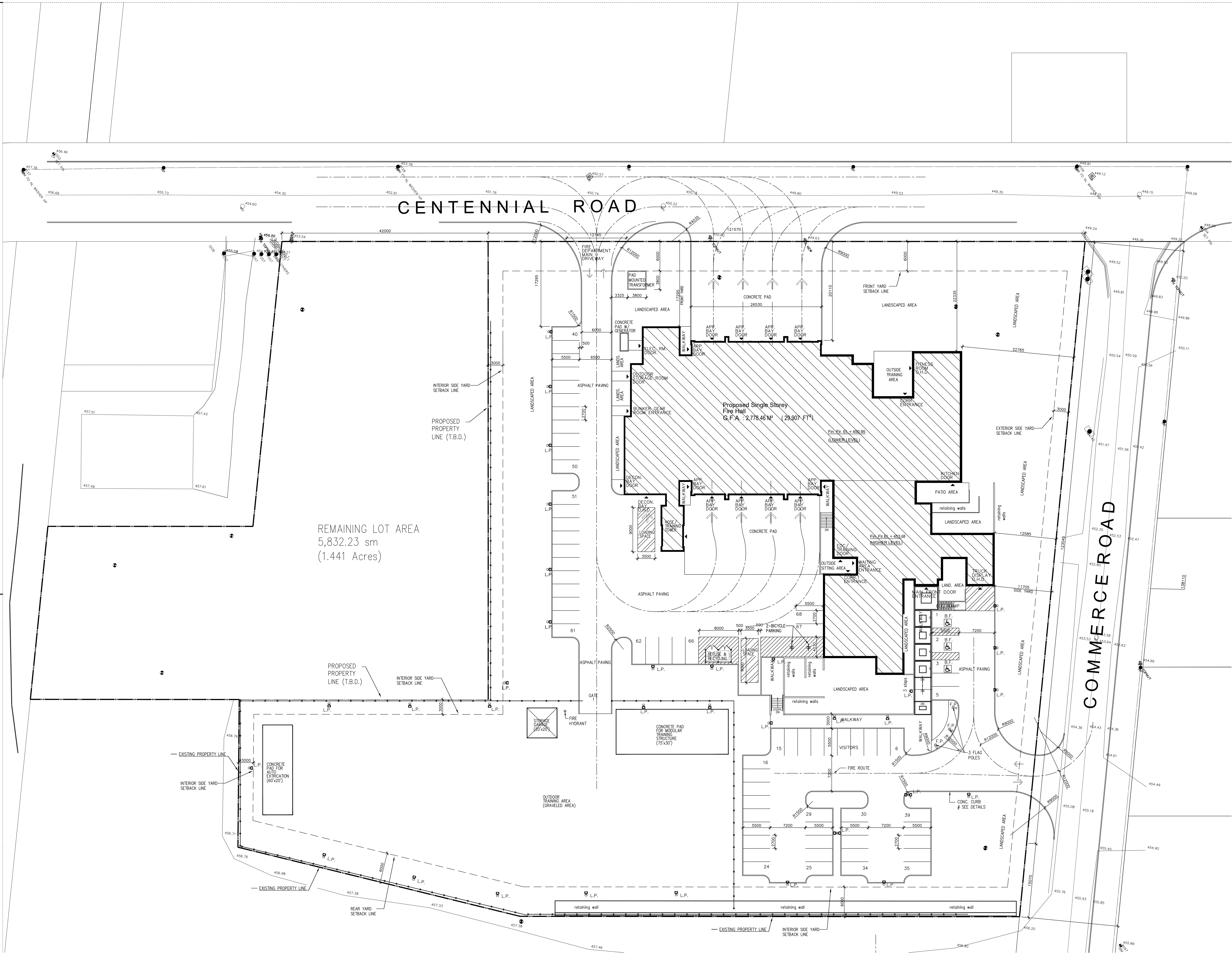
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AS SHOWN

SHEET NO.

**A5**



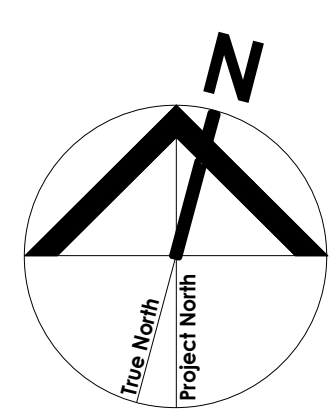


ABBREVIATIONS LEGEND

F.P	FLAG POLES
L.P	LAMP POST
P.L	PROPERTY LINE
F.R	FIRE ROUTE

1 SITE PLAN OVERALL  
1:250

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No.	Issued For	Date
1	UPDATED LOT	July 5, 2024



Development File Number  
D 00-000

**alaimo**  
architecture inc.

202-8531 Weston Road  
Woodbridge, ON L4L 9K4  
P: (905) 856-2840  
F: (905) 856-4912  
info@alaimoarchitecture.com

Drawing Title  
**SITE PLAN OVERALL**

Project  
**TOWN OF ORANGEVILLE  
FIRE HALL PROJECT**  
10 COMMERCE ROAD, ORANGEVILLE, ONTARIO

Scale  
1 : 250

Issued by  
**F.A.**

File No:  
**2021-020**

Plot Date  
**2024-07-05**

## **APPENDIX B – LOG OF BOREHOLES**





LOG OF BOREHOLE

No. BH101 SHEET. 1 of 1

PROJECT NO.: FE 24-14036

PROJECT NAME: GEOTECHNICAL INVESTIGATION

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: D-50 Track Soid Stem Auger

DRILLING DATE: 9 July, 2024

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION	
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80					
							SHEAR STRENGTH (Kpa) ➤				MOISTURE CONTENT (%) ●					
0	0		456.74													
		TOPSOIL	0.15 / 456.59													
2		SILT: Brown, some clay, trace to some sand, moist, firm to stiff			SS-1	8										
						SS-2	9									
4	1															
6	2					SS-3	7									
8		SAND: Reddish brown, some silt, wet, compact	2.35 / 454.39		SS-4	12										
10	3	SILT: Brown, trace sand, wet, very stiff	2.68 / 454.06													
12					SS-5	22										
14	4															
16	5	Grey @4.82m			SS-6	24										
18		End of borehole at 5.03m	5.03 / 451.71													
20	6															
22																
24	7															
26	8															
28																
30	9															
32																
34	10															

Groundwater Depth (m): on completion: 4.27m

DRAWN: T.L.

LOGGED: D.G.

CHECKED: C.W.



PROJECT NAME: GEOTECHNICAL INVESTIGATION

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: D-50 Track Solid Stem

DRILLING DATE: 9 July, 2024

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION		
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE											
							20 40 60 80				20 40 60 80						
							SHEAR STRENGTH (Kpa) ➤				MOISTURE CONTENT (%) ●						
							40	80	120	160		10	20	30	40		
0			456.89														
	TOPSOIL		0.15 / 456.74														
2	FILL: Brown to dark brown sandy silt, trace clay, topsoil, gravel, rootlets, moist				SS-1	17											
4					SS-2	5											
6	SILT: Brown, trace to some clay and sand, moist, firm to very stiff Pocket of sand and layers of clayey silt from 1.68m to 1.83m		1.68 / 455.21		SS-3	7											
8					SS-4	14											
10	Wet @2.90m				SS-5	21											
12																	
14	Grey @4.42m																
16	Pocket of clayey silt @4.88m to 4.98m				SS-6	15											
18	End of borehole at 5.03m		5.03 / 451.86														
20																	
22																	
24																	
26																	
28																	
30																	
32																	
34																	

Groundwater Depth (m): on completion: Dry, on 17 July, 2024: 1.35m

DRAWN: T.L.

LOGGED: D.G.

CHECKED: C.W.

2" blank PVC

1.35m

2" Slotted Pipe

Bentonite Pellets

Silica Sand

Concrete

4.57m



LOG OF BOREHOLE

No. BH103 SHEET. 1 of 1

PROJECT NO.: FE 24-14036

PROJECT NAME: GEOTECHNICAL INVESTIGATION

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: D-50 Track Solid Stem

DRILLING DATE: 9 July, 2024

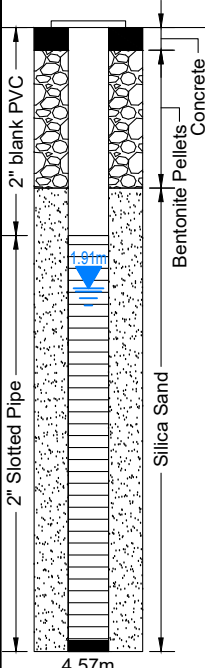
(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80				
							SHEAR STRENGTH (Kpa) ➤				MOISTURE CONTENT (%) ●				
							40 80 120 160	10 20 30 40							
0			455.34												
2	TOPSOIL		0.61 / 454.73		SS-1	9									
4	SILT: Brown, trace to some sand and clay, moist to wet, stiff to very stiff				SS-2	8									
6					SS-3	8									
8					SS-4	16									
10					SS-5	13									
12															
14															
16	Grey @3.26m				SS-6	18									
18	End of borehole at 5.03m		5.03 / 450.31												
20															
22															
24															
26															
28															
30															
32															
34															

PROJECT NAME: GEOTECHNICAL INVESTIGATION

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: D-50 Track Solid Stem

DRILLING DATE: 9 July, 2024

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80				
							SHEAR STRENGTH (Kpa) ➤				MOISTURE CONTENT (%) ●				
0	0														
	102mm TOPSOIL		456.91												
	FILL: Brown to dark brown sandy silt, trace to some clay, trace topsoil, gravel, rootlets, organics, dry to moist				SS-1	12									
					SS-2	10									
					SS-3	12									
			1.95 / 454.96												
	CLAYEY SILT: Brown, trace sand, moist, stiff to very stiff				SS-4	14									
					SS-5	26									
			3.81 / 453.10												
	SILT: Brown, trace sand, wet, stiff														
			5.03 / 451.88		SS-6	15									
	End of borehole at 5.03m														

Groundwater Depth (m): on completion: 3.96m; on 17 July, 2024: 1.91m

DRAWN: T.L.

LOGGED: D.G.






CHECKED: C.W.

PROJECT NAME: GEOTECHNICAL INVESTIGATION

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: D-50 Track Solid Stem

DRILLING DATE: 9 July, 2024

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION	
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80					
							SHEAR STRENGTH (Kpa) ➤				MOISTURE CONTENT (%) ●					
							40	80	120	160	10	20	30	40		
0			456.97													
	TOPSOIL		0.15 / 456.82													
2	FILL: Brown to dark brown sandy silt, some clay, trace gravel, topsoil, rootlets, moist				SS-1	9										
							SS-2	14								
4																
6			1.91 / 455.06			SS-3	9									
8	SANDY CLAYEY SILT: Brown, trace gravel, moist, stiff															
					SS-4	9										
10			3.00 / 453.97													
12	SANDY SILT: Brown, some clay, trace gravel, moist, very stiff					SS-5	17									
14			3.91 / 453.06													
16	FINE SAND: Reddish brown, some silt, wet, compact															
			4.72 / 452.25			SS-6	12									
18	SILT: Brown, wet, stiff		5.03 / 451.94													
20	End of borehole at 5.03m															
22																
24																
26																
28																
30																
32																
34																

Groundwater Depth (m): on completion: 1.22m

DRAWN: T.L.

LOGGED: D.G.

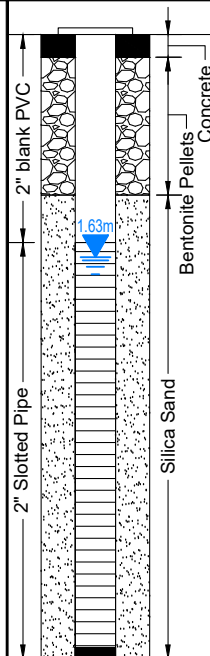
CHECKED: C.W.

PROJECT NAME: GEOTECHNICAL INVESTIGATION

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: D-50 Track Solid Stem

DRILLING DATE: 9 July, 2024

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80				
							SHEAR STRENGTH (Kpa) ■				MOISTURE CONTENT (%) ●				
0	0		456.80												
	TOPSOIL		0.15												
	FILL: Brown to dark brown sandy silt, trace to some clay, trace gravel, topsoil, rootlets, moist Pockets of clayey silt		456.65		SS-1	9									
2															
					SS-2	14									
4															
					SS-3	17									
6															
8	SANDY CLAYEY SILT: Brown, trace gravel, moist, stiff		2.35 454.45		SS-4	10									
10	SANDY SILT: Brown, some clay, trace gravel, moist, very stiff		2.99 453.81		SS-5	25									
12															
14	FINE SAND: Reddish brown, some silt, wet, loose to compact		3.96 452.84												
16	SILT: Brown, wet, stiff		4.75 452.05		SS-6	9									
	End of borehole at 5.03m		5.03 451.77												
18															
20															
22															
24															
26															
28															
30															
32															
34															

Groundwater Depth (m): on completion: 4.27m; on 17 July, 2024: 1.63m

DRAWN: T.L.

LOGGED: D.G.

CHECKED: C.W.



PROJECT NAME: GEOTECHNICAL INVESTIGATION

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: D-50 Track Solid Stem

DRILLING DATE: 9 July, 2024

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80				
							SHEAR STRENGTH (Kpa) ➤				MOISTURE CONTENT (%) ●				
0			456.83												
	TOPSOIL		0.15												
	FILL: Brown to dark brown sandy silt, trace clay, topsoil, gravel, rootlets, moist		456.68		SS-1	10									
2															
			1.19		SS-2	15									
4	SANDY SILT: Brown, trace gravel, some clay, moist, stiff		455.64												
6					SS-3	12									
			2.04												
8	CLAYEY SILT: Brown, trace sand and gravel, moist, very stiff		454.79												
					SS-4	16									
			2.90												
10	SILT: Brown, trace clay, trace/seams of sand, moist, very stiff		453.93		SS-5	21									
12															
14	Wet @4.11m														
16					SS-6	22									
			5.03												
	End of borehole at 5.03m		451.80												
18															
20															
22															
24															
26															
28															
30															
32															
34															

Groundwater Depth (m): on completion: 3.96m

DRAWN: T.L.

LOGGED: D.G.

CHECKED: C.W.



LOG OF BOREHOLE

No. BH108 SHEET. 1 of 1

PROJECT NO.: FE 24-14036

PROJECT NAME: GEOTECHNICAL INVESTIGATION

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: D-50 Track Solid Stem

DRILLING DATE: 9 July, 2024

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80				
							SHEAR STRENGTH (Kpa) ■				MOISTURE CONTENT (%) ●				
0	76mm TOPSOIL		456.94												
2	SANDY SILT: Brown, trace gravel, occasional cobbles, dry				SS-1	30									
4	SILT: Brown, trace sand, clay, moist to wet, soft to very stiff Wet @1.37m		1.19 / 455.75		SS-2	11									
6					SS-3	4									
8					SS-4	4									
10					SS-5	10									
12															
14															
16	Pockets of clayey silt @4.42m Grey @4.45m				SS-6	17									
18	End of borehole at 5.03m		5.03 / 451.91												
20															
22															
24															
26															
28															
30															
32															
34															

Groundwater Depth (m): on completion: 4.27m

DRAWN: T.L.

LOGGED: D.G.

CHECKED: C.W.



## LOG OF BOREHOLE

NO. BH1 SHEET. 1 of 1

PROJECT NO.: FE-P# 22-12632/12641

PROJECT NAME: GEOTECHNICAL INVESTIGATION &  
SOIL SAMPLING

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: Track, Solid Stem

DRILLING DATE: 22 November, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80				
							SHEAR STRENGTH (Kpa) ➕				MOISTURE CONTENT (%) ●				
0			452.44												
	~6" TOPSOIL		0.15 / 452.29												
2	FILL: Dark brown silty sand, trace clay, gravel, roots & topsoil, moist		0.69 / 451.75		SS-1	6									
4	SILT: Reddish brown, trace clay & sand, very moist, firm to stiff				SS-2	5									
6															
2	End of borehole at 1.98m		1.98 / 450.46		SS-3	12									
8															
10															
12															
14															
16															
18															
20															
22															
24															
26															
28															
30															
32															
34															

Groundwater Depth (m): on completion: Dry

DRAWN: D.C.

LOGGED: J.Y.

CHECKED: C.W.



PROJECT NAME: GEOTECHNICAL INVESTIGATION &amp; SOIL SAMPLING

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: Track, Solid Stem

DRILLING DATE: 23 November, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80				
							SHEAR STRENGTH (Kpa) ➕				MOISTURE CONTENT (%) ●				
0			451.03												
	~6" TOPSOIL														
	FILL: Dark brown sandy silt/silty sand, trace clay, gravel & topsoil, moist		0.38 / 450.65		SS-1	7									
2	SILT: Brown to greyish brown, trace clay & sand, moist to wet, firm to very stiff				SS-2	7									
4															
6					SS-3	9									
8					SS-4	15									
10					SS-5	17									
12															
14	SILTY SAND TILL: Greyish brown/reddish brown, trace clay & gravel, moist, compact to very dense		3.96 / 447.07		SS-6	25									
16															
18															
20					SS-7	37									
22															
24															
26				SS-8	81										
28	End of borehole at 8.08m		8.08 / 442.95												
30															
32															
34															

Groundwater Depth (m): on completion: 1.83m

DRAWN: D.C.

LOGGED: J.Y.

CHECKED: C.W.

PROJECT NAME: GEOTECHNICAL INVESTIGATION &  
SOIL SAMPLING

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: Track, Solid Stem

DRILLING DATE: 21 November, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80				
							SHEAR STRENGTH (Kpa) ➤				MOISTURE CONTENT (%) ●				
0			450.84												
	~6" TOPSOIL		0.15 / 450.69												
2	FILL: Dark brown sand, some to trace silt, trace topsoil, moist		0.69 / 450.15		SS-1	7									
4	CLAYEY SILT/CLAY & SILT: Reddish brown, trace sand, wet, firm to stiff				SS-2	5									
6					SS-3	13									
8					SS-4	13									
10															
12	SILT: Greyish brown, trace clay & sand, moist, stiff to very stiff		2.90 / 447.94		SS-5	14									
14															
16					SS-6	26									
18															
20	SANDY SILT TILL: Brownish grey to grey, trace clay & gravel, moist, compact to very dense		5.64 / 445.20		SS-7	29									
22															
24															
26					SS-8	95									
28	End of borehole at 8.08m		8.08 / 442.76												
30															
32															
34															

Groundwater Depth (m): on completion: 2.13m

DRAWN: D.C.

LOGGED: J.Y.

CHECKED: C.W.



## LOG OF BOREHOLE

NO. BH5 SHEET. 1 of 1

PROJECT NO.: FE-P# 22-12632/12641

PROJECT NAME: GEOTECHNICAL INVESTIGATION &  
SOIL SAMPLING

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: Track, Solid Stem

DRILLING DATE: 22 November, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80				
							SHEAR STRENGTH (Kpa) ➕				MOISTURE CONTENT (%) ●				
0			450.04												
	~6" TOPSOIL		0.15 / 449.89	22-9492-1											
	FILL: Dark brown sand, trace clay, silt, gravel, roots & topsoil, moist		0.69 / 449.35	22-9492-2 (DUP)	SS-1	6									
	SILT: Reddish brown, trace clay & sand, moist to wet, firm to stiff				SS-2	5									
					SS-3	10									
	End of borehole at 1.98m		1.98 / 448.06												

Groundwater Depth (m): on completion: Dry

DRAWN: D.C.

LOGGED: J.Y.

CHECKED: C.W.

PROJECT NAME: GEOTECHNICAL INVESTIGATION &amp; SOIL SAMPLING

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: Track, Solid Stem

DRILLING DATE: 22 November, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80				
							SHEAR STRENGTH (Kpa) ➕				MOISTURE CONTENT (%) ●				
0			450.86												
	~6" TOPSOIL		0.15 / 450.71												
2	FILL: Dark brown silty sand, trace clay & roots, moist		0.53 / 450.33		SS-1	9									
	SILT: Reddish brown, trace clay & sand, moist to wet, stiff				SS-2	9									
4					SS-3	10									
6					SS-4	11									
8															
10	SILT: Grey, trace clay & sand, wet, firm to very stiff		2.90 / 447.96		SS-5	8									
12															
14															
16					SS-6	17									
18	SILTY SAND TILL: Reddish brown, trace clay & gravel, moist, compact to dense		5.49 / 445.37												
20					SS-7	16									
22															
24					SS-8	35									
26	End of borehole at 8.08m		8.08 / 442.78												
28															
30															
32															
34															

Groundwater Depth (m): on completion: 3.35m

DRAWN: D.C.

LOGGED: J.Y.

CHECKED: C.W.





## LOG OF BOREHOLE

NO. BH7 SHEET. 1 of 1

PROJECT NO.: FE-P# 22-12632/12641

PROJECT NAME: GEOTECHNICAL INVESTIGATION &  
SOIL SAMPLING

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: Track, Solid Stem

DRILLING DATE: 22 November, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20	40	60	80	20	40	60	80	
							SHEAR STRENGTH (Kpa) ➕				MOISTURE CONTENT (%) ●				
							40	80	120	160		10	20	30	40
0	0		450.48												
	~5" TOPSOIL		0.13 / 450.35												
	FILL: Dark brown sand, trace silt, some gravel & crushed stones, moist		0.69 / 449.79		SS-1	34									
2															
	SAND: Reddish brown, trace to some silt, moist, compact		1.14 / 449.34		SS-2	10									
4															
	SILT: Reddish brown, trace clay, some to trace sand, moist to wet, firm		1.98 / 448.50		SS-3	6									
6															
2	End of borehole at 1.98m														
8															
10															
12															
14															
16															
18															
20															
22															
24															
26															
28															
30															
32															
34															

Groundwater Depth (m): on completion: Dry

DRAWN: D.C.

LOGGED: J.Y.

CHECKED: C.W.

PROJECT NAME: GEOTECHNICAL INVESTIGATION &amp; SOIL SAMPLING

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: Track, Solid Stem

DRILLING DATE: 22 November, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80				
							SHEAR STRENGTH (Kpa) ➕				MOISTURE CONTENT (%) ●				
0			450.20												
	~6" TOPSOIL		0.15 / 450.05												
2	FILL: Dark brown silty sand, trace clay, gravel, roots, topsoil & topsoil mixed soils, moist		0.53 / 449.67		SS-1	20							13.2%		
1	SANDY SILT/SILT & SAND: Reddish brown, some clay, moist, compact				SS-2	10							21.4%		
4			1.37 / 448.83												
6	SILT: Reddish brown, trace clay & sand, stiff		1.98 / 448.22		SS-3	14									
2	End of borehole at 1.98m														
8															
10															
12															
14															
16															
18															
20															
22															
24															
26															
28															
30															
32															
34															

Groundwater Depth (m): on completion: Dry

DRAWN: D.C.

LOGGED: J.Y.

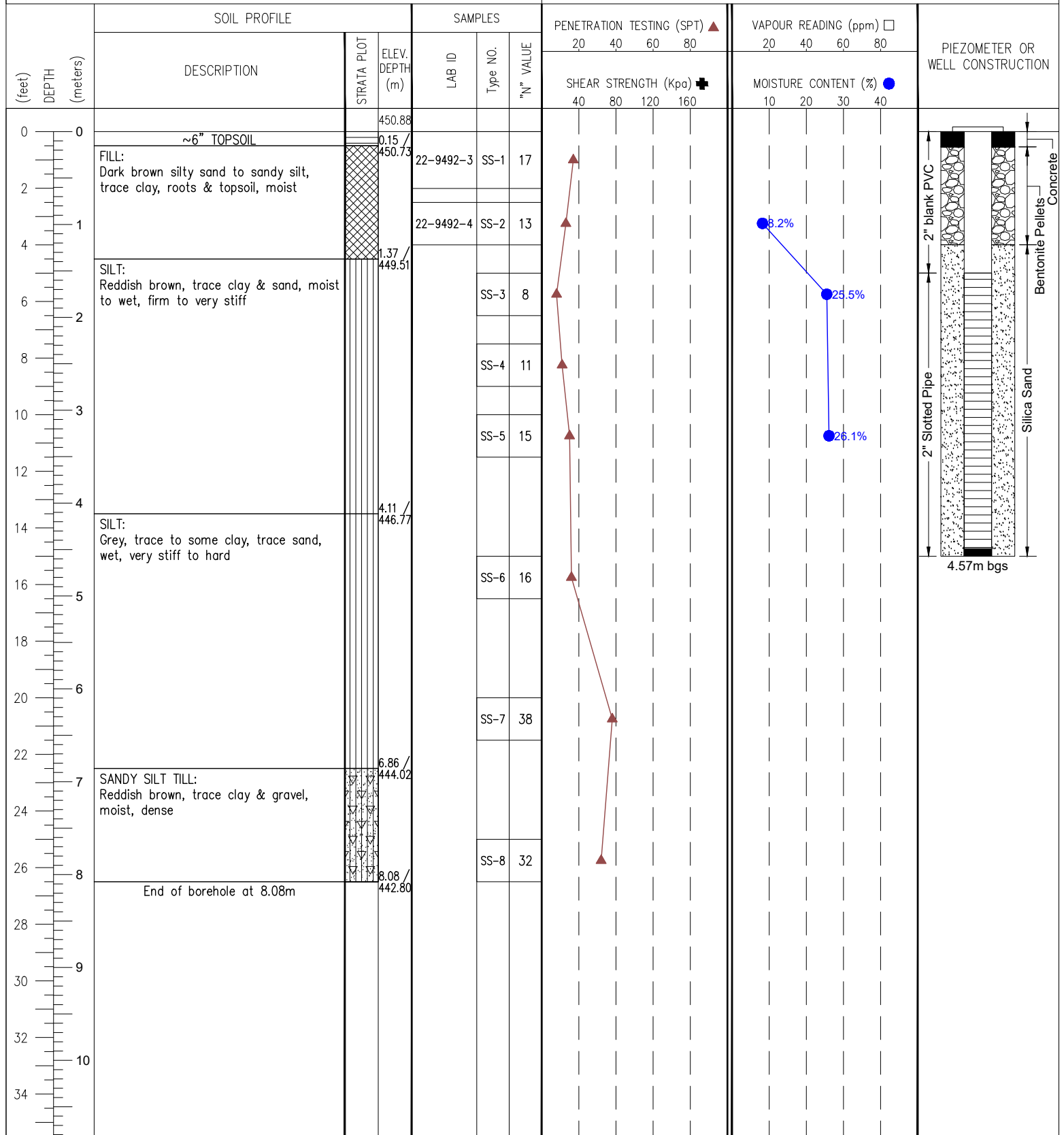
CHECKED: C.W.

PROJECT NAME: GEOTECHNICAL INVESTIGATION &amp; SOIL SAMPLING

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: Track, Solid Stem

DRILLING DATE: 22 November, 2022



Groundwater Depth (m): on completion: 2.74m; 2 December 2022: Dry

DRAWN: D.C.

LOGGED: J.Y.

CHECKED: C.W.



## LOG OF BOREHOLE

NO. BH10 SHEET. 1 of 1

PROJECT NO.: FE-P# 22-12632/12641

PROJECT NAME: GEOTECHNICAL INVESTIGATION &  
SOIL SAMPLING

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: Track, Solid Stem

DRILLING DATE: 22 November, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20	40	60	80	20	40	60	80	
							SHEAR STRENGTH (Kpa) ➕				MOISTURE CONTENT (%) ●				
							40	80	120	160		10	20	30	40
0			451.34												
2	FILL: Dark brown sandy silt to silty sand, some clay, trace gravel, topsoil & topsoil mixed soils, moist				SS-1	21									
4			1.14 / 450.20		SS-2	6									
6	SILT: Reddish brown, some to trace clay, trace sand, moist to wet, very stiff														
8			1.98 / 449.36		SS-3	15									
10	End of borehole at 1.98m														
12															
14															
16															
18															
20															
22															
24															
26															
28															
30															
32															
34															

Groundwater Depth (m): on completion: Dry

DRAWN: D.C.

LOGGED: J.Y.

CHECKED: C.W.



PROJECT NAME: GEOTECHNICAL INVESTIGATION &  
SOIL SAMPLING

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: Track, Solid Stem

DRILLING DATE: 21 November, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80				
							SHEAR STRENGTH (Kpa) ➕				MOISTURE CONTENT (%) ●				
0			452.80												
	~6" TOPSOIL		0.15 / 452.65												
2	FILL: Dark brown silty sand to sandy silt, trace clay, gravel, roots, topsoil & topsoil mixed soils, moist				SS-1	6									
4	SILTY SAND TO SANDY SILT: Reddish brown, trace clay, moist, compact		1.07 / 451.73		SS-2	9									
6			1.98 / 450.82		SS-3	10									
8	SILT: Reddish brown to greyish brown, trace clay & sand, moist, very stiff				SS-4	19									
10					SS-5	17									
12															
14															
16					SS-6	16									
18															
20															
22			6.86 / 445.94												
24	SANDY SILT TILL: Grey, trace clay, sand & gravel, moist, compact														
26			8.08 / 444.72		SS-8	24									
28	End of borehole at 8.08m														
30															
32															
34															

Groundwater Depth (m): on completion: 4.57m

DRAWN: D.C.

LOGGED: J.Y.

CHECKED: C.W.

PROJECT NAME: GEOTECHNICAL INVESTIGATION &amp; SOIL SAMPLING

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: Track, Solid Stem

DRILLING DATE: 22 November, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80				
							SHEAR STRENGTH (Kpa) ➕				MOISTURE CONTENT (%) ●				
0			452.97												
	~6" TOPSOIL		0.15 / 452.82	22-9492-5	SS-1	9	▲								
2	FILL: Dark brown sandy silt/silty sand, trace clay, gravel, roots & topsoil, moist		0.69 / 452.28												
1	SILTY SAND: Reddish brown, trace clay, moist, loose		1.07 / 451.90		SS-2	7		▲							
4	SILT: Reddish brown, trace clay & sand, moist to wet, firm														
6			1.98 / 450.99	SS-3	8	▲									
	End of borehole at 1.98m														
8															
10															
12															
14															
16															
18															
20															
22															
24															
26															
28															
30															
32															
34															

Groundwater Depth (m): on completion: Dry

DRAWN: D.C.

LOGGED: J.Y.

CHECKED: C.W.



## LOG OF BOREHOLE

NO. BH14 SHEET. 1 of 1

PROJECT NO.: FE-P# 22-12632/12641

PROJECT NAME: GEOTECHNICAL INVESTIGATION &  
SOIL SAMPLING

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: Track, Solid Stem

DRILLING DATE: 22 November, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20	40	60	80	20	40	60	80	
							SHEAR STRENGTH (Kpa) ➕				MOISTURE CONTENT (%) ●				
			453.78												
0	~6" TOPSOIL		0.15 / 453.63												
2	FILL: Dark brown sandy silt, trace clay, gravel, roots & topsoil, moist		0.69 / 453.09		SS-1	10									
1	SILT: Reddish brown, trace clay, some to trace sand, moist to wet, firm to stiff				SS-2	8									
4															
6					SS-3	14									
2	End of borehole at 1.98m		1.98 / 451.80												
8															
10															
12															
14															
16															
18															
20															
22															
24															
26															
28															
30															
32															
34															

Groundwater Depth (m): on completion: Dry

DRAWN: D.C.

LOGGED: J.Y.

CHECKED: C.W.





## LOG OF BOREHOLE

NO. BH15 SHEET. 1 of 1



PROJECT NO.: FE-P# 22-12632/12641

PROJECT NAME: GEOTECHNICAL INVESTIGATION &  
SOIL SAMPLING

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: Track, Solid Stem

DRILLING DATE: 22 November, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION	
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80					
							SHEAR STRENGTH (Kpa) ➕				MOISTURE CONTENT (%) ●					
0			454.61													
	~6" TOPSOIL		0.15 / 454.46													
2	FILL: Dark brown sandy silt/silty sand, trace clay, gravel, asphalt, topsoil & topsoil mixed soils, moist				SS-1	10										
4							SS-2	8								
6	SANDY SILT: Reddish brown, some clay, moist, loose		1.37 / 453.24													
2	End of borehole at 1.98m		1.98 / 452.63													
8																
10																
12																
14																
16																
18																
20																
22																
24																
26																
28																
30																
32																
34																

Groundwater Depth (m): on completion: Dry

DRAWN: D.C.

LOGGED: J.Y.

CHECKED: C.W.



## LOG OF BOREHOLE

NO. BH16 SHEET. 1 of 1


PROJECT NO.: FE-P# 22-12632/12641

PROJECT NAME: GEOTECHNICAL INVESTIGATION &  
SOIL SAMPLING

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: Track, Solid Stem

DRILLING DATE: 22 November, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80				
							SHEAR STRENGTH (Kpa) ➕				MOISTURE CONTENT (%) ●				
0			455.89												
	~6" TOPSOIL		0.15 / 455.74												
2	FILL: Dark brown sandy silt/silty sand, trace clay, gravel, roots & topsoil, moist				SS-1	17									
4					SS-2	22									
6															
2	End of borehole at 1.98m		1.98 / 453.91												
8															
10															
12															
14															
16															
18															
20															
22															
24															
26															
28															
30															
32															
34															

Groundwater Depth (m): on completion: Dry

DRAWN: D.C.

LOGGED: J.Y.

CHECKED: C.W.





## LOG OF BOREHOLE

NO. BH18 SHEET. 1 of 1

PROJECT NO.: FE-P# 22-12632/12641

PROJECT NAME: GEOTECHNICAL INVESTIGATION &  
SOIL SAMPLING

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: Track, Solid Stem

DRILLING DATE: 21 November, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80				
							SHEAR STRENGTH (Kpa) ➕				MOISTURE CONTENT (%) ●				
							40 80 120 160					10 20 30 40			
0	TOPSOIL		456.35												
2	FILL: Dark brown sandy silt/silty sand, trace clay, roots, topsoil & topsoil mixed soils		0.61 / 455.74		SS-1	6									
4					SS-2	7									
6				1.75 / 454.60		SS-3	9								
8	SILT: Brown, trace clay & sand, moist, stiff		1.98 / 454.37												
	End of borehole at 1.98m														
10															
12															
14															
16															
18															
20															
22															
24															
26															
28															
30															
32															
34															

Groundwater Depth (m): on completion: Dry

DRAWN: D.C.

LOGGED: P.S.



CHECKED: C.W.

PROJECT NAME: GEOTECHNICAL INVESTIGATION &amp; SOIL SAMPLING

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: Track, Solid Stem

DRILLING DATE: 21 November, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80				
							SHEAR STRENGTH (Kpa) ➕				MOISTURE CONTENT (%) ●				
0			455.10												
	~4" TOPSOIL		0.10 / 455.00	22-9492-7	SS-1	10	▲								
2	FILL: Dark brown sandy silt, trace clay, gravel, roots, topsoil & topsoil mixed soils, moist				SS-2	8	▲								
4															
6															
	SILT: Brown, trace clay & sand, moist, stiff		1.68 / 453.42		SS-3	11	▲								
2	End of borehole at 1.98m		1.98 / 453.12												
8															
10															
12															
14															
16															
18															
20															
22															
24															
26															
28															
30															
32															
34															

Groundwater Depth (m): on completion: Dry

DRAWN: D.C.

LOGGED: P.S.

CHECKED: C.W.



## LOG OF BOREHOLE

NO. BH20 SHEET. 1 of 1


PROJECT NO.: FE-P# 22-12632/12641

PROJECT NAME: GEOTECHNICAL INVESTIGATION &  
SOIL SAMPLING

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: Track, Solid Stem

DRILLING DATE: 21 November, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80				
							SHEAR STRENGTH (Kpa) ➕				MOISTURE CONTENT (%) ●				
0			455.50												
	~4" TOPSOIL		0.10 / 455.40												
2	FILL: Dark brown sandy silt/silty sand, trace clay, gravel, topsoil & topsoil mixed soils, moist				SS-1	15									
1					SS-2	13									
4															
6			1.98 / 453.52		SS-3	12									
2	End of borehole at 1.98m														
8															
10															
12															
14															
16															
18															
20															
22															
24															
26															
28															
30															
32															
34															

Groundwater Depth (m): on completion: Dry

DRAWN: D.C.

LOGGED: P.S.

CHECKED: C.W.

PROJECT NAME: GEOTECHNICAL INVESTIGATION &  
SOIL SAMPLING

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: Track, Solid Stem

DRILLING DATE: 21 November, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80				
							SHEAR STRENGTH (Kpa) ➕				MOISTURE CONTENT (%) ●				
0			453.79												
	~6" TOPSOIL		0.15 / 453.64	22-9492-8	SS-1	9									
2	FILL: Dark brown to brown silty sand, trace clay, gravel, roots, topsoil, topsoil mixed soils, moist			22-9492-9	SS-2	11									
				22-9492-10 (DUP)											
4															
6	SILT: Reddish brown, trace clay & sand, moist to wet, stiff to very stiff		1.68 / 452.11		SS-3	12									
8															
10															
12															
14	SILT: Grey, trace clay & sand, wet, stiff		3.81 / 449.98												
16															
18															
20	SANDY SILT TILL: Grey, trace clay & gravel, moist, compact to very dense		5.64 / 448.15												
22															
24															
26				SS-8	80										
28	End of borehole at 8.08m		8.08 / 445.71												
30															
32															
34															

Groundwater Depth (m): on completion: 3.96m

DRAWN: D.C.

LOGGED: J.Y.

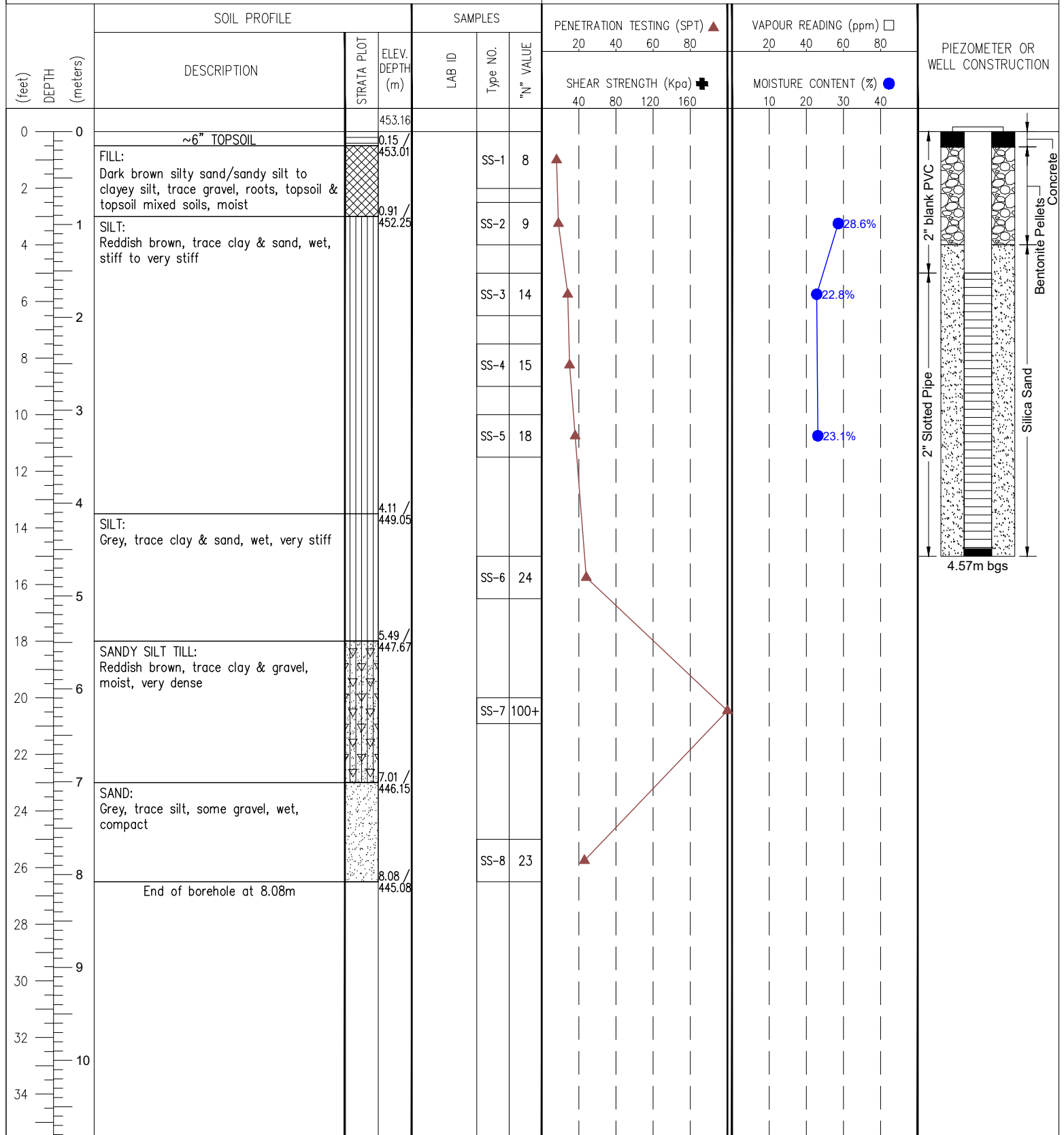
CHECKED: C.W.

PROJECT NAME: GEOTECHNICAL INVESTIGATION & SOIL SAMPLING

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: Track, Solid Stem

DRILLING DATE: 21 November, 2022



Groundwater Depth (m): on completion: 3.66m; 2 December 2022: Dry

DRAWN: D.C.

LOGGED: J.Y.

CHECKED: C.W.



PROJECT NAME: GEOTECHNICAL INVESTIGATION &  
SOIL SAMPLING

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: Track, Solid Stem

DRILLING DATE: 21 November, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80				
							SHEAR STRENGTH (Kpa) ➤				MOISTURE CONTENT (%) ●				
0			452.86												
	~6" TOPSOIL		0.15 / 452.71	22-9492-11	SS-1	10									
2	FILL: Dark brown silty sand to brown silt, trace clay, gravel, roots, topsoil & topsoil mixed soils, moist		0.91 / 451.95		SS-2	11									
1	SILT: Reddish brown, trace clay & sand, moist, stiff to very stiff														
4					SS-3	14									
6															
8					SS-4	15									
10															
12					SS-5	16									
14															
4	SILT: Grey, trace clay & sand, wet, stiff		3.96 / 448.90												
16					SS-6	14									
18															
6	SAND TILL: Reddish brown to brown, trace clay & silt, some gravel, occasional cobble, moist to wet, very dense		5.49 / 447.37												
20					SS-7	100+									
22															
7															
24															
26					SS-8	100+									
8	End of borehole at 7.90m		7.90 / 444.96												
28															
9															
30															
32															
10															
34															

Groundwater Depth (m): on completion: 3.66m

DRAWN: D.C.

LOGGED: J.Y.

CHECKED: C.W.

PROJECT NAME: GEOTECHNICAL INVESTIGATION &amp; SOIL SAMPLING

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: Track, Solid Stem

DRILLING DATE: 21 November, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80				
							SHEAR STRENGTH (Kpa) ➤				MOISTURE CONTENT (%) ●				
0			452.37												
	~6" TOPSOIL		0.15 / 452.22												
2	FILL: Dark brown silty sand/sandy silt to clayey silt, trace gravel, roots, topsoil & topsoil mixed soils, moist		0.69 / 451.68		SS-1	9									
4	SILT: Reddish brown, trace clay, some sand, wet, stiff to very stiff				SS-2	11									
6					SS-3	16									
8					SS-4	11									
10					SS-5	17									
12															
14	SILT: Grey, trace clay & sand, wet, very stiff		4.11 / 448.26												
16					SS-6	21									
18			5.49 / 446.88												
20	SANDY SILT TILL: Reddish brown, trace clay & gravel, moist, compact to dense				SS-7	29									
22															
24															
26			8.08 / 444.29		SS-8	43									
28	End of borehole at 8.08m														
30															
32															
34															

Groundwater Depth (m): on completion: 4.27m

DRAWN: D.C.

LOGGED: J.Y.

CHECKED: C.W.

PROJECT NAME: GEOTECHNICAL INVESTIGATION &  
SOIL SAMPLING

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: Track, Solid Stem

DRILLING DATE: 21 November, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80				
							SHEAR STRENGTH (Kpa) ➤				MOISTURE CONTENT (%) ●				
0			451.72												
	~6" TOPSOIL		0.15 / 451.57	22-9492-12	SS-1	10									
2	FILL: Dark brown silty sand, trace clay, gravel, roots, topsoil & topsoil mixed soils, moist		0.69 / 451.03												
4	SILT: Reddish brown, trace clay & sand, wet, stiff to very stiff			22-9492-13	SS-2	12									
6					SS-3	9									
8					SS-4	16									
10					SS-5	17									
12															
14	SILT: Grey, trace clay & sand, wet, very stiff		3.96 / 447.76												
16					SS-6	25									
18															
20	SANDY SILT TILL: Reddish brown, trace clay & gravel, moist, compact to dense		5.49 / 446.23												
22					SS-7	28									
24															
26					SS-8	32									
28	End of borehole at 8.08m		8.08 / 443.64												
30															
32															
34															

Groundwater Depth (m): on completion: 3.96m

DRAWN: D.C.

LOGGED: J.Y.

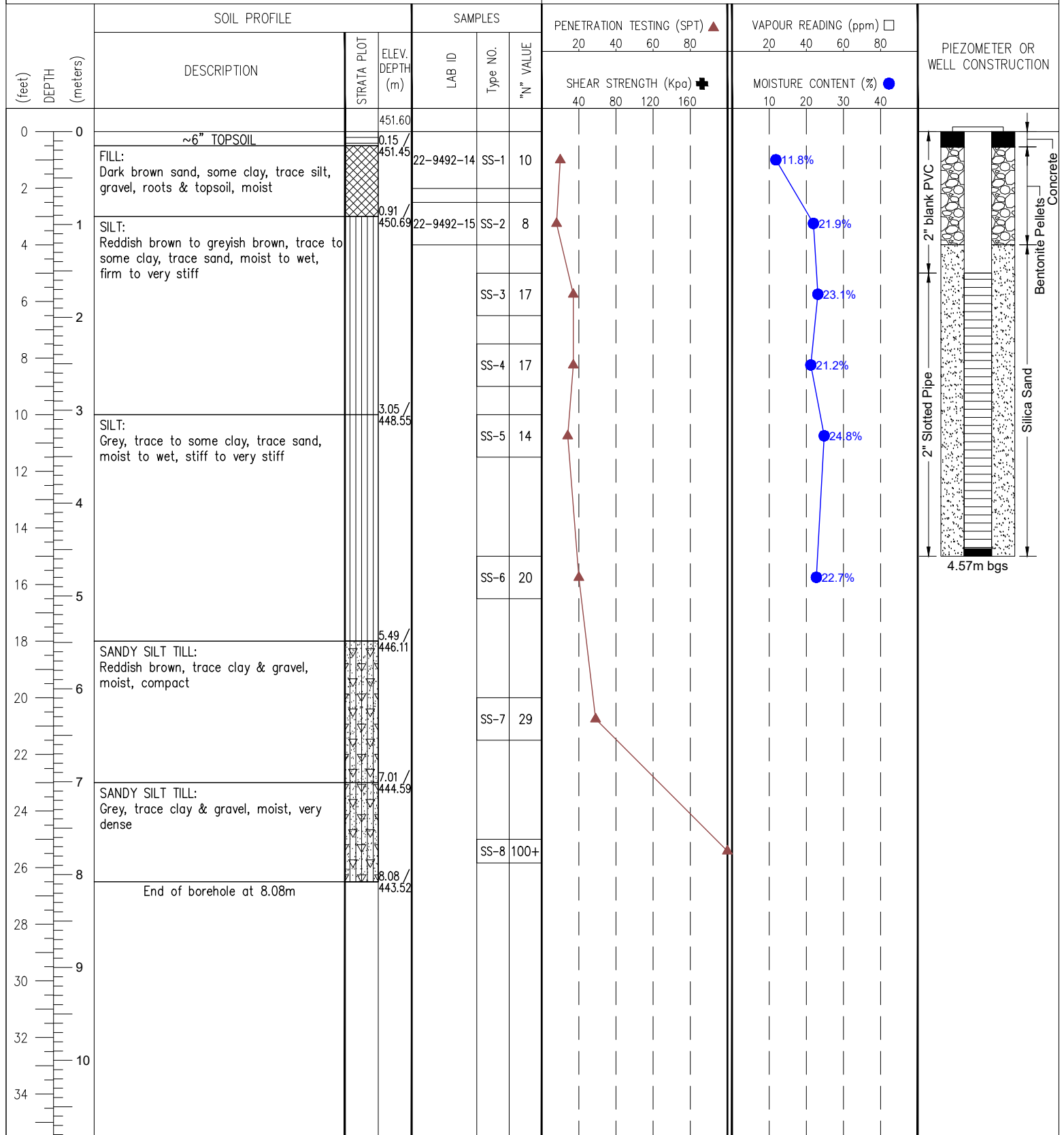
CHECKED: C.W.

PROJECT NAME: GEOTECHNICAL INVESTIGATION &amp; SOIL SAMPLING

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: Track, Solid Stem

DRILLING DATE: 22 November, 2022



Groundwater Depth (m): on completion: 2.44m; 2 December 2022: Dry

DRAWN: D.C.

LOGGED: J.Y.

CHECKED: C.W.

PROJECT NAME: GEOTECHNICAL INVESTIGATION &amp; SOIL SAMPLING

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: Track, Solid Stem

DRILLING DATE: 21 November, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80				
							SHEAR STRENGTH (Kpa) ➤				MOISTURE CONTENT (%) ●				
							40	80	120	160		10	20	30	40
0			452.36												
	~6" TOPSOIL		0.15 / 452.21												
2	SAND (POSSIBLY FILL): Reddish brown, some silt, moist, compact		0.69 / 451.67		SS-1	14									
4	SILT: Reddish brown, some to trace clay, trace sand, moist, stiff to very stiff				SS-2	10									
6					SS-3	19									
8					SS-4	12									
10			3.20 / 449.16		SS-5	17									
12	SILT: Brownish grey, trace clay & sand, moist, very stiff														
14															
16					SS-6	18									
18			5.49 / 446.87												
20	SANDY SILT TILL: Brown, trace clay & gravel, moist, dense				SS-7	34									
22															
24	SILTY SAND TILL: Grey, some clay, trace gravel, moist, very dense		7.01 / 445.35												
26	End of borehole at 7.87m		7.87 / 444.49		SS-8	100+									
28															
30															
32															
34															

Groundwater Depth (m): on completion: 2.44m

DRAWN: D.C.

LOGGED: J.Y.

CHECKED: C.W.



## LOG OF BOREHOLE

NO. BH28 SHEET. 1 of 1

PROJECT NO.: FE-P# 22-12632/12641

PROJECT NAME: GEOTECHNICAL INVESTIGATION &  
SOIL SAMPLING

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: Track, Solid Stem

DRILLING DATE: 22 November, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80				
							SHEAR STRENGTH (Kpa) ➕				MOISTURE CONTENT (%) ●				
0			452.51												
	~6" TOPSOIL		0.15 / 452.36												
2	FILL: Dark brown sand, trace clay, silt, roots & topsoil, moist		0.69 / 451.82		SS-1	8									
1	SAND: Reddish brown, some silt, moist, loose		1.07 / 451.44		SS-2	8									
4	SILT: Brown, trace clay & sand, moist to wet, firm to very stiff		1.98 / 450.53		SS-3	15									
6	End of borehole at 1.98m														
8															
10															
12															
14															
16															
18															
20															
22															
24															
26															
28															
30															
32															
34															

Groundwater Depth (m): on completion: Dry

DRAWN: D.C.

LOGGED: J.Y.

CHECKED: C.W.

PROJECT NAME: GEOTECHNICAL INVESTIGATION &amp; SOIL SAMPLING

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: Track, Solid Stem

DRILLING DATE: 22 November, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80				
							SHEAR STRENGTH (Kpa) ➕				MOISTURE CONTENT (%) ●				
0			453.36												
	~6" TOPSOIL		0.15 / 453.21		SS-1	6									
2	FILL: Dark brown sand to silty sand, trace clay, roots, topsoil & topsoil mixed soils, moist		0.69 / 452.67												
1	SAND TO SILTY SAND: Reddish brown, moist, compact		1.14 / 452.22		SS-2	11									
4	SILT: Brown, trace clay & sand, moist to wet, stiff to very stiff		1.98 / 451.38		SS-3	18									
6	End of borehole at 1.98m														
8															
10															
12															
14															
16															
18															
20															
22															
24															
26															
28															
30															
32															
34															

Groundwater Depth (m): on completion: Dry

DRAWN: D.C.

LOGGED: J.Y.

CHECKED: C.W.



## LOG OF BOREHOLE

NO. BH30 SHEET. 1 of 1

PROJECT NO.: FE-P# 22-12632/12641

PROJECT NAME: GEOTECHNICAL INVESTIGATION &  
SOIL SAMPLING

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: Track, Solid Stem

DRILLING DATE: 22 November, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80				
							SHEAR STRENGTH (Kpa) ➕				MOISTURE CONTENT (%) ●				
0			454.02												
	~6" TOPSOIL		0.15 / 453.87												
2	FILL: Dark brown silty sand to sandy silt, trace clay, gravel, roots, topsoil & topsoil mixed soils, moist				SS-1	13									
4	SILTY SAND TO SILT: Brown, trace clay, moist, loose		0.99 / 453.03		SS-2	9									
6															
	End of borehole at 1.98m		1.98 / 452.04		SS-3	8									
8															
10															
12															
14															
16															
18															
20															
22															
24															
26															
28															
30															
32															
34															

Groundwater Depth (m): on completion: Dry

DRAWN: D.C.

LOGGED: J.Y.

CHECKED: C.W.





## LOG OF BOREHOLE

NO. BH31 SHEET. 1 of 1

PROJECT NO.: FE-P# 22-12632/12641

PROJECT NAME: GEOTECHNICAL INVESTIGATION &  
SOIL SAMPLING

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: Track, Solid Stem

DRILLING DATE: 22 November, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80				
							SHEAR STRENGTH (Kpa) ➤				MOISTURE CONTENT (%) ●				
0			453.61												
	~5" TOPSOIL		0.13 / 453.48												
2	FILL: Dark brown sand, some silt, trace clay, roots & topsoil, moist		0.69 / 452.92		SS-1	5								9.8%	
4	SILT: Brown, trace clay & sand, moist to wet, firm to stiff				SS-2	7								24.9%	
6															
2	End of borehole at 1.98m		1.98 / 451.63		SS-3	11									
8															
10															
12															
14															
16															
18															
20															
22															
24															
26															
28															
30															
32															
34															

Groundwater Depth (m): on completion: Dry

DRAWN: D.C.

LOGGED: J.Y.

CHECKED: C.W.

PROJECT NAME: GEOTECHNICAL INVESTIGATION &  
SOIL SAMPLING

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: Track, Solid Stem

DRILLING DATE: 23 November, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80				
							SHEAR STRENGTH (Kpa) ➤				MOISTURE CONTENT (%) ●				
							40	80	120	160					
0			452.81												
	~6" TOPSOIL														
	FILL: Dark brown sandy silt, trace clay, roots & topsoil ,very moist		0.30 / 452.51	22-9492-16	SS-1	11									
2															
	SANDY SILT/SILT & SAND: Brown, trace clay, occasional trace gravel, moist, compact				SS-2	11									
4															
	SILT: Reddish brown, trace clay & sand, moist to wet, stiff to very stiff		1.37 / 451.44		SS-3	14									
6															
					SS-4	14									
8															
					SS-5	16									
10															
12															
14	SILT: Brownish grey, trace clay & sand, moist to wet, very stiff		4.11 / 448.70		SS-6	22									
16															
18															
	SANDY SILT TILL: Reddish brown, trace clay & gravel, moist, very dense		5.64 / 447.17		SS-7	57									
20															
22															
	SILTY SAND TILL: Grey, trace clay & gravel, moist, very dense		7.01 / 445.80												
24															
	End of borehole at 7.72m		7.72 / 445.09		SS-8	100±									
26															
28															
30															
32															
34															

Groundwater Depth (m): on completion: 2.13m

DRAWN: D.C.

LOGGED: J.Y.

CHECKED: C.W.

PROJECT NAME: GEOTECHNICAL INVESTIGATION &  
SOIL SAMPLING

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: Track, Solid Stem

DRILLING DATE: 23 November, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80				
							SHEAR STRENGTH (Kpa) ➕				MOISTURE CONTENT (%) ●				
0			452.55												
	~6" TOPSOIL		0.15 / 452.40	22-9492-17	SS-1	10									
2	FILL: Dark brown sand, trace clay, some silt, trace roots & topsoil, moist		0.84 / 451.71	22-9492-18	SS-2	11									
	SILT: Brown, some to trace clay, trace sand, moist to wet, stiff to very stiff														
6					SS-3	13									
8															
					SS-4	14									
10															
				SS-5	16										
12															
	SILT: Grey, trace clay & sand, wet, very stiff		3.96 / 448.59												
16															
				SS-6	18										
18															
	SANDY SILT TILL: Reddish brown, trace clay & gravel, moist, dense		5.49 / 447.06												
20															
				SS-7	34										
22															
	SILTY SAND TILL: Grey, trace clay & gravel, moist, very dense		7.01 / 445.54												
24															
				SS-8	100+										
26	End of borehole at 7.75m		7.75 / 444.80												
28															
30															
32															
34															

Groundwater Depth (m): on completion: 2.44m

DRAWN: D.C.

LOGGED: J.Y.

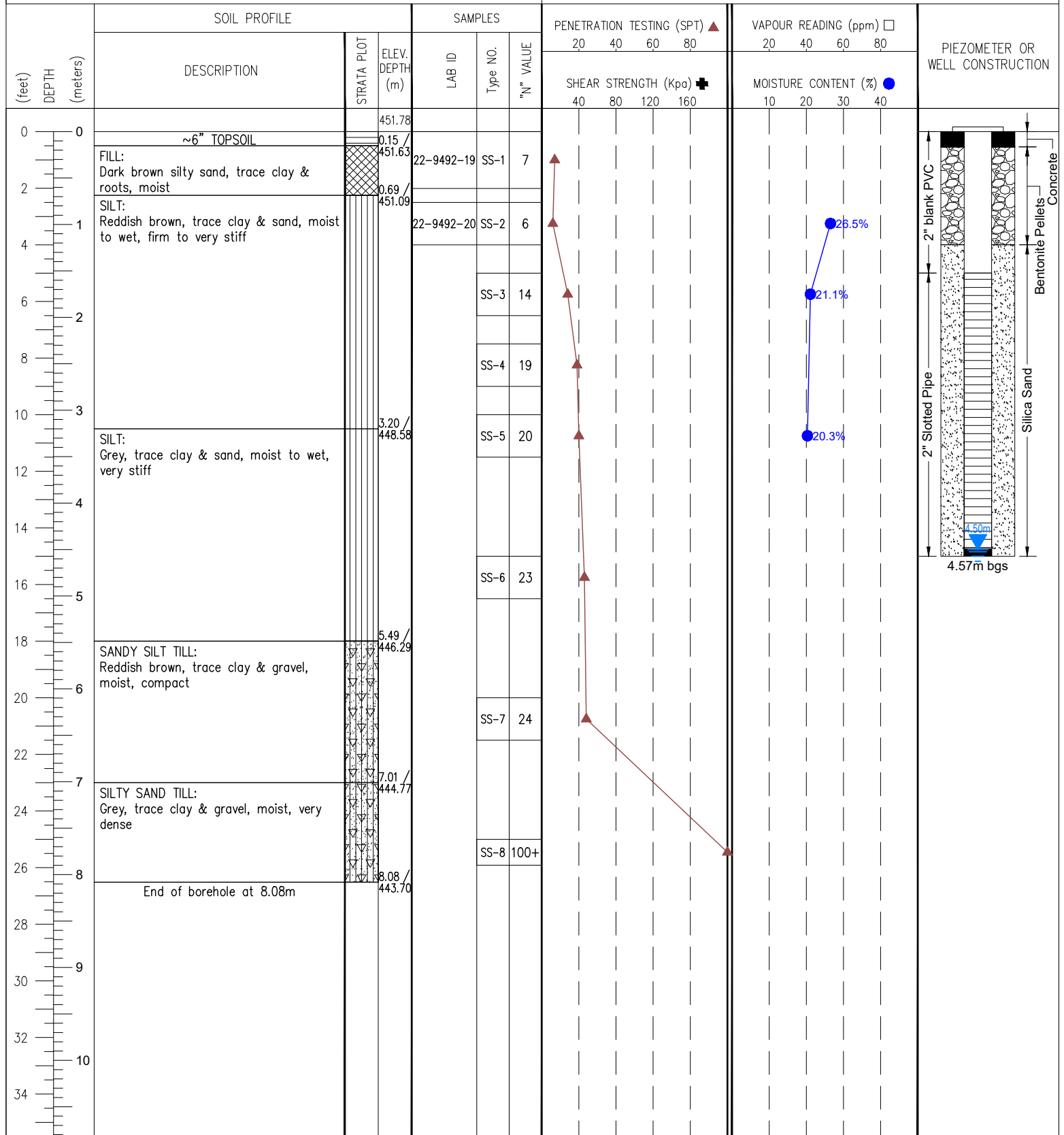
CHECKED: C.W.

PROJECT NAME: GEOTECHNICAL INVESTIGATION &amp; SOIL SAMPLING

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: Track, Solid Stem

DRILLING DATE: 22 November, 2022



Groundwater Depth (m): on completion: 3.35m; 2 December 2022: 4.50m

DRAWN: D.C.

LOGGED: J.Y.

CHECKED: C.W.

PROJECT NAME: GEOTECHNICAL INVESTIGATION &  
SOIL SAMPLING

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: Track, Solid Stem

DRILLING DATE: 22 November, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80				
							SHEAR STRENGTH (Kpa) ➕				MOISTURE CONTENT (%) ●				
0			452.27												
	~6" TOPSOIL		0.15 / 452.12												
2	FILL: Dark brown sand, trace clay, trace to some silt, trace gravel, roots, topsoil & topsoil mixed soils, moist				SS-1	7									
1	SILT: Reddish brown/brown, trace to some clay, trace sand, moist to wet, stiff		0.91 / 451.36		SS-2	9									
4															
6					SS-3	14									
2	End of borehole at 1.98m		1.98 / 450.29												
8															
10															
12															
14															
16															
18															
20															
22															
24															
26															
28															
30															
32															
34															

Groundwater Depth (m): on completion: Dry

DRAWN: D.C.

LOGGED: J.Y.

CHECKED: C.W.

## **APPENDIX C – LABORATORY TEST RESULTS**



**Project Name:** Geotechnical Investigation

**F.E. Lab #:** 24-432

**Client:** Town of Orangeville

**Date Sampled:** 9-Jul-2024

**Project ID:** 24-14036

**Date Received:** 11-Jul-2024

**Location:** 30 Centennial Road,  
Orangeville, Ontario

**Date Reported:** 22-Jul-2024

## Certificate of Analysis

Analyses	Matrix	Quantity	Testing Date	Method Reference
Moisture Content	Soil	16	11-Jul-24	ASTM D2216
Grain Size (Sieve Analysis)	Soil	0	N.A.	LS-602
Grain Size (Hydrometer)	Soil	4	12-Jul-24	LS-702
Atterberg test	Soil	0	N.A.	LS-703/704

Authorized by:



Behnam Sayad Pour Zanjani  
Geo-Lab Supervisor

## Certificate of Analysis

<b>Analysis Requested:</b>	Moisture Content	<b>Sample Description:</b>	16 Soil Sample(s)
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<b>Sample Info</b>	BH1 SS2	BH1 SS3	BH1 SS4	BH1 SS5	BH3 SS2	BH3 SS3
<b>Sample Depth (m)</b>	0.76-1.22	1.53-1.98	2.29-2.75	3.05-3.51	0.76-1.22	1.53-1.98
<b>Moisture Content (%)</b>	17.9	19.8	13.2	17.8	9.7	16.3

<b>Sample Info</b>	BH3 SS4	BH3 SS5	BH5 SS2	BH5 SS3	BH5 SS4	BH5 SS5
<b>Sample Depth (m)</b>	2.29-2.75	3.05-3.51	0.76-1.22	1.53-1.98	2.29-2.75	3.05-3.51
<b>Moisture Content (%)</b>	11.6	11.2	8.9	10.2	18.9	20.1

<b>Sample Info</b>	TH1	TH2	TH3	TH4		
<b>Sample Depth (m)</b>	1.53-1.98	1.53-1.98	1.53-1.98	1.53-1.98		
<b>Moisture Content (%)</b>	26.1	11.8	16.7	15.2		



## Certificate of Analysis

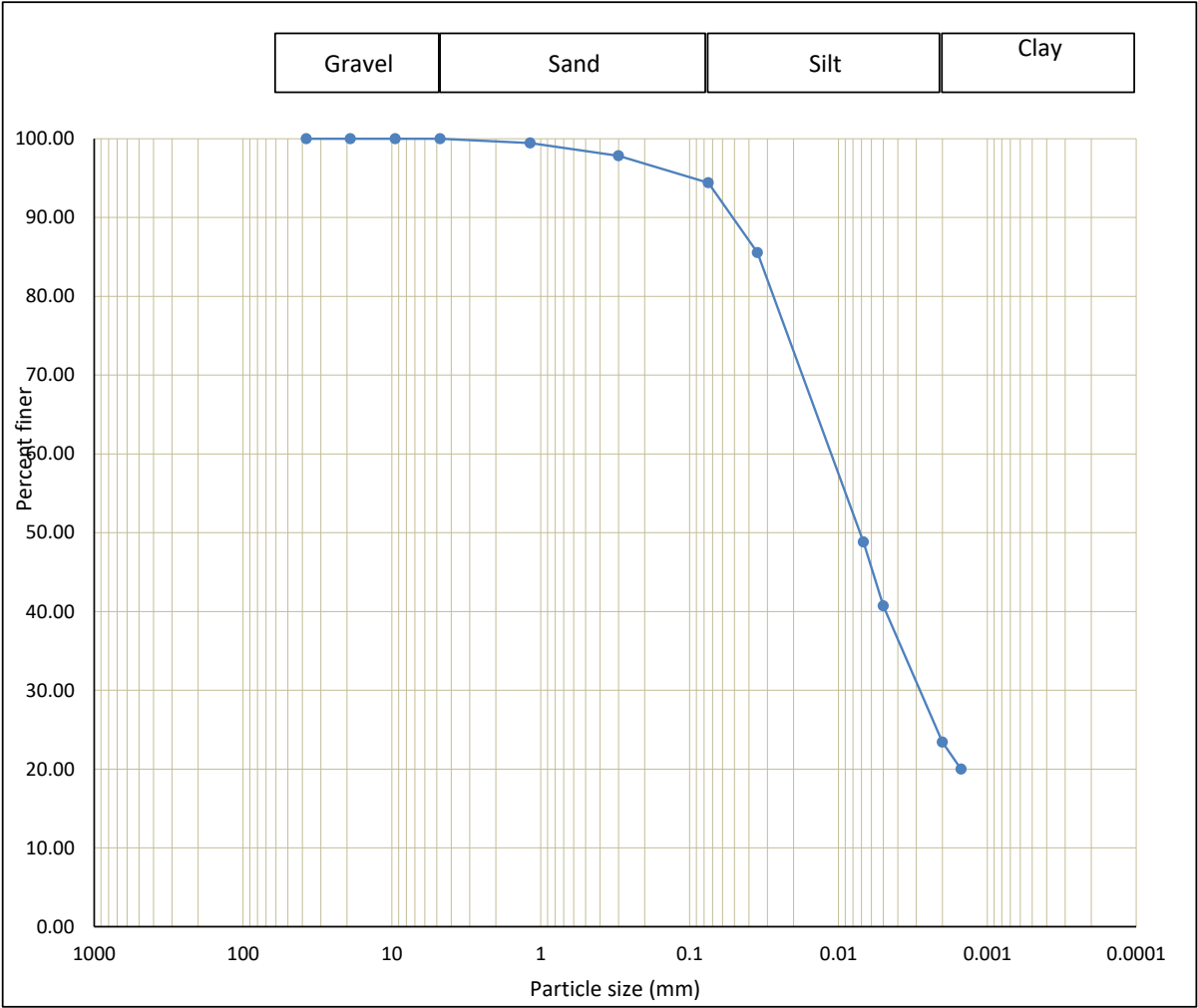
<b>Analysis Requested:</b>	Grain Size (Hydrometer)
<b>Sample Description:</b>	4 Soil Sample(s)

Sample Info	24-433 TH1	24-434 TH2	24-435 TH3	24-436 TH4		
Sample Depth (m)	1.53-1.98	1.53-1.98	1.53-1.98	1.53-1.98		
<b>Grain Size (%)</b>						
>19mm	0.0	10.9	0.0	0.0		
9.5mm-19mm	0.0	2.3	0.0	0.0		
4.75mm-9.5mm	0.0	1.6	2.1	0.0		
1.18mm-4.75mm	0.5	1.7	2.4	1.0		
300um-1.18mm	1.6	4.8	5.5	1.3		
75um-300um	3.4	17.3	14.2	4.3		
5um-75um	53.7	39.4	43.4	39.9		
2um-5um	17.3	8.1	12.4	22.3		
<2um	23.4	13.8	20.1	31.3		
Clay	23.4	13.8	20.1	31.3		
Silt	71.0	47.5	55.8	62.1		
Sand	5.6	23.9	22.0	6.6		
Gravel	0.0	14.8	2.1	0.0		

Grain Size Distribution

Sample ID: 24-433 TH1 (1.53-1.98m)

Gravel: 0%      Sand: 5.6%      Silt: 71%      Clay: 23.4%

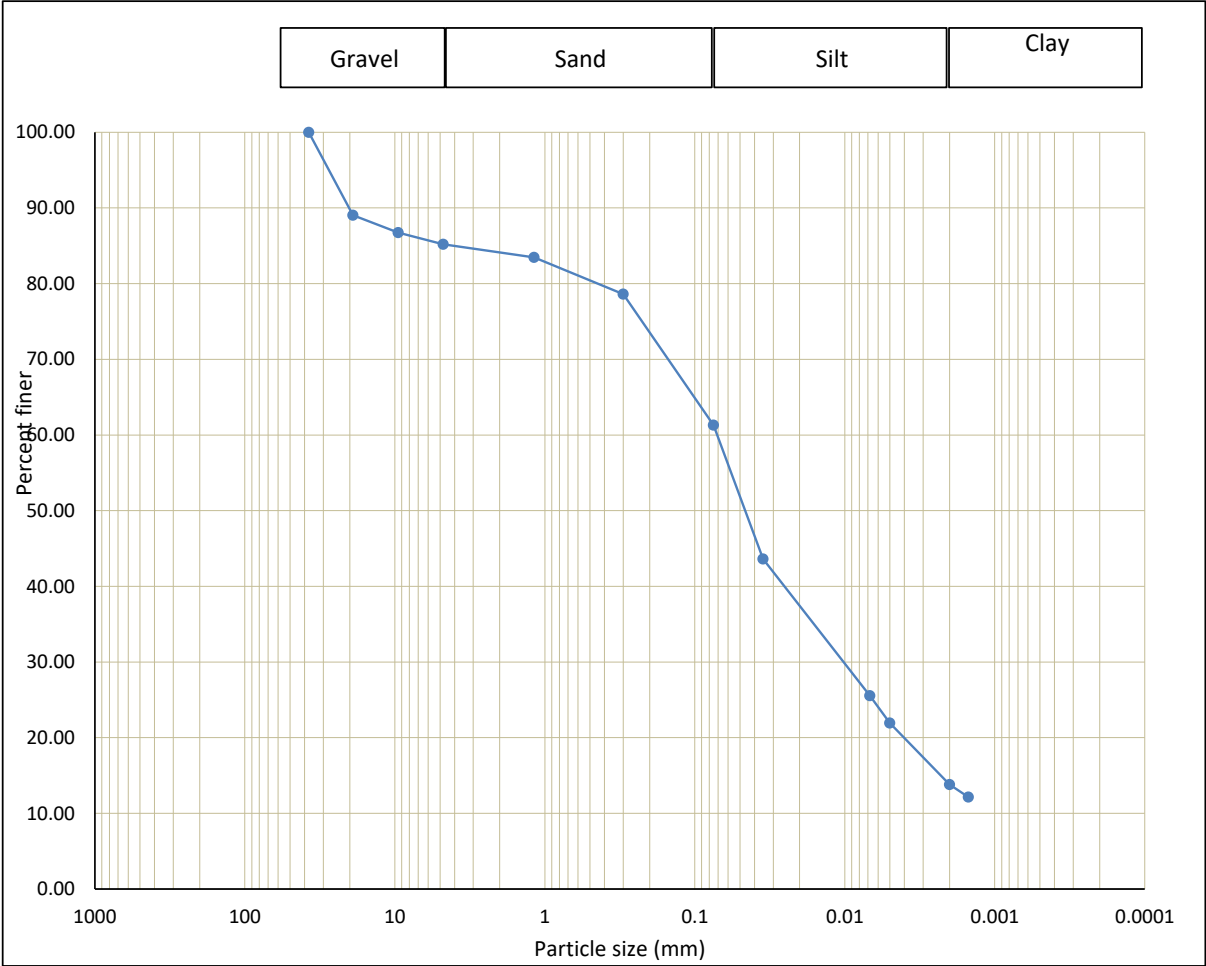


Sample ID: 24-433 TH1 (1.53-1.98m)		
Diameter	Weight (%)	Grain Size
>4.75mm	0.0	Gravel
1.18mm-4.75mm	0.5	Coarse Sand
300um-1.18mm	1.6	Medium Sand
75um-300um	3.4	Fine Sand
5um-75um	53.7	Silt
2um-5um	17.3	
<2um	23.4	Clay

Grain Size Distribution

Sample ID: 24-434 TH2 (1.53-1.98m)

Gravel: 14.8%      Sand: 23.9%      Silt: 47.5%      Clay: 13.8%

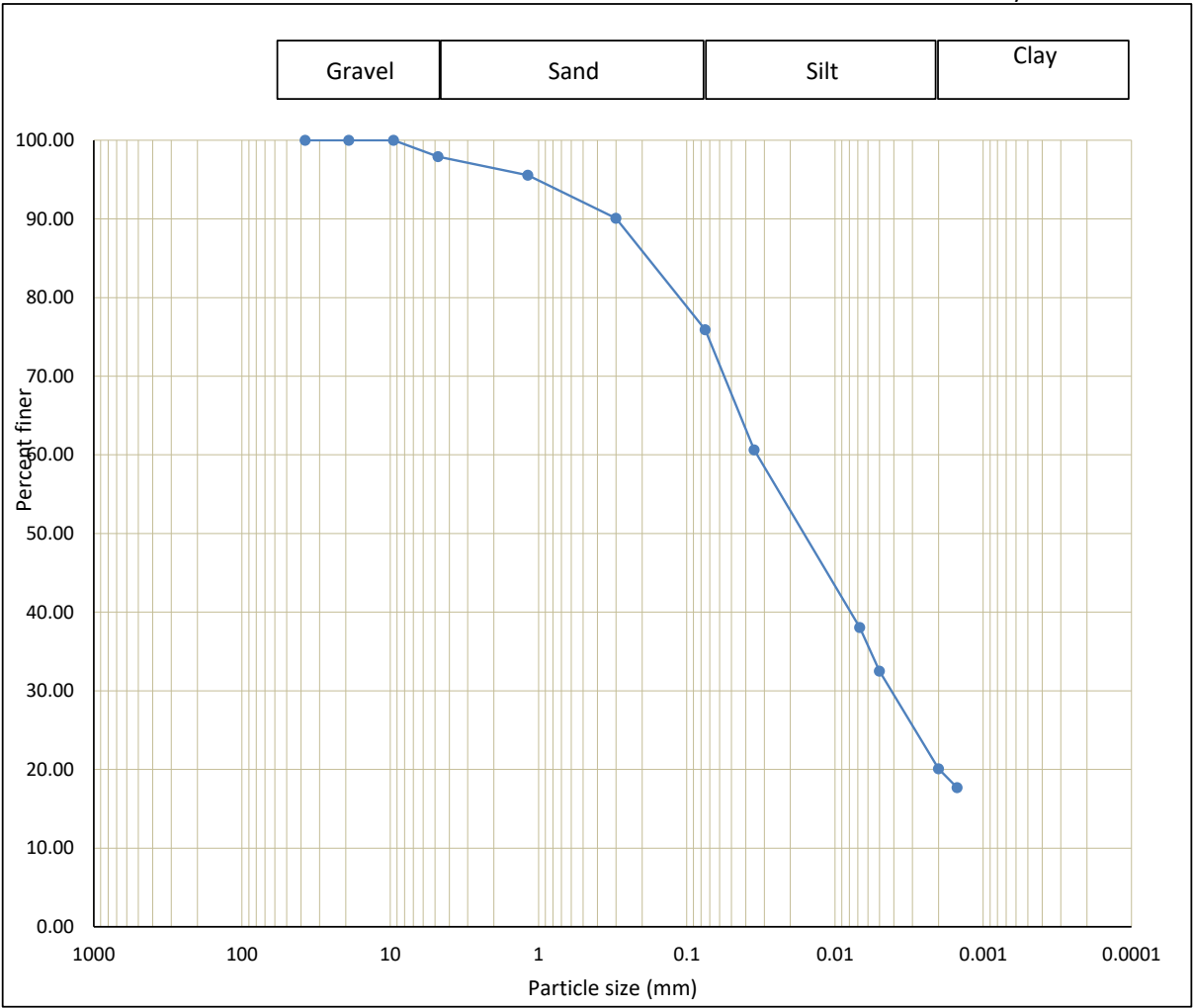


Sample ID: 24-434 TH2 (1.53-1.98m)		
Diameter	Weight (%)	Grain Size
>4.75mm	14.8	Gravel
1.18mm-4.75mm	1.7	Coarse Sand
300um-1.18mm	4.8	Medium Sand
75um-300um	17.3	Fine Sand
5um-75um	39.4	Silt
2um-5um	8.1	
<2um	13.8	Clay

Grain Size Distribution

Sample ID: 24-435 TH3 (1.53-1.98m)

Gravel: 2.1%      Sand: 22%      Silt: 55.8%      Clay: 20.1%

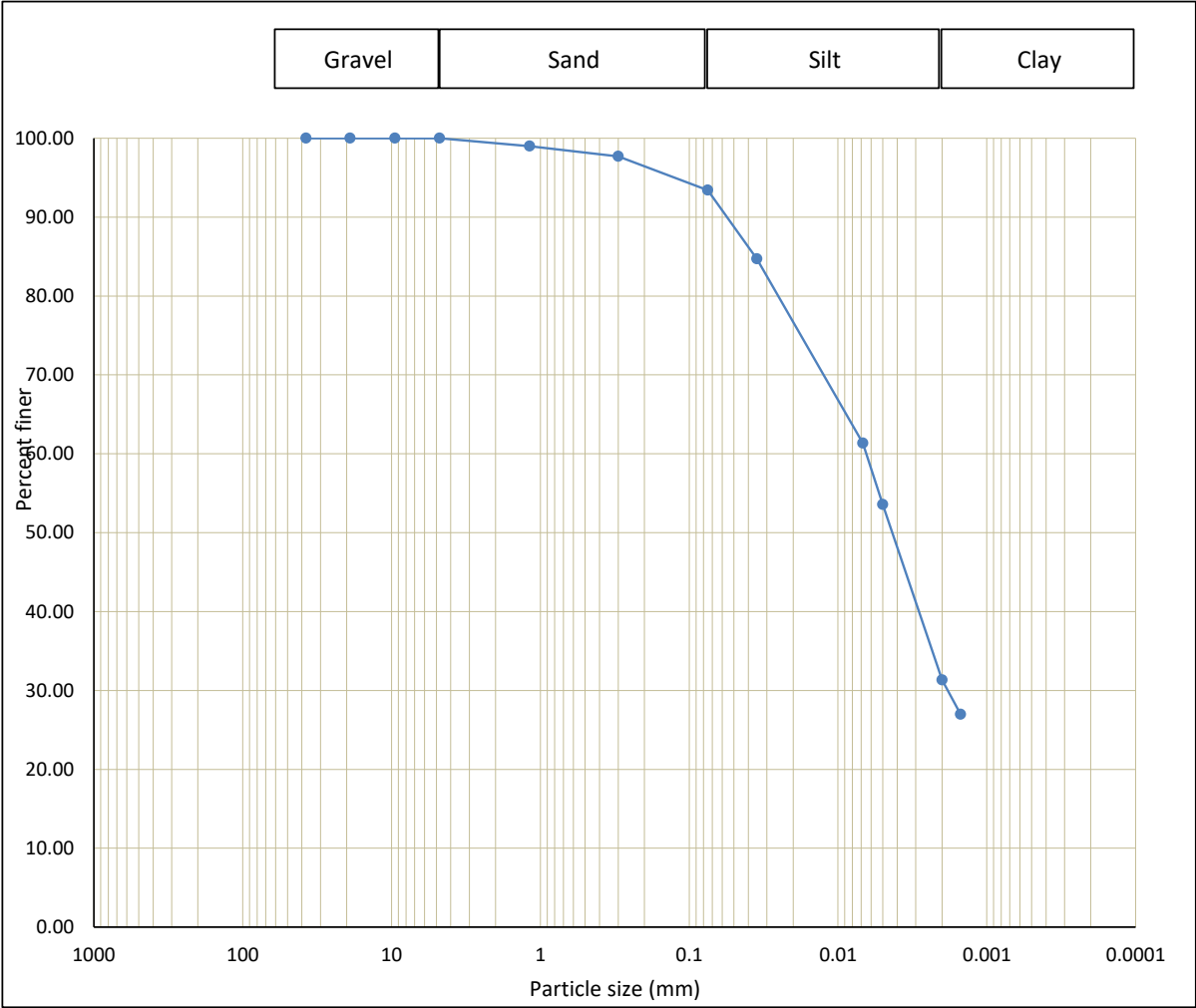


Sample ID: 24-435 TH3 (1.53-1.98m)		
Diameter	Weight (%)	Grain Size
>4.75mm	2.1	Gravel
1.18mm-4.75mm	2.4	Coarse Sand
300um-1.18mm	5.5	Medium Sand
75um-300um	14.2	Fine Sand
5um-75um	43.4	Silt
2um-5um	12.4	
<2um	20.1	Clay

Grain Size Distribution

Sample ID: 24-436 TH4 (1.53-1.98m)

Gravel: 0%      Sand: 6.6%      Silt: 62.1%      Clay: 31.3%



Sample ID: 24-436 TH4 (1.53-1.98m)		
Diameter	Weight (%)	Grain Size
>4.75mm	0.0	Gravel
1.18mm-4.75mm	1.0	Coarse Sand
300um-1.18mm	1.3	Medium Sand
75um-300um	4.3	Fine Sand
5um-75um	39.9	Silt
2um-5um	22.3	
<2um	31.3	Clay



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Hours: 9AM - 5PM M-F  
Call for Emergency Response

Revision 1.03 ; March 2022

**Project Name:** Geotechnical Investigation

**F.E. Lab #:** 22-652

**Client:** Town of Orangeville

**Date Sampled:** 21-Nov-2022

**Project ID:** 22-12035

**Date Received:** 25-Nov-2022

**Location:** 2839 Jane Street

**Date Reported:** 2-Dec-2022

Toronto, Ontario

## Certificate of Analysis

Analyses	Matrix	Quantity	Testing Date	Method Reference
Moisture Content	Soil	23	25-Nov-22	ASTM D2216
Grain Size (Sieve Analysis)	Soil	17	29-Nov-22	LS-602
Grain Size (Hydrometer)	Soil	0	N.A.	LS-702
Atterberg test	Soil	0	N.A.	LS-703/704

Authorized by:



Behnam Sayad Pour Zanjani  
Geo-Lab Supervisor

## Certificate of Analysis

<b>Analysis Requested:</b>	Moisture Content	<b>Sample Description:</b>	23 Soil Sample(s)
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<b>Sample Info</b>	BH2 SS1	BH2 SS2	BH8 SS1	BH8 SS2	BH9 SS2	BH9 SS3
<b>Sample Depth (m)</b>	0-0.61	0.76-1.22	0-0.61	0.76-1.22	0.76-1.22	1.53-1.98
<b>Moisture Content (%)</b>	23.2	25.8	13.2	21.4	8.2	25.5

<b>Sample Info</b>	BH9 SS5	BH15 SS1	BH15 SS2	BH22 SS2	BH22 SS3	BH22 SS5
<b>Sample Depth (m)</b>	3.05-3.51	0-0.61	0.76-1.22	0.76-1.22	1.53-1.98	3.05-3.51
<b>Moisture Content (%)</b>	26.1	15.7	15.3	28.6	22.8	23.1

<b>Sample Info</b>	BH26 SS1	BH26 SS2	BH26 SS3	BH26 SS4	BH26 SS5	BH26 SS6
<b>Sample Depth (m)</b>	0-0.61	0.76-1.22	1.53-1.98	2.29-2.75	3.05-3.51	4.58-5.03
<b>Moisture Content (%)</b>	11.8	21.9	23.1	21.2	24.8	22.7

<b>Sample Info</b>	BH31 SS1	BH31 SS2	BH34 SS2	BH34 SS3	BH34 SS5	
<b>Sample Depth (m)</b>	0-0.61	0.76-1.22	0.76-1.22	1.53-1.98	3.05-3.51	
<b>Moisture Content (%)</b>	9.8	24.9	26.5	21.1	20.3	



# Certificate of Analysis

<b>Analysis Requested:</b>	Grain Size ( Sieve Analysis)	<b>Sample Quantity:</b>	17	Soil Sample(s)
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Sample Info	22-653 BH2 SS1	22-654 BH2 SS2	22-655 BH8 SS1	22-656 BH8 SS2	22-657 BH9 SS2	22-658 BH9 SS3
Sample Depth (m)	0-0.61	0.76-1.22	0-0.61	0.76-1.22	0.76-1.22	1.53-1.98
<b>Grain Size (%)</b>						
>19mm	0.0	0.0	0.0	0.0	0.0	0.0
9.5mm-19mm	0.0	0.0	0.0	0.0	0.0	0.0
4.75mm-9.5mm	0.0	0.0	0.0	0.0	0.0	0.0
1.18mm-4.75mm	0.2	0.0	3.2	0.1	0.0	0.0
300um-1.18mm	1.5	0.2	4.4	0.6	0.7	0.9
75um-300um	3.6	1.1	13.3	0.3	14.9	0.5
<75um	94.8	98.8	79.1	99.0	84.5	98.6
Clay and Silt	95	99	79	99	84	99
Sand	5	1	21	1	16	1
Gravel	0	0	0	0	0	0

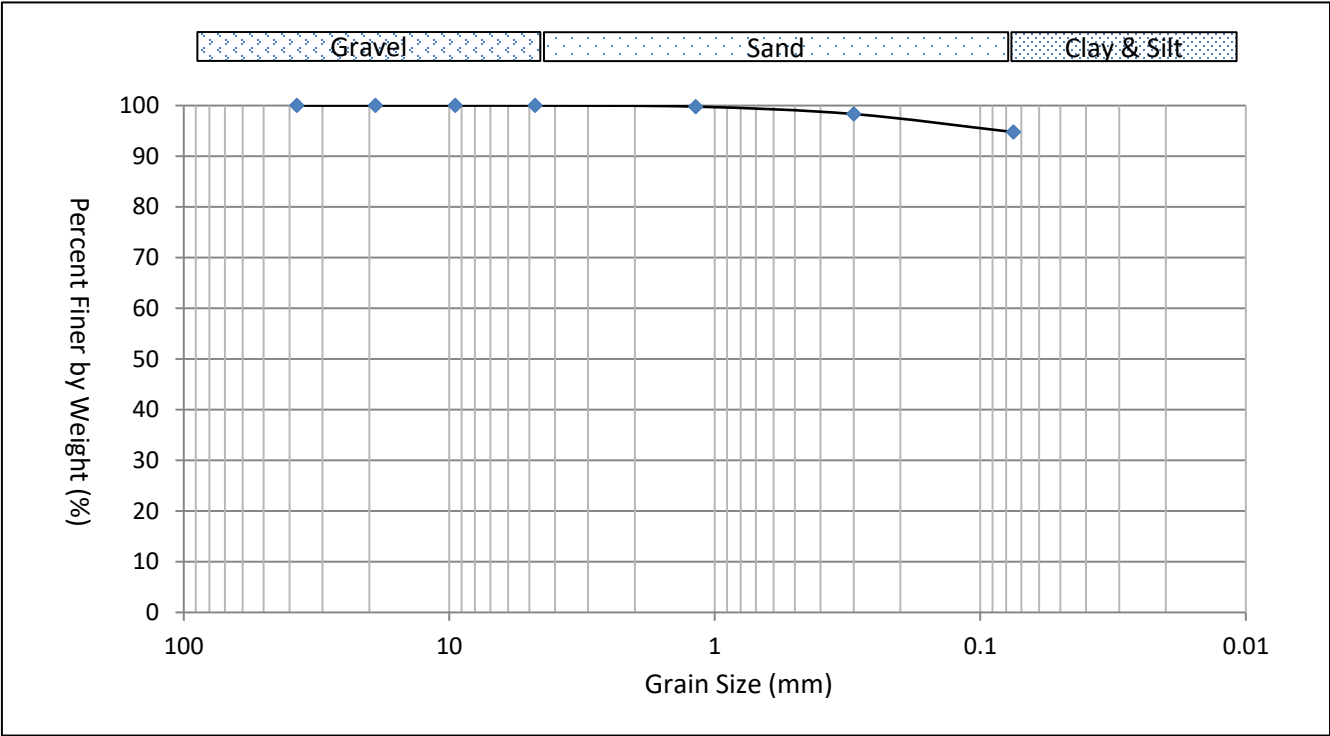
Sample Info	22-659 BH9 SS5	22-660 BH15 SS1	22-661 BH15 SS2	22-662 BH22 SS2	22-663 BH22 SS3	22-664 BH22 SS5
Sample Depth (m)	3.05-3.51	0-0.61	0.76-1.22	0.76-1.22	1.53-1.98	3.05-3.51
<b>Grain Size (%)</b>						
>19mm	0.0	0.0	0.0	0.0	0.0	0.0
9.5mm-19mm	0.0	0.0	2.4	0.0	0.0	0.0
4.75mm-9.5mm	0.0	0.0	0.3	0.4	0.0	0.0
1.18mm-4.75mm	0.1	0.7	4.6	2.3	0.0	0.2
300um-1.18mm	0.1	5.0	5.6	1.9	0.0	0.1
75um-300um	1.4	16.1	12.1	1.4	0.8	0.4
<75um	98.5	78.1	75.1	94.1	99.2	99.2
Clay and Silt	98	78	75	94	99	99
Sand	2	22	22	6	1	1
Gravel	0	0	3	0	0	0

Sample Info	22-665 BH31 SS1	22-666 BH31 SS2	22-667 BH34 SS2	22-668 BH34 SS3	22-669 BH34 SS5	
Sample Depth (m)	0-0.61	0.76-1.22	0.76-1.22	1.53-1.98	3.05-3.51	
<b>Grain Size (%)</b>						
>19mm	0.0	0.0	0.0	0.0	0.0	
9.5mm-19mm	0.0	0.0	0.0	0.0	0.0	
4.75mm-9.5mm	0.0	0.0	0.0	0.0	0.0	
1.18mm-4.75mm	0.7	0.0	0.4	0.0	0.0	
300um-1.18mm	3.5	0.2	1.0	0.0	0.0	
75um-300um	27.2	1.1	0.6	0.6	0.1	
<75um	68.7	98.7	98.1	99.4	99.9	
Clay and Silt	69	99	98	99	100	
Sand	31	1	2	1	0	
Gravel	0	0	0	0	0	

# Grain Size Distribution

Sample ID: 22-653 BH2 SS1 0-0.61

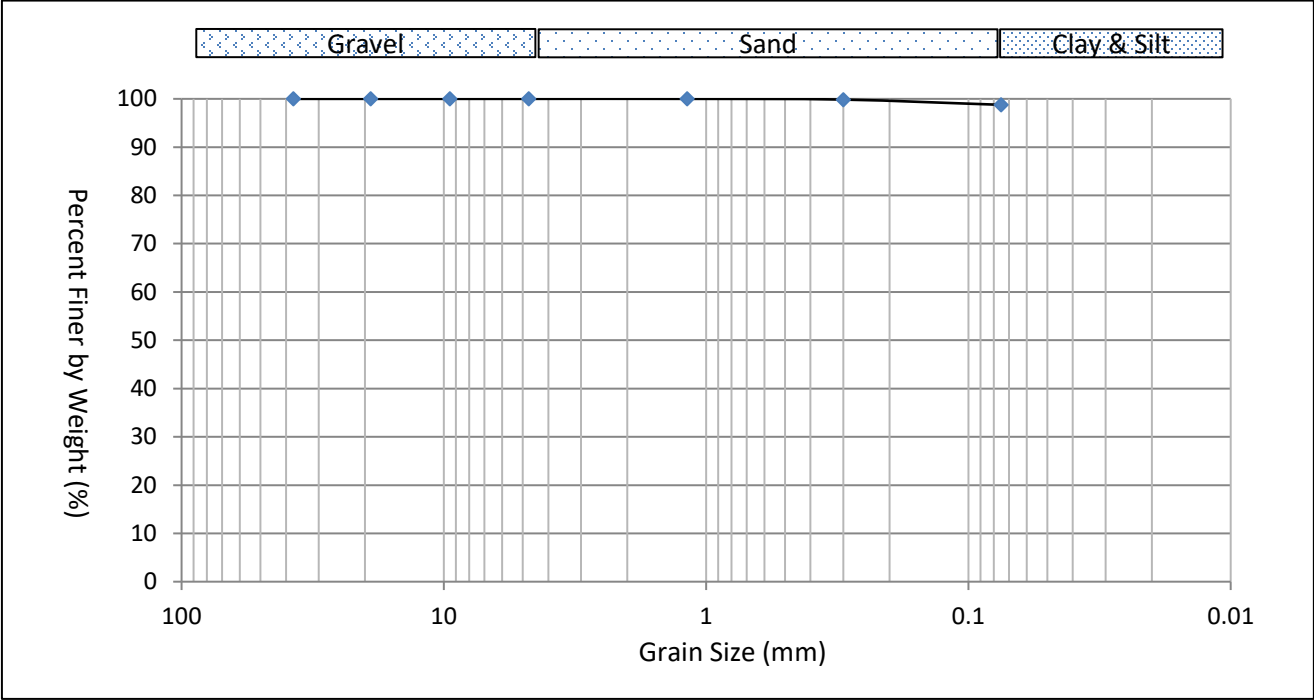
Gravel: 0%      Sand: 5%      Clay and Silt: 95%



# Grain Size Distribution

Sample ID: 22-654 BH2 SS2 0.76-1.22

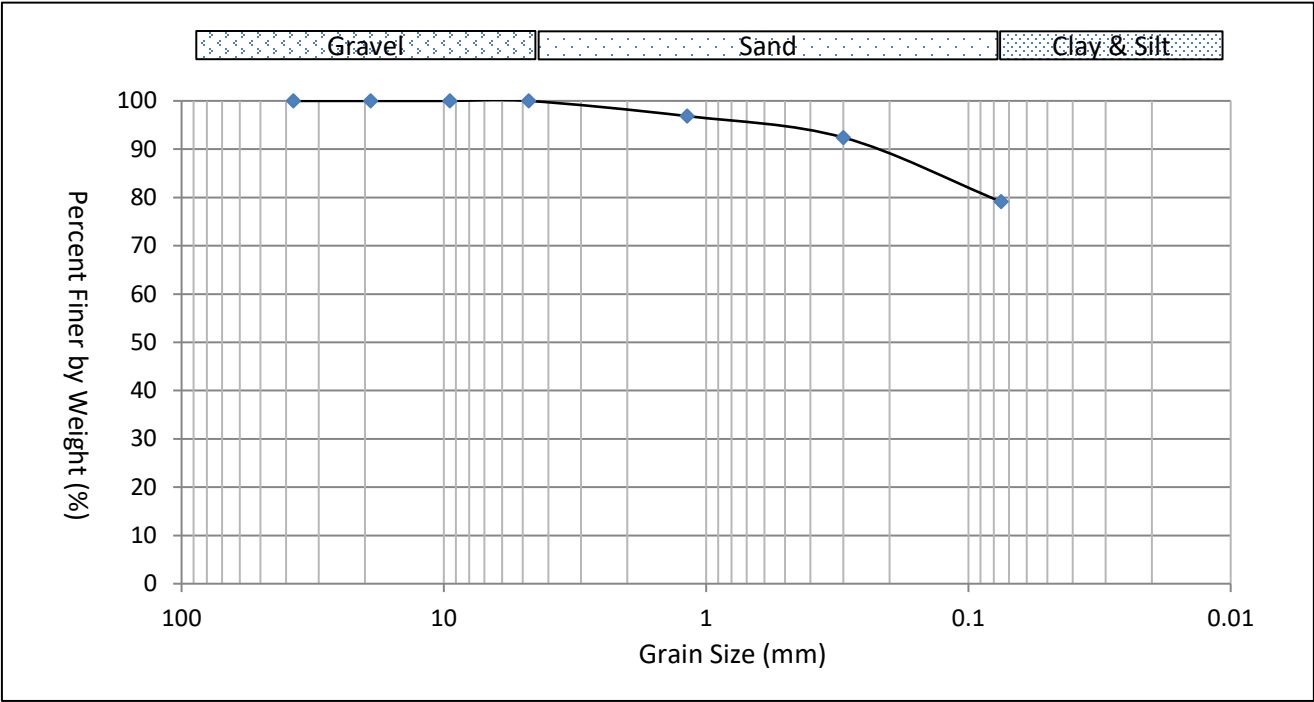
Gravel: 0%      Sand: 1%      Clay and Silt    99%



# Grain Size Distribution

Sample ID: 22-655 BH8 SS1 0-0.61

Gravel: 0%      Sand: 21%      Clay and Silt    79%



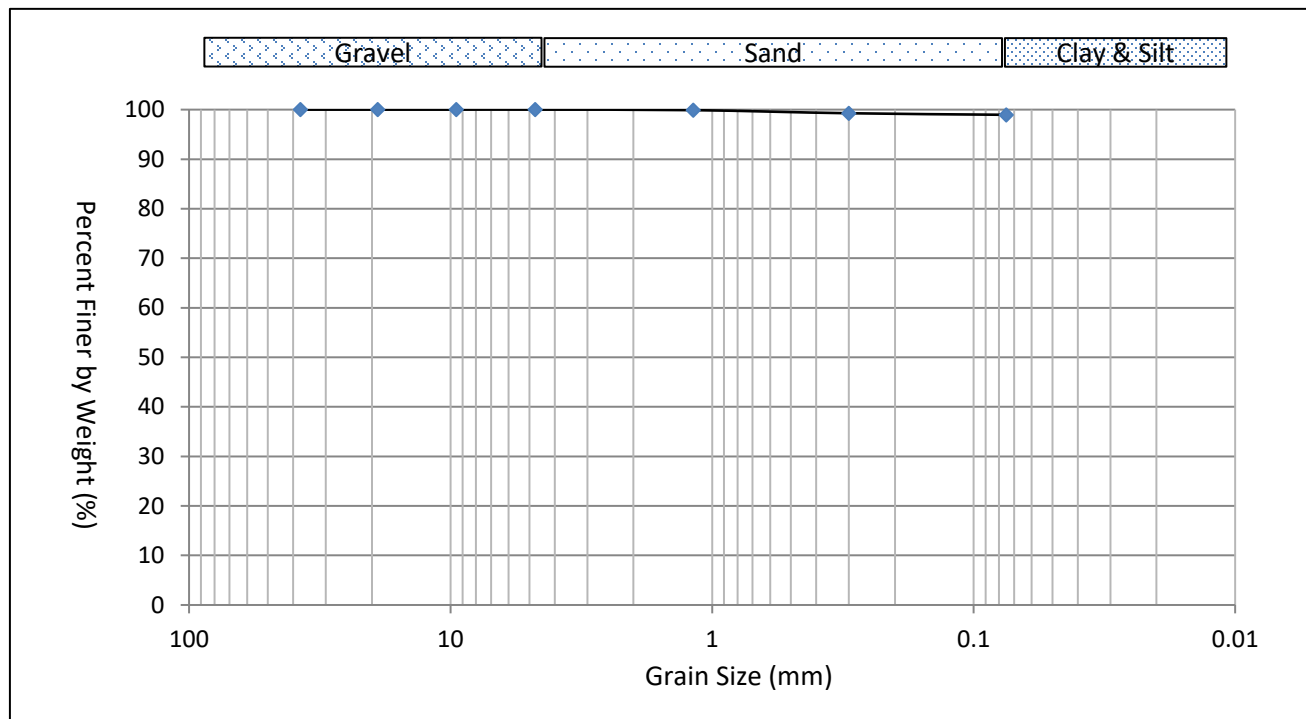
## Grain Size Distribution

Sample ID: 22-656 BH8 SS2 0.76-1.22

Gravel: 0%

Sand: 1%

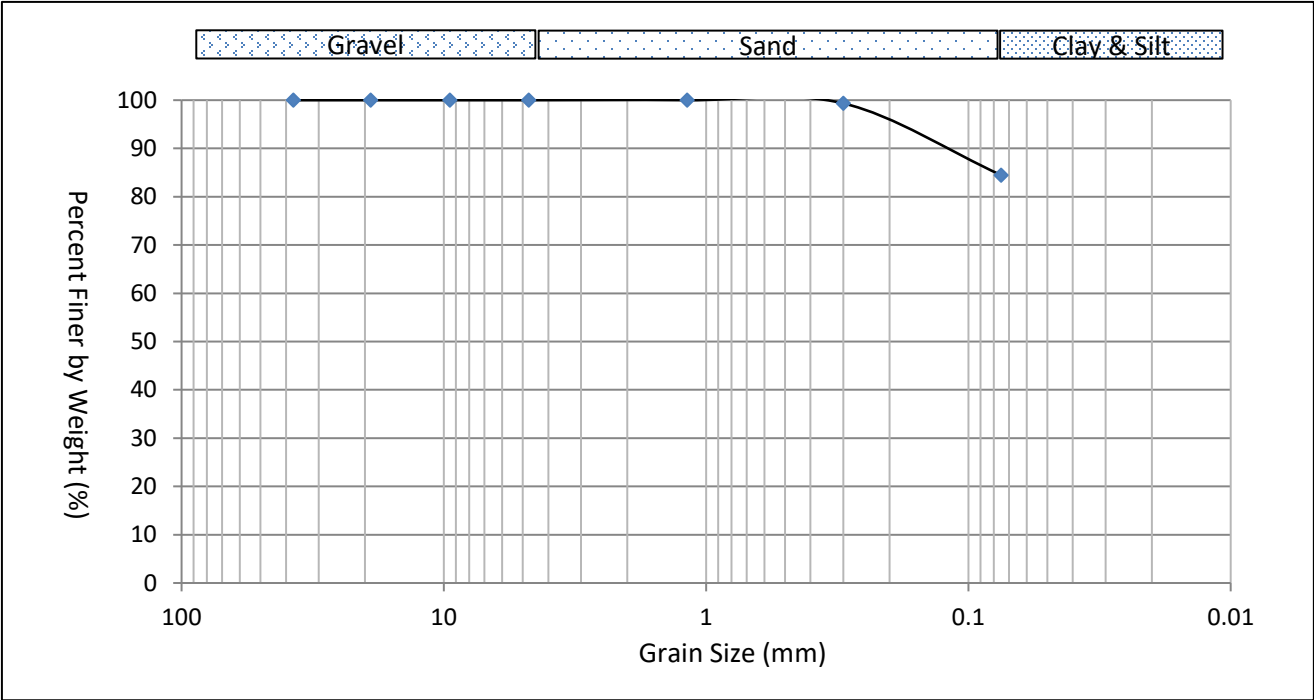
Clay and Silt 99%



# Grain Size Distribution

Sample ID: 22-657 BH9 SS2 0.76-1.22

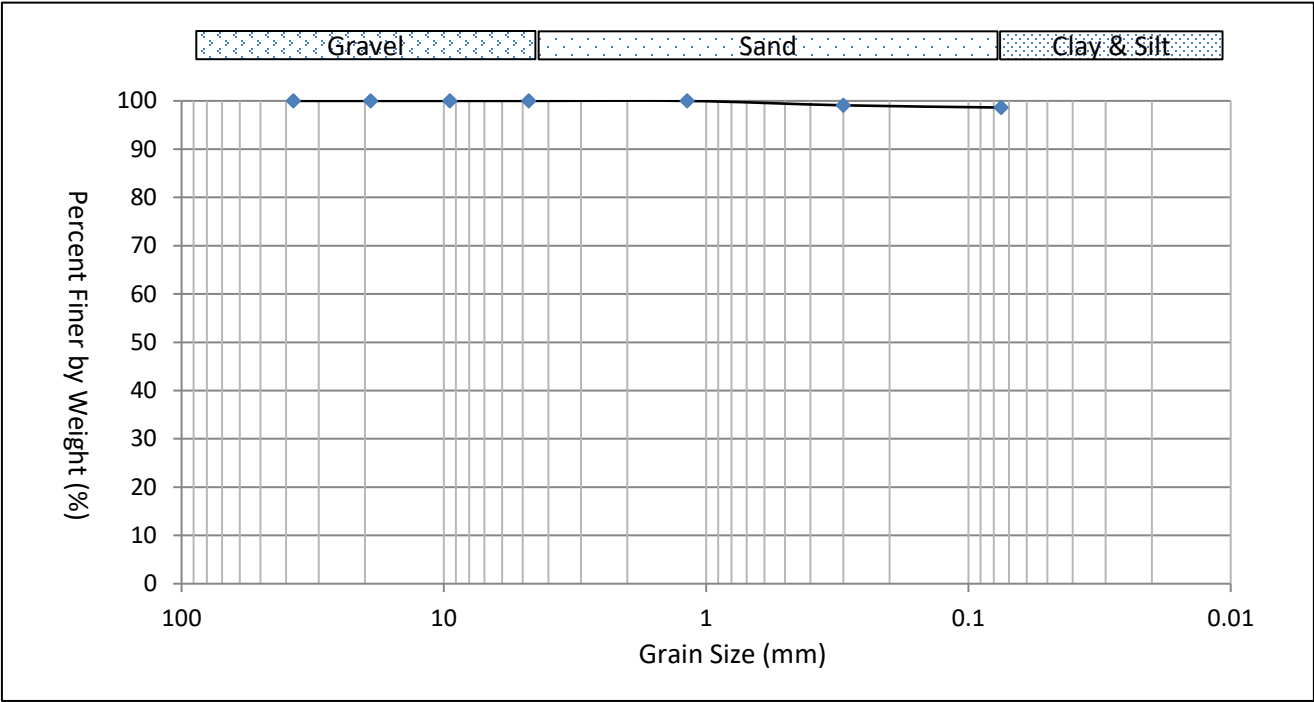
Gravel: 0%      Sand: 16%      Clay and Silt    84%



# Grain Size Distribution

Sample ID: 22-658 BH9 SS3 1.53-1.98

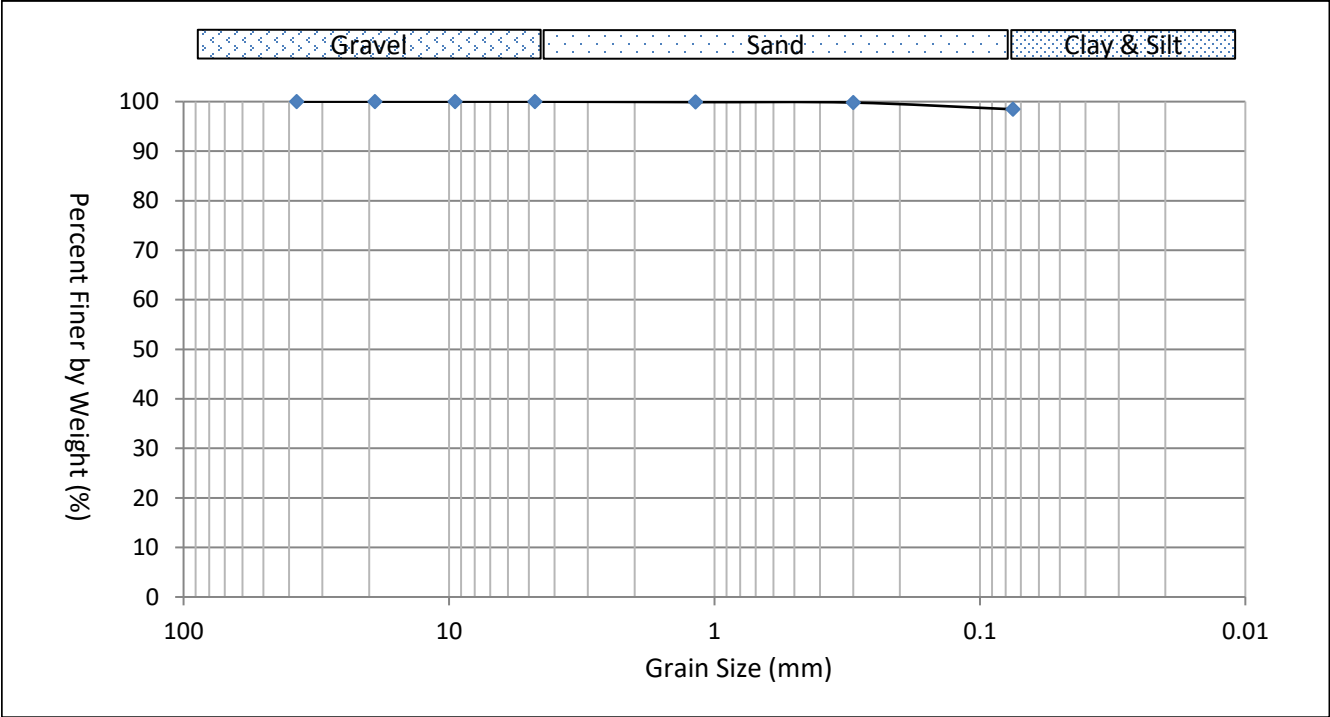
Gravel: 0%      Sand: 1%      Clay and Silt    99%



# Grain Size Distribution

Sample ID: 22-659 BH9 SS5 3.05-3.51

Gravel: 0%      Sand: 2%      Clay and Silt    98%

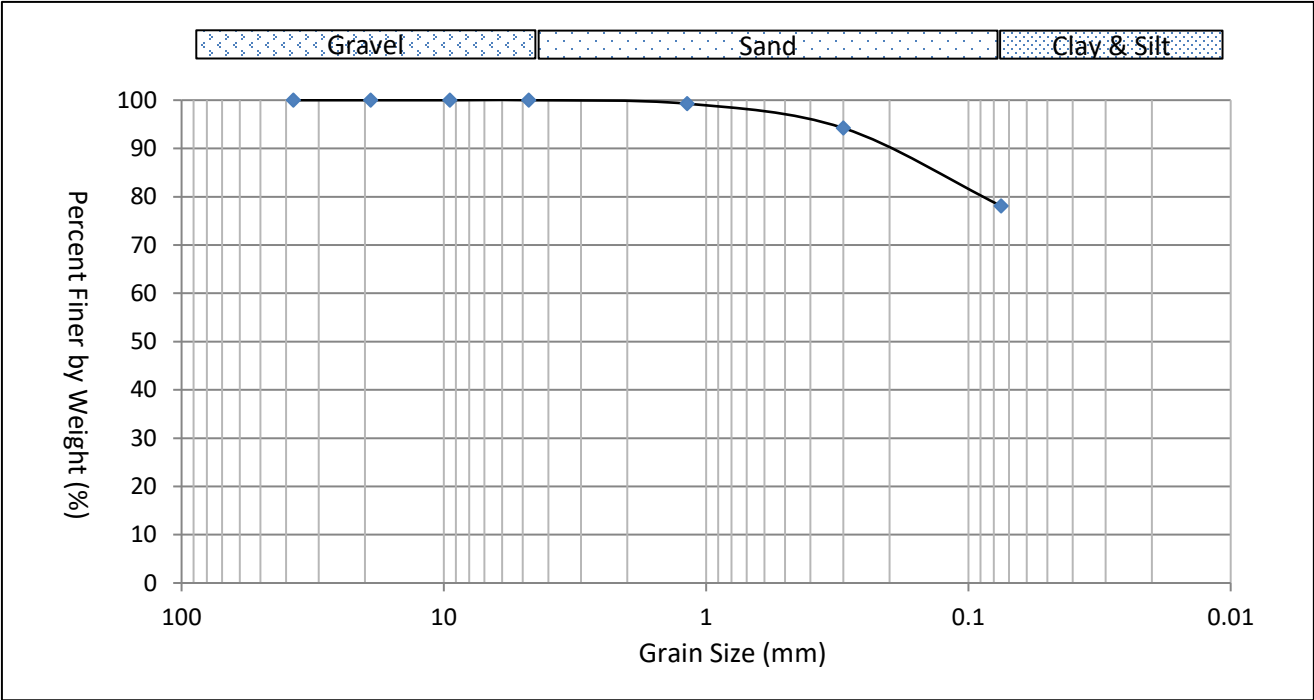




# Grain Size Distribution

Sample ID: 22-660 BH15 SS1 0-0.61

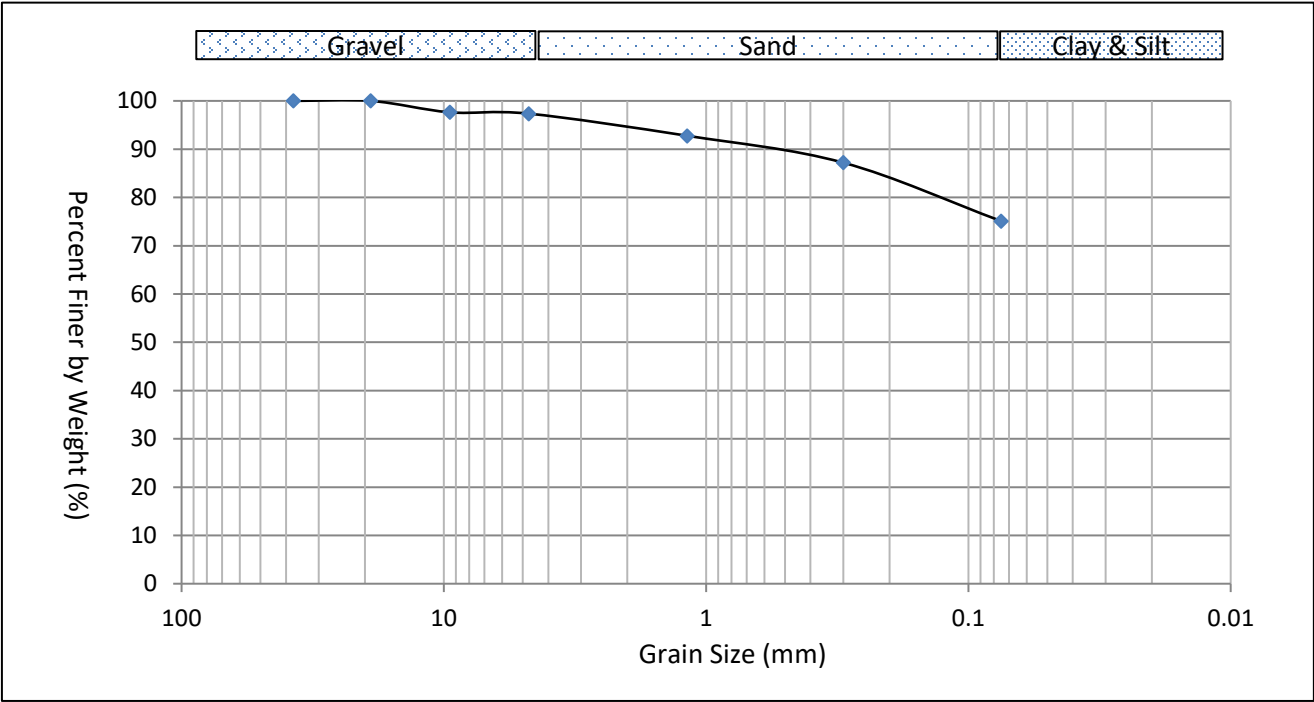
Gravel: 0%      Sand: 22%      Clay and Silt    78%



# Grain Size Distribution

Sample ID: 22-661 BH15 SS2 0.76-1.22

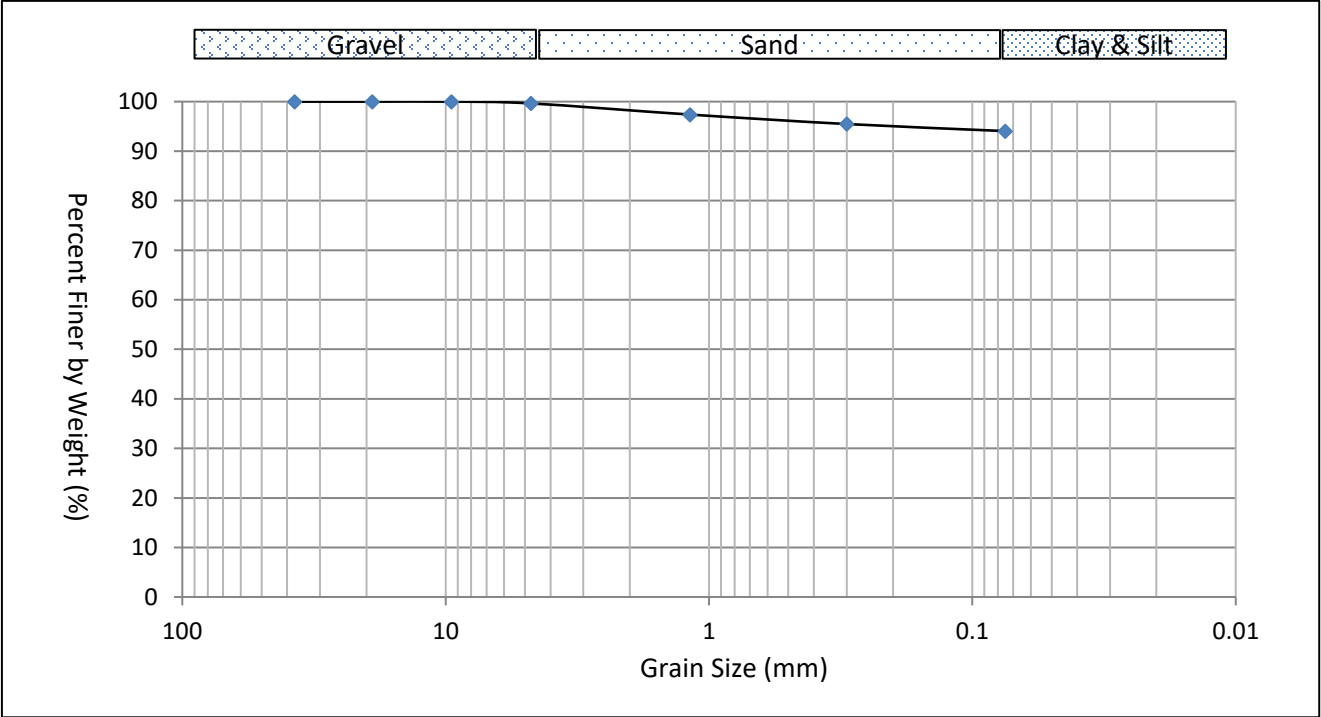
Gravel: 3%      Sand: 22%      Clay and Silt    75%



# Grain Size Distribution

Sample ID: 22-662 BH22 SS2 0.76-1.22

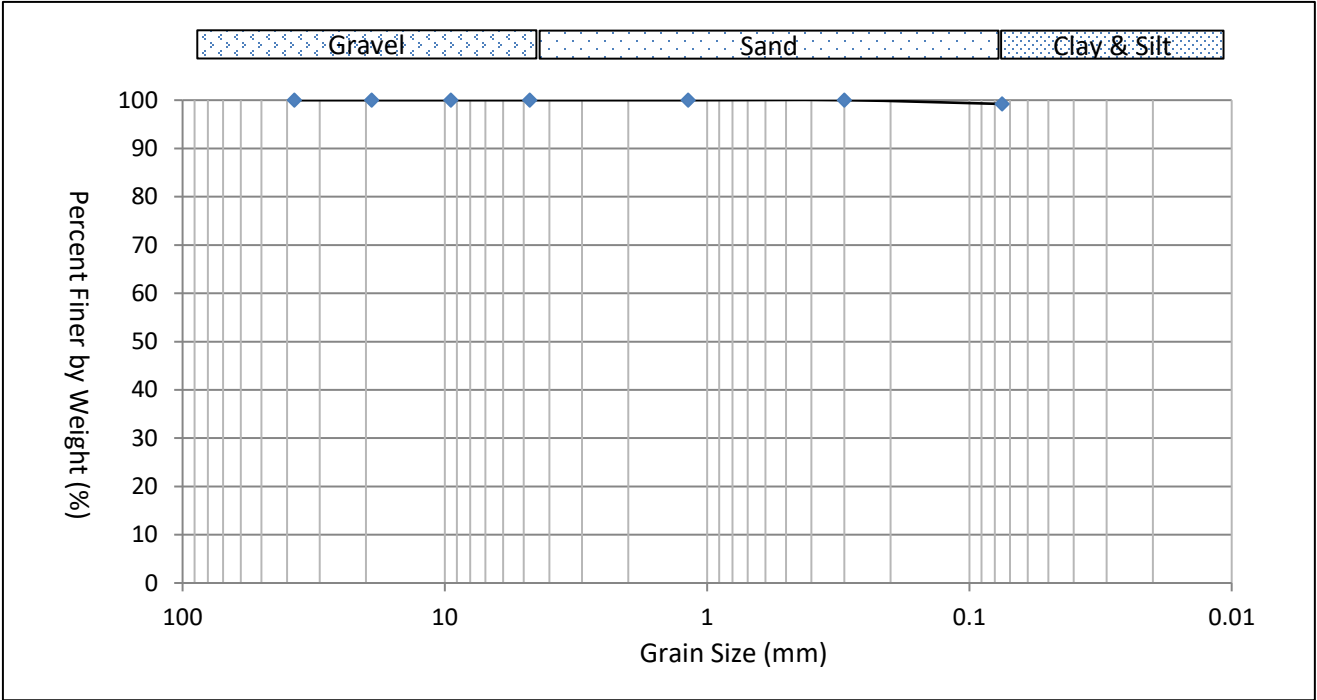
Gravel: 0%      Sand: 6%      Clay and Silt    94%



# Grain Size Distribution

Sample ID: 22-663 BH22 SS3 1.53-1.98

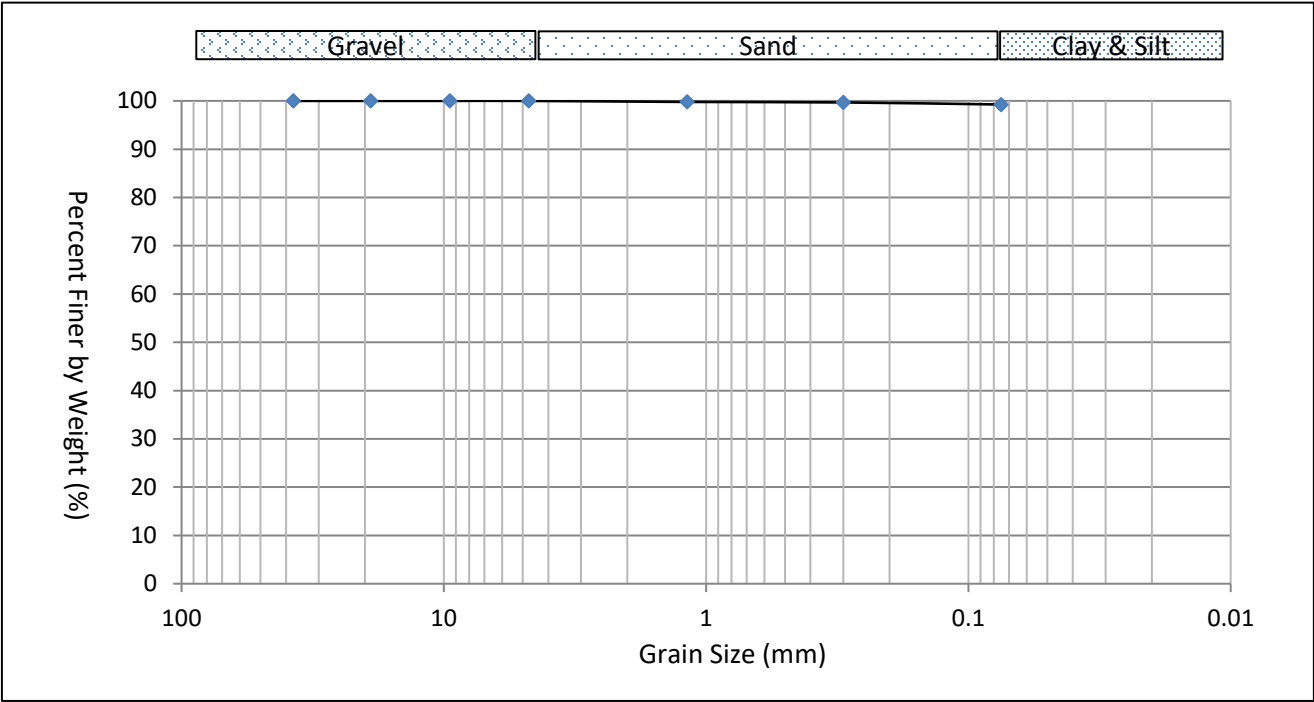
Gravel: 0%      Sand: 1%      Clay and Silt    99%



# Grain Size Distribution

Sample ID: 22-664 BH22 SS5 3.05-3.51

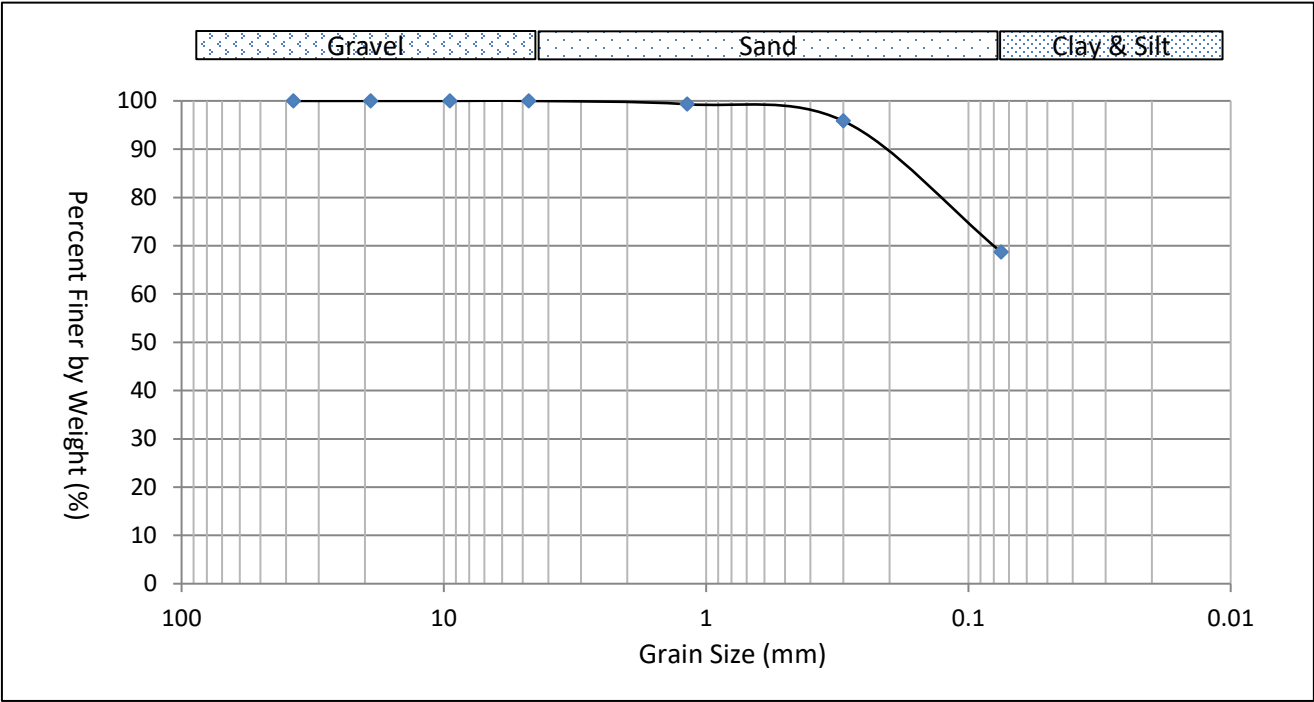
Gravel: 0%      Sand: 1%      Clay and Silt    99%



# Grain Size Distribution

Sample ID: 22-665 BH31 SS1 0-0.61

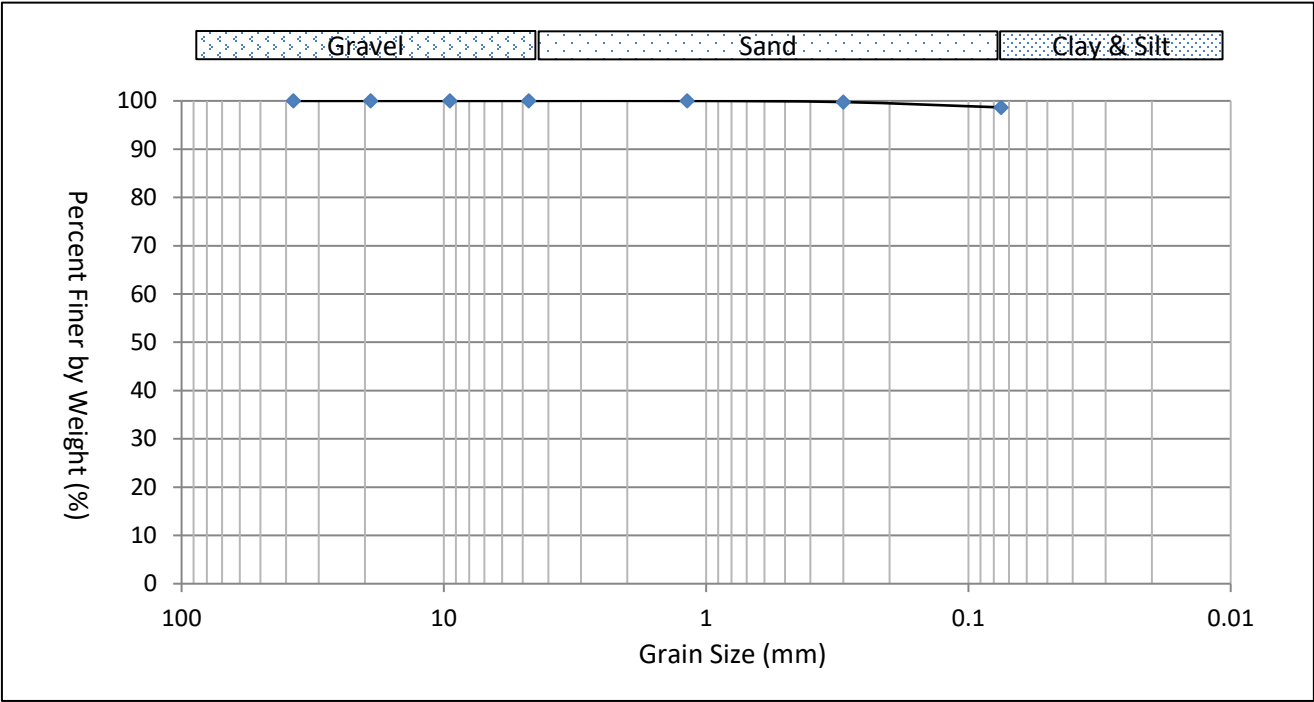
Gravel: 0%      Sand: 31%      Clay and Silt    69%



# Grain Size Distribution

Sample ID: 22-666 BH31 SS2 0.76-1.22

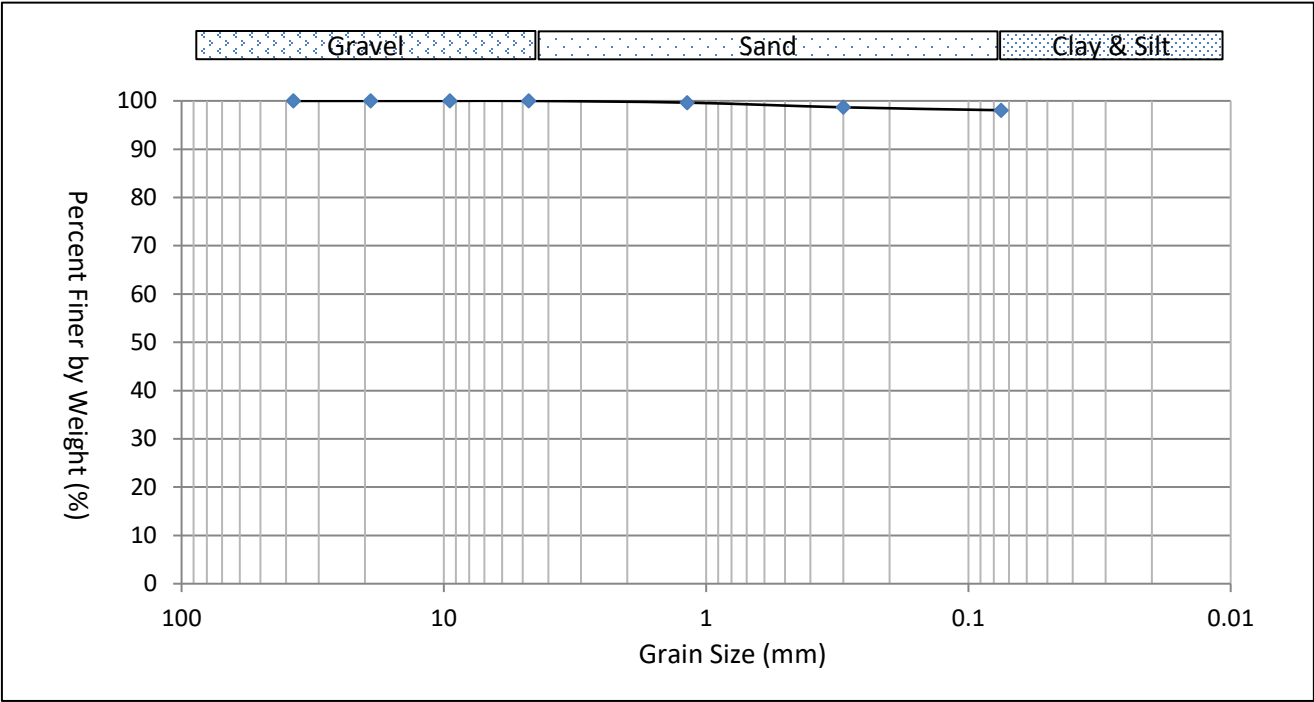
Gravel: 0%      Sand: 1%      Clay and Silt    99%



# Grain Size Distribution

Sample ID: 22-667 BH34 SS2 0.76-1.22

Gravel: 0%      Sand: 2%      Clay and Silt: 98%

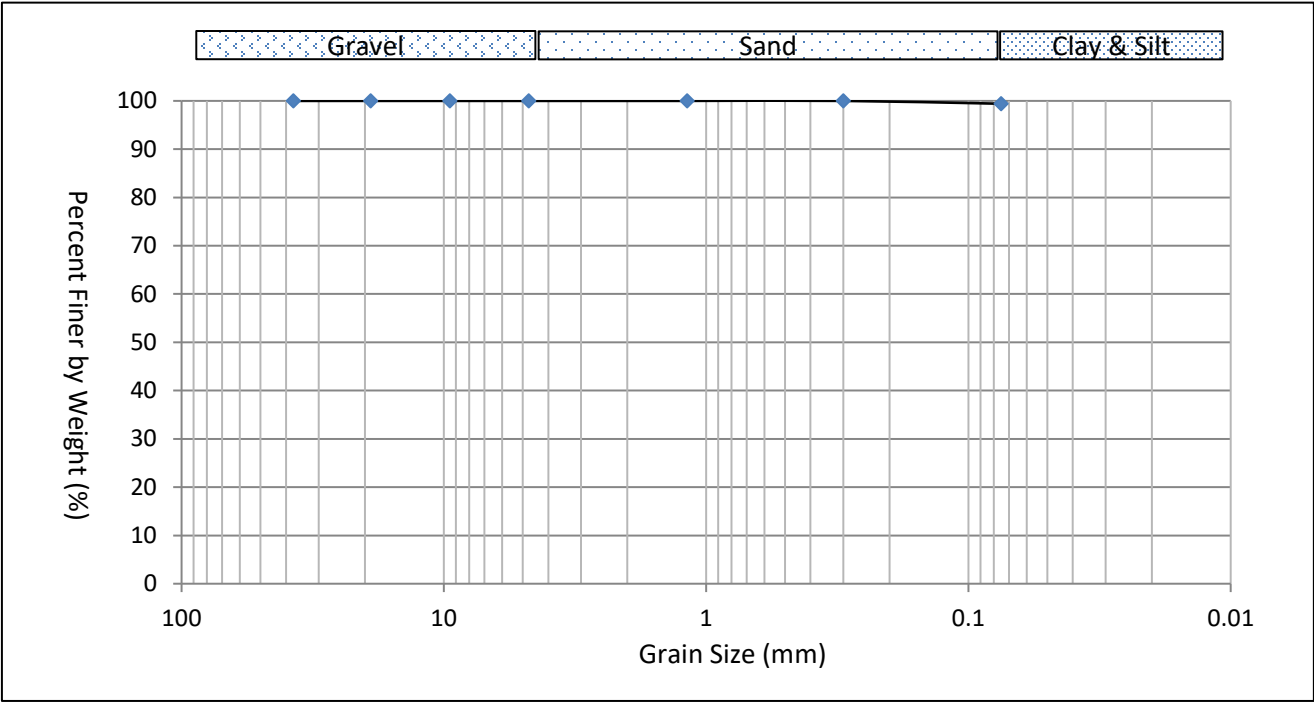




# Grain Size Distribution

Sample ID: 22-668 BH34 SS3 1.53-1.98

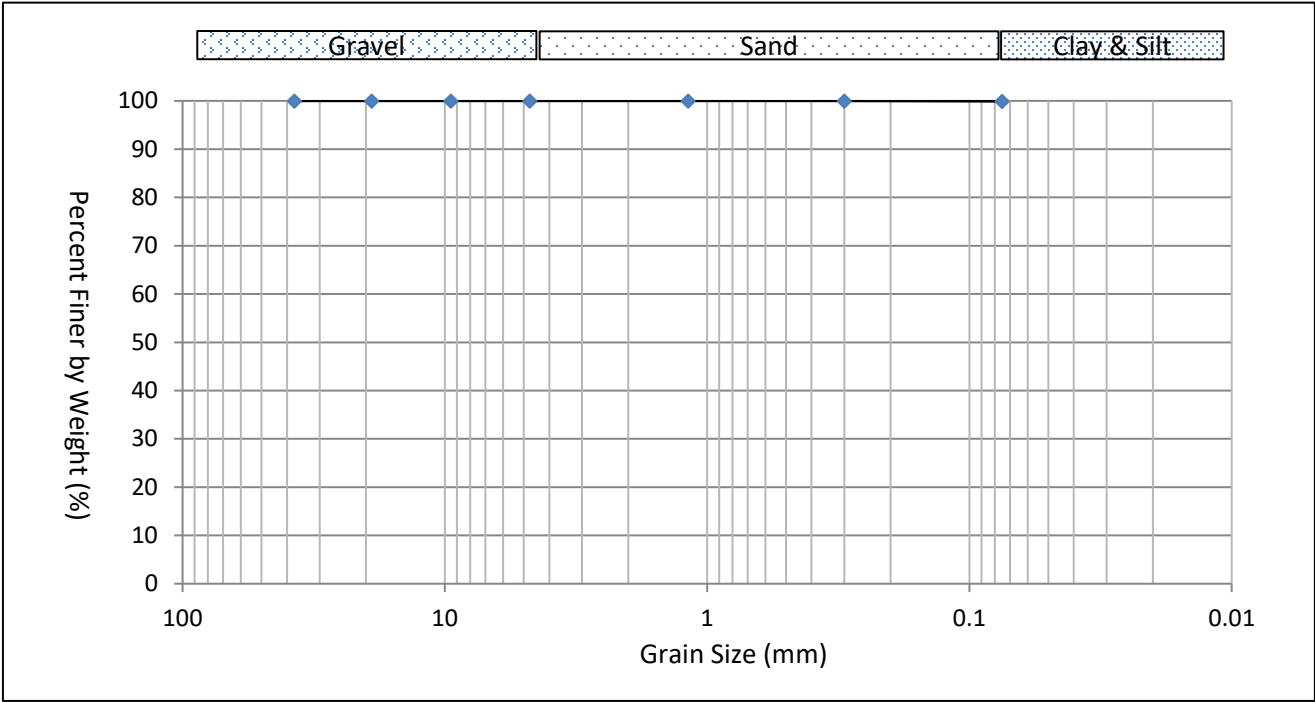
Gravel: 0%      Sand: 1%      Clay and Silt    99%



# Grain Size Distribution

Sample ID: 22-669 BH34 SS5 3.05-3.51

Gravel: 0%      Sand: 0%      Clay and Silt: 100%



LAB JOB No: 22-652 **Standard Laboratory Request Form: Chain of Custody** Page 1 of 2

<b>CLIENT INFORMATION</b> Name: _____ Contact: _____ Address: <u>30 Centennial</u> Email: _____ Fax: _____ Phone: _____		<b>PROJECT INFORMATION</b> Project Name: <u>Geotechnical Investigation</u> Project ID: <u>22-12632</u> Sampled By: <u>Jamal</u>		<b>BILLING INFORMATION</b> Purchase Order No: _____ Verbal Authorization: _____ Credit Card Type (e.g. MC/Visa/AMEX...): _____ Credit Card #: _____ Expiry Date: _____	
<b>TURNAROUND TIME (TAT): Check ONE if all samples are the same/or see below.</b>					
STD - Standard (5-7 bus. days)		3D - Three-Day (72 hrs.) <input checked="" type="checkbox"/>		Standard Charge SURCHARGES MAY APPLY Custom quotations (if applicable) will be reflected on final billing. CALL for: Emergencies, Bulk Quotes, or other Questions.	
Reg. Business Hrs. 9am to 5pm Samples received after 2pm are considered next day orders.					

LAB SAMPLE ID	CLIENT'S SAMPLE ID AND DESCRIPTION	SAMPLING DATE/TIME	SAMPLE MATRIX	CONTAINER NO. and TYPE	TAT (Above)	ANALYSIS REQUESTED (Check or Specify)										NOTES
						Moisture Content	Sieve Analysis	Hydrometer	Atterberg Limits	Proctor						
	BH2 (0-2') (2.5-4')	Nov 21	Soil	Bag	3D	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>									
	BH8 (0-2') (2.5-4')					<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>									
	BH9 (2.5-4') (5-6.5') (10-11.5')					<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>									
	BH15 (0-2') (2.5-4')					<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>									
	BH22 (2.5-4') (5-6.5') (10-11.5')					<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>									
	BH26 (0-2') (2.5-4') (5-6.5') (7.5-9') (10-11.5') (15-16.5')					<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>									

<b>Relinquished by:</b> Name: (print) <u>Oliver</u> Signature: _____ Date & Time: <u>Nov 25 / 2022</u> Method of Shipment: _____		<b>Client's Comments:</b> _____ _____		<b>Regulatory Requirements:</b> OPSS Reg. _____ Purpose for sampling: Road Base _____ Road Subbase _____ Subgrade _____ Backfill _____	
<b>Received by (Internal):</b> Name: _____ Date & Time: _____		<b>Arrival Temperature °C:</b> Laboratory Remarks: _____		Engineering Fill _____ Soil Classification _____ Other _____	



T. 905 475-7755 [fisher@fishereng.com](mailto:fisher@fishereng.com)  
15-400 Esna Park Drive • Markham, ON • L3R 3K2  
Hours: 9AM - 5PM M-F  
Call for Emergency Response

Page 2 of 2Revision 1.03 : March 2022



# FISHER ENVIRONMENTAL LABORATORIES

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FAX: 905 475-7718  
www.fisherenvironmental.com

**Client:** Town of Orangeville

**Address:**

**Tel.:**

**Email:**

**Attn.:**

**F.E. Job #:** 22-9491

**Project Name:** Geotechnical Investigation

**Project ID:** FE-P 22-12632

**Date Sampled:** N/A

**Date Received:** 25-Nov-2022

**Date Reported:** 30-Nov-2022


**Location:** 30 Centennial Road  
Orangeville, ON

## Certificate of Analysis

Analyses	Matrix	Quantity	Date Extracted	Date Analyzed	Lab SOP	Method Reference
pH	Soil	2	25-Nov-22	25-Nov-22	pH-EC-SAR F-16	SW-846, 9045D
Chloride	Soil	2	N/A	28-Nov-22	Chloride F-20	SM 4500-Cl-E
Sulphate	Soil	2	25-Nov-22	28-Nov-22	Sulphate F-21	SM 4500-SO <sub>4</sub>

Fisher Environmental Laboratories is accredited by CALA (the Canadian Association for Laboratory Accreditation Inc.) for specific parameters as required by Ontario Regulation 153/04. All analytical testing has been performed in accordance with ISO 17025 and the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act published by Ontario Ministry of the Environment.

Authorized by:

  
Roger Lin, Ph. D., C. Chem.  
Laboratory Manager



## Certificate of Analysis

<b>Analysis Requested:</b>	pH, Sulphate, Chloride
<b>Sample Description:</b>	2 Soil Sample(s)

Parameter	22-9491-1 BH22 SS2 0.76-1.22m	22-9491-2 BH26 SS2 0.76-1.22m				Soil Standards *
<b>pH (pH unit)</b>	8.31	8.44				(5-11) 5-9

\* Surface soil pH value from 5 - 9, Sub-surface soil pH value from 5-11.

## QA/QC Report

Parameter	LCS	AR	Duplicate	AR		
	<b>Absolute Difference (pH Unit)</b>					
<b>pH (pH unit)</b>	7.18	6.90-7.20	0.05	<0.3		

**LEGEND:**

LCS - Laboratory Control Sample

AR - Acceptable Range

## Certificate of Analysis

<b>Analysis Requested:</b>	pH, Sulphate, Chloride					
<b>Sample Description:</b>	2 Soil Sample(s)					
<b>Parameter</b>	<b>22-9491-1</b>	<b>22-9491-2</b>				
	BH22 SS2	BH26 SS2				
	0.76-1.22m	0.76-1.22m				
	<i>Concentration (µg/g)</i>					
<b>Chloride in Soil</b>	39.7	33.6				

< result obtained was below RL (Reporting Limit).

## QA/QC Report

Parameter	Blank	RL	LCS	AR	MS	AR
	(µg/g)		Recovery (%)		Recovery (%)	
<b>Chloride in Soil</b>	<10	10	101	70-130	100	70-130

Parameter	Duplicate	AR				
	RPD (%)					
<b>Chloride in Soil</b>	0.7	0-20				

**LEGEND:**

RL - Reporting Limit

LCS - Laboratory Control Sample

MS - Matrix Spike

AR - Acceptable Range

RPD - Relative Percent Difference

## Certificate of Analysis

<b>Analysis Requested:</b>	pH, Sulphate, Chloride
<b>Sample Description:</b>	2 Soil Sample(s)

Parameter	22-9491-1 BH22 SS2 0.76-1.22m	22-9491-2 BH26 SS2 0.76-1.22m				
<b>Sulphate (mg/kg)</b>	26.1	34.9				

## QA/QC Report

Parameter	Blank	RL	LCS/Spike	AR	Duplicate	AR
	(mg/kg)		Recovery (%)		RPD (%)	
<b>Sulphate</b>	<1	1	90	70-130	12	0-30

**LEGEND:**

RL - Reporting Limit

LCS - Laboratory Control Sample

AR - Acceptable Range

RPD - Relative Percent Difference



LAB JOB No:

9491

## STANDARD LABORATORY REQUEST FORM: CHAIN OF CUSTODY

Page 1 of 1

## CLIENT INFORMATION

 Name: Town of Orangeville  
 Contact:  
 Address: 30 Centennial

Email:

Fax:

Phone:

Fax results?

 Email results? ☒

## PROJECT INFORMATION

 Project Name: Geotechnical Investigation  
 Project ID: 22-12632  
 Sampled By: Jamal

## TURNAROUND TIME (TAT): Check ONE if all samples are the same/or see below.

STD - Standard (5-7 bus. days)	<input checked="" type="checkbox"/>	Standard Charge	Reg. Business Hrs.
3D - Three-Day (72 hrs.)	<input type="checkbox"/>	+25%	9am to 5pm
SR - Semi Rush (48 hrs.)	<input type="checkbox"/>	+50%	Samples received
R - Rush (24 hrs.)	<input type="checkbox"/>	+75%	after 2pm
SD - Same Day - 100%	<input type="checkbox"/>	+100%	are considered
			next day orders.

## BILLING INFORMATION

Purchase Order No:

Verbal Authorization:

Credit Card Type (e.g. MC/Visa/AMEX...):

Credit Card #:

Expiry Date: CW

LAB SAMPLE ID	CLIENT'S SAMPLE ID AND DESCRIPTION	SAMPLING DATE/TIME	SAMPLE MATRIX	CONTAINER NO. and TYPE	TAT (Above)	ANALYSIS REQUESTED (Check or Specify)								NOTES
						Metals	PHCs	VOCs	PAHs	PCBs	PH	SO <sub>4</sub>	CL	
	BH22 SS2 (25-4')		Soil	Bag	STD						✓	✓	✓	
	BH26 SS2 (25-4')		~	~	~						✓	✓	✓	
			</											

## Relinquished by:

Name: (print)

Signature:

Date &amp; Time:

Method of Shipment:

## Client's Comments:

## Received by (Internal):

Name:

Date &amp; Time:

## Laboratory Remarks:

## Regulatory Requirements:

## Reg. 153

Table \_\_\_\_\_

☐ Residential / Parkland

☐ Industrial / Commercial

☐ Agricultural

Soil Texture

☐ Coarse ☐ Med/Fine

## Sewer Use

☐ Sanitary

☐ Storm

Region \_\_\_\_\_

## Reg. 558

☐ TCLP

## **APPENDIX D – RFQ-2022-054**



**Fisher Engineering Limited**

Project No. FG 24-14036\_V4 March 20, 2025

Subject: Invitation to Quote - Town of Orangeville RFQ-2022-054 **Geotechnical Services**

Dear Sir or Madam:

The Town of Orangeville has a requirement to purchase **Geotechnical Services** as described in detail in the attached Request for Quotations (RFQ).

#### **Submission Deadline**

You are invited to a written Quotation to supply the above-noted services/goods by completing the attached Bidder Quotation Sheet and submitting the Quotation Sheet on the Town's bids and tenders website, or where applicable, by completing the information online, by not later than **14:00:00, (2:00:00 p.m.) EST on October 28, 2022**

The Bidding System will send a confirmation email to the Bidder advising that their bid was submitted successfully. If no confirmation email is received, Bidders should contact bids & tenders support at support@bidsandtenders.ca.

A Bid is considered to have been received when the Bid is recorded as received by the Bidding System, not the time the Bid is submitted. The time of Bid receipt shall be determined by the Bidding System's web clock. Quotations received after this time will be rejected. Please be advised that any delays caused by telecommunication lines or IT systems will be your responsibility, so you are encouraged to submit your quote well in advance of the deadline.

#### **Inquiries**

Inquiries related to this RFQ must be submitted through the Bidding System using the "Submit a Question" button associated with this specific RFQ. All responses to such requests will be provided by the Town by email to all prospective contractors. No verbal requests will be considered. The Town will accept requests up to 5 business days prior to closing. Requests received after that time may not be addressed.

If a Bidder submits their Bid prior to the issuance of Addenda, the Bidding System shall WITHDRAW the Bid and the bid status will change to an INCOMPLETE STATUS. The Bidder can view this status change in the "MY BIDS" section of the Bidding System. In such an event, the Bidder will be required to resubmit their Bid.

Sincerely,

**Charles Cosgrove**, on behalf of the Town of Orangeville

**TOWN OF ORANGEVILLE**

**REQUEST FOR QUOTATIONS NO. RFQ-2022-054**

**Geotechnical Services for property that will become the home of the new Orangeville Fire Station**

**BIDDER'S FINANCIAL QUOTATION**

**SERVICES:**

TOTAL QUOTE FOR SERVICES In Canadian Dollars			
Services	Total Number of Hours for Services	Hourly Rate	Extended Totals
To complete 35 Bore Holes as per the outlined scope of work and drawing	SEE ONLINE FORM		
TOTAL ALL-INCLUSIVE BID PRICE: <i>Prices are inclusive of shipping, travel and lodging costs unless otherwise specified below. Prices are exclusive of HST</i>			

## RFQ TERMS AND CONDITIONS

### RFQ TERMS AND CONDITIONS

1. Selection Criteria. Subject to these terms, the Town intends to enter into a Contract with the Bidder offering the lowest Total All-Inclusive Quote.
2. Language. All Quotes must be submitted in the English language.
3. Town's Reserved Rights and Privileges. The Town may: (i) reject Quotes which fail in any respect to comply with the requirements of the RFQ; (ii) reject any or all Quotes, cancel or re-issue this RFQ, in whole or in part, at any time, for any reason, without any obligation or liability whatsoever to any Bidder; (iv) award one or more Contracts in connection with this RFQ; (v) seek clarification, verify or confirm, independently or with the help of the Bidder, any or all information provided by the Bidder with respect to this RFQ; (vi) disqualify a Bidder on a ground listed in the Town's procurement policy which is available at [www.orangeville.ca](http://www.orangeville.ca); (vii) reject a Bid that is in any other language but in English; (viii) if there is only one Quote, to cancel the RFQ process and negotiate with that Bidder.
4. Contract Terms and Conditions. By responding to this RFQ, the Bidder accepts to supply the goods and services described in this RFQ pursuant to the information in this RFQ, the Bidder Quotation Sheet and the Town's General Terms and Conditions (< \$100k). The Town's General Terms and Conditions are available at [Orangeville.ca](http://Orangeville.ca) by searching "terms and conditions".

## **SCHEDULE A – SERVICE REQUIREMENTS**

\*\*\*

### **1. SERVICE SPECIFICATIONS**

The Town of Orangeville is located just outside the Greater Toronto Area and is home to 30,000 residents. It is a vibrant community located in Southern portion of Dufferin County. Currently, the Town of Orangeville is in the process of building a new fire station and as part of the process we require a Geotechnical report. The location of the new fire station is located at 30 Centennial Road, Orangeville Ontario. It is at the corner of Centennial and Commerce Road, legal description Part of Lot 23, RCP 335, Part 2 RP 7R-6688

The purpose of the soil investigation is to determine the subsurface conditions at borehole locations and from the findings at the boreholes make Geotechnical Recommendations for the following:

- Foundations
- Groundwater conditions as well as soil permeability to determine the infiltration rates for storm events, also height and ground water table etc.
- Floor slabs and permanent drainage.
- Spring constant of soil
- Excavation and ground water control
- Earth pressures
- Earthquake considerations
- Pavement design (exterior pads/slabs at apparatus bays, asphalt cross section recommendations for heavy and standard duty traffic based on soil conditions).

Note: A mark-up site plan with borehole locations based on the site, property depth and width, building and parking areas has been included with this request.

### **2. DELIVERABLES AND DELIVERY TIMELINES**

- It is intended that this Geotechnical report will be completed by mid-December, 2022

### **3. SPECIAL REQUIREMENTS**

- The Town's COVID-19 Vaccination Policy requires that all Town contractors whose personnel will have in-person interactions at Town of Orangeville facilities be fully vaccinated. Such contractors will be required to submit a declaration of their personnel's vaccination status before commencing work. For more information on the Town's COVID Vaccination Policy and to access the vaccine declaration form, visit: <https://www.orangeville.ca/en/town-hall/contractor-occupational-health-and-safety-requirements.aspx#Before-beginning-work>

- The Bidder will be required to sign and submit the Health and Safety Package prior to commencing work. The Contractor Health and Safety Package is available at [Orangeville.ca](http://Orangeville.ca) by searching “health and safety package”.
- The Bidder must carry professional liability or errors and omissions insurance.

\*\*\*



# ZONING MATRIX

ZONING REQUIREMENTS:			
ZONING CATEGORY: General Industrial (M1)			
PERMITTED USE PROPOSED: Office building/ Fire Station			
SITE AREA:		PART 2 (Fire Hall) STATISTICS	
PROPERTY AREA (3.882 ACRES)	14,902.51	160,406.30	100.00
HEAVY DUTY ASPHALT (DRIVEWAY)	2,000.51	21,533.31	15.42
LIGHT DUTY ASPHALT PAVING (PARKING)	1,044.19	11,239.57	7.00
CONC. WALKWAY (ENTRANCES, WALKWAYS, PADS)	1,550.54	16,888.87	10.40
GRAVELLED OUTSIDE TRAINING AREA	2,564.59	27,805.02	17.21
SOFT LANDSCAPING (SOOPLANTING)	5,035.25	54,108.86	33.77
BUILDING AREA (MEASURED TO EXTERIOR FACE)	2,714.93	29,223.26	18.22
GROSS FLOOR AREA:			
GROUND FLOOR GROSS FLOOR AREA OF BUILDING	2,714.93	29,223.26	
GROSS FLOOR AREA OF STORAGE/ GARAGE (REDUCTION)	1,425.40	15,342.88	
GROSS FLOOR AREA OF BUILDING (LESS REDUCTION)	1,289.53	13,880.39	
PARKING SPACE:			
1 PARKING SPACE FOR EACH 20M <sup>2</sup> OF FLOOR AREA	64	64	
H.C. STALLS 13'100 4% of total	2.56 (3)	3	
2 TYPE 'A' & 1 TYPE 'B' ACCESSIBLE STALL PROVIDED			
TOTAL PARKING STALLS (BASED ON AREA DEDUCTION)	64	64	
*H.C. STALLS PROVIDED AT 4% OF TOTAL PROPOSED PARKING STALLS			
LOADING SPACES PROVIDED:			
INDUSTRIAL LOADING SPACE @ 2,300 - 7,500m <sup>2</sup>	Required 2	Provided 2	
ZONING REQUIREMENTS:			
LOT AREA (MINIMUM)	2,000 m <sup>2</sup>	Proposed 14,902.51m <sup>2</sup>	
LOT FRONTAGE (MINIMUM)	30.0m	115.12m	
FRONT YARD - (MINIMUM) - CENTENNIAL ROAD	6.0m	17.29m	
REAR YARD (MINIMUM)	3.0m	16.83m	
EXTERIOR SIDE YARD (MINIMUM) - COMMERCE ROAD	3.0m	49.28m	
INTERIOR SIDE YARD (MINIMUM) - WEST LOT LINE	3.0m	21.12m	
HEIGHT (MAXIMUM)	18.0m	23.39m*	
LOT COVERAGE (MAXIMUM)	60%	18.22%	
LANDSCAPE OPEN SPACE (MINIMUM)	10%	33.77%	
*H.S. PER BY-LAW REFERENCE SECTION 5.13 - REGARDING HEIGHT EXCEPTION FOR THE CLOCK TOWER			

Firm Name : Alaimo Architecture Inc. Certificate of Practice Number : 4995 Unit 2A, 27 Roytec Rd., Vaughan, Ontario Woodbridge, Ontario, L4L 8E3 Name of Project : Town of Orangeville Fire Hall Location : 30 Centennial Road, Orangeville, Ontario									
Item	Ontario's 2012 Building Code Data Matrix Part 3 or 9							B C Reference	
1	Project Description :			<input checked="" type="checkbox"/> New <input type="checkbox"/> Addition <input type="checkbox"/> Alteration	<input type="checkbox"/> Part 11 11.1 to 11.4	<input checked="" type="checkbox"/> Part 3 1.1.2, [A]	<input type="checkbox"/> Part 9 1.1.2, [A] & 9.10.1.3		
	New Industrial Building <input type="checkbox"/> Change of Use								
2	Major Occupancy(s) BUILDING CLASSIFICATION: 3.2.2.79 GROUP F, DIVISION 3, UP TO 2 STORIES, SPRINKLERED MAJOR OCCUPANCIES: F-3 STORAGE GARAGE (APPARATUS BAY & ANCILLARY ROOMS) MAJOR OCCUPANCIES: GROUP D (ALL OTHER ROOMS)					3.1.2.1, (1)	9.10.2		
3	Building Area (sq.m.) :  PROPOSED F-3/D Existing 0.00 s.m. Proposed 2,714.93 s.m. Total Building: 2,714.93 s.m. 0.00 s.f. 29,223.26 s.f. 29,223.26 s.f. 100.00 % 100.00 %					1.4.1.2 [A]	1.4.1.2 [A]		
4	Net Building Area (sq.m.) Total 2695.00 s.m.					1.4.1.2 [A]	1.4.1.2 [A]		
5	Number of Storeys Above grade 1 Below grade 0					1.4.1.2 [A] & 3.2.1.1	9.10.4		
6	Number of Streets/Fire Fighter Access 3					3.2.2.10 & 3.2.5.	9.10.20		
7	Building Classification GROUP F DIVISION 3 - 3.2.2.79					3.2.2.20 - .83	9.10.2		
8	Sprinkler System Proposed <input checked="" type="checkbox"/> Entire building <input type="checkbox"/> Selected Compartments <input type="checkbox"/> Selected Floor Areas <input type="checkbox"/> Basement <input checked="" type="checkbox"/> In Lieu of Roof Rating <input type="checkbox"/> Not Required					3.2.2.20 - .83 3.2.1.5 3.2.2.17 INDEX	9.10.8.2 9.10.8.2 INDEX		
9	Standpipe required <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					3.2.9	N/A		
10	Fire Alarm required <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					3.2.4	9.10.18		
11	Water Service/Supply is Adequate <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No					3.2.5.7	N/A		
12	High Building <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					3.2.6	N/A		
13	Construction Restrictions <input type="checkbox"/> Combustible permitted <input type="checkbox"/> Non-combustible required <input checked="" type="checkbox"/> Both					3.2.2.20 - .83	9.10.6		
	Actual Construction <input type="checkbox"/> Combustible <input checked="" type="checkbox"/> Non-combustible <input type="checkbox"/> Both								
14	Mezzanine(s) Area (sq.m.) N/A					3.2.1.1 (3) - (8)	9.10.4.1		
15	Occupant load based on Prop. Bldg. <input type="checkbox"/> sq.m. / person <input checked="" type="checkbox"/> design of building Occupancy: F-3/D Load: 58					3.1.17	9.8.1.3		
16	Barrier-free Design <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No (Explain)					3.8	9.5.2		
17	Hazardous Substances <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					3.3.1.2 & 3.3.1.19	9.10.1.3 (4)		
18	Required Fire Resistance Rating (FRR)		Horizontal Assemblies FRR (Hours)		Listed Design No. or Description (SB-2)		3.2.2.20 - .83 & 3.2.1.4	9.10.8 & 9.10.9	
Floors N/A Hours									
Roof N/A Hours									
Mezzanine N/A Hours									
FRR of Supporting Members			Listed Design No. or Description (SB-2)						
			Floors N/A Hours						
			Roof N/A Hours						
			Mezzanine N/A Hours						
20	Plumbing Fixture Requirements Male/Female Count @ 50 % / 50 % Except as noted otherwise.  Occupancy: Group D  Note: Building contains 9 Unisex Washrooms & 2 Unisex Universal Washroom			Occupant Load 58	BC Table Number 3.7.4.7.	Fixtures Required 3/3	Fixtures Provided 9 Unisex + 2 Universal	3.7.4.2 - 3.7.4.8.	
21	Spatial Separation - Construction of Exterior Walls								
	Wall	Area of EBF (m2)	L.D. (m)	U/H or H/L	Max. Permitted % of Openings	Proposed % of Openings	F.R.R. (hrs.)	Comb. Constr.	
	North	565.27	26.79 C/L ST.	N/A	100	23.60	N/A	No	
	South	523.28	49.28	N/A	100	26.16	N/A	No	
	East	452.44	27.10 C/L ST.	N/A	100	13.22	N/A	No	
	West	611.19	21.63	N/A	100	7.83	N/A	No	



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This Drawing Is Not To Be Used For Construction Until Signed By The Architect.

No	Revision	Date

## Client Authorization

I hereby authorize the Architect & their Consultants to commence with the "Design Development" based on the layout & intent shown herein.

Town of Orangeville  
Orangeville Fire Services Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Town of Orangeville  
Community Services Signature: \_\_\_\_\_ Date: \_\_\_\_\_

9	CLIENT REVIEW	JULY 22, 2022
8	CLIENT REVIEW	JULY 04, 2022
7	CLIENT REVIEW	JUNE 23, 2022
6	CLIENT REVIEW	JUNE 14, 2022
5	CLIENT REVIEW	MAR 22, 2022
4	CLIENT REVIEW	MAR 04, 2022
3	CLIENT REVIEW	MAR 01, 2022
2	CLIENT REVIEW	JAN 31, 2022
1	CLIENT REVIEW	JAN 21, 2022
No	Issued For:	_____ Date: _____

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F: (905) 856-4912  
info@alaimoarchitecture.com

## Drawing Title

SITE PLAN, ZONING  
STATISTICS, AND OBC  
DATA MATRIX

## Project

TOWN OF ORANGEVILLE  
FIRE HALL PROJECT  
30 CENTENNIAL ROAD, ORANGEVILLE, ONTARIO

1 : 250  
S.P.  
F.A.  
2021-020  
2022-07-22

03 OF 04

DD-2C



**RFQ-2022-054 - Geotechnical Services**

The Town of Orangeville is located just outside the Greater Toronto Area and is home to 30,000 residents. It is a vibrant community located in Southern portion of Dufferin County. Currently, the Town of Orangeville is in the process of building a new fire station and as part of the process we require a Geotechnical report. The location of the new fire station is located at 30 Centennial Road, Orangeville Ontario. It is at the corner of Centennial and Commerce Road, parcel ID number 221403001904120, legal RCP 335 Pt Lot 23 RP, description 7R5642 Part 1.

The purpose of the soil investigation is to determine the subsurface conditions at borehole locations and from the findings at the boreholes make Geotechnical Recommendations.

Schedule of Prices

\*Denotes a "MANDATORY" field

Total Quote for Services in Canadian Dollars

To complete 35 Bore Holes as per the outlined scope of work and drawing.

Line Item	Services	Total Number of Hours for Services *	Hourly Rate *	Extended Price
1	To complete 35 Bore Holes as per the outlined scope of work and drawing			
Subtotal:				

## Addenda, Terms and Conditions

1. Selection Criteria. Subject to these terms, the Town intends to enter into a Contract with the Bidder offering the lowest Total All-Inclusive Quote.
2. Language. All Quotes must be submitted in the English language.
3. Town's Reserved Rights and Privileges. The Town may: (i) reject Quotes which fail in any respect to comply with the requirements of the RFQ; (ii) reject any or all Quotes, cancel or re-issue this RFQ, in whole or in part, at any time, for any reason, without any obligation or liability whatsoever to any Bidder; (iv) award one or more Contracts in connection with this RFQ; (v) seek clarification, verify or confirm, independently or with the help of the Bidder, any or all information provided by the Bidder with respect to this RFQ; (vi) disqualify a Bidder on a ground listed in the Town's procurement policy which is available at [www.orangeville.ca](http://www.orangeville.ca); (vii) reject a Bid that is in any other language but in English; (viii) if there is only one Quote, to cancel the RFQ process and negotiate with that Bidder.
4. Contract Terms and Conditions. By responding to this RFQ, the Bidder accepts to supply the goods and services described in this RFQ pursuant to the information in this RFQ, the Bidder Quotation Sheet and the Town's General Terms and Conditions (< \$100k). The Town's General Terms and Conditions are available at [Orangeville.ca](http://Orangeville.ca) by searching "terms and conditions".



I/WE have authority to submit this bid on behalf of the Bidder.

The Bidder shall declare any potential conflict of interest that could arise from bidding on this Bid. Do you have a potential conflict of interest?

☒ **Yes**   ☐ **No**

The Bidder acknowledges and agrees that the addendum/addenda below form part of the Bid Document

Please check the box in the column "**I have reviewed this addendum**" below to acknowledge each of the addenda.

File Name	I have reviewed the below addendum and attachments (if applicable)	Pages
There have not been any addenda issued for this bid.		

## **APPENDIX E – SHEAR WAVE VELOCITY TESTS RESULTS**





**FRONTWAVE**  
G E O P H Y S I C S

**SHEAR WAVE VELOCITY TESTING  
FOR SEISMIC SITE CLASSIFICATION**  
30 CENTENNIAL ROAD, ORANGEVILLE, ONTARIO

Submitted to:

**Fisher Engineering Limited**  
15-400 Esna Park Drive  
Markham, Ontario L3R 3K2

Attention:

Mr. Clive Wiggan

Email: [Clive@fishereng.com](mailto:Clive@fishereng.com)

---

**File No. F-25289**

**March 18, 2025**

Frontwave Geophysics Inc.  
Brampton, ON  
(647) 514-4724  
[www.frontwave.ca](http://www.frontwave.ca)

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## 1 INTRODUCTION

Frontwave Geophysics Inc. was retained by Fisher Engineering Limited to carry out a geophysical investigation for the proposed development at 30 Centennial Road in Orangeville, Ontario.

The objective of the survey was to determine site designation for seismic site response based on average shear wave velocity value measured in the upper 30 m ( $V_{s30}$ ). The multi-channel analysis of surface waves (MASW) method was used to obtain shear wave velocity profile.

The fieldwork was conducted on March 12, 2025. The location of the MASW survey line is shown in Figure 1.

This report describes the basic principles of MASW, survey design, interpretation method, and presents the results of the investigation in the chart and table format.

## 2 INVESTIGATION METHODOLOGY

### Overview

The Multi-channel Analysis of Surface Waves (MASW) is a seismic method widely applied to produce shear wave velocity ( $V_s$ ) profiles. It is based on the dispersive nature of Rayleigh or Love surface waves in layered media. Surface waves with longer wavelengths propagate deeper in the subsurface, hence, their phase velocity is more influenced by the elastic properties of deeper layers. The velocity of surface waves depends mainly on the shear wave velocity of the medium. The distribution of surface waves phase velocities as a function of wavelength (or frequency) can be visualized as a dispersion curve. The inverse problem is then solved by modelling the experimental data with a theoretical dispersion curve; the model parameters are typically limited to layer thickness and shear wave velocity with an assumption of horizontally layered strata. As a result of the inversion, a shear wave velocity depth profile is obtained. Figure 2 illustrates the overall procedure of the MASW method.

Two approaches different in data acquisition and processing can be implemented. The active method involves using artificial sources (e.g., sledgehammer, drop weight) to generate seismic energy, whereas the passive method utilizes energy generated by natural sources (wind, waves, microseismicity) and human activities (mostly vehicle traffic). The energy that can be generated with easily accessible active sources such as sledgehammers is typically concentrated within a relatively high frequency range, and the maximum depth of penetration for active surveys is limited to approximately 15-30 m, depending on the mass of the source and geology of the site. Ambient vibrations registered with the passive acquisition are usually of lower frequency and provide better resolution at greater depths. When survey logistics allow, the active and passive source methods are combined for obtaining well-resolved dispersion images over a wide frequency range, thus increasing the depth of investigation while retaining high resolution at shallow depths.





Legend



Location of MASW survey line  
(69 m geophone spread)

Image: Google Earth 2023

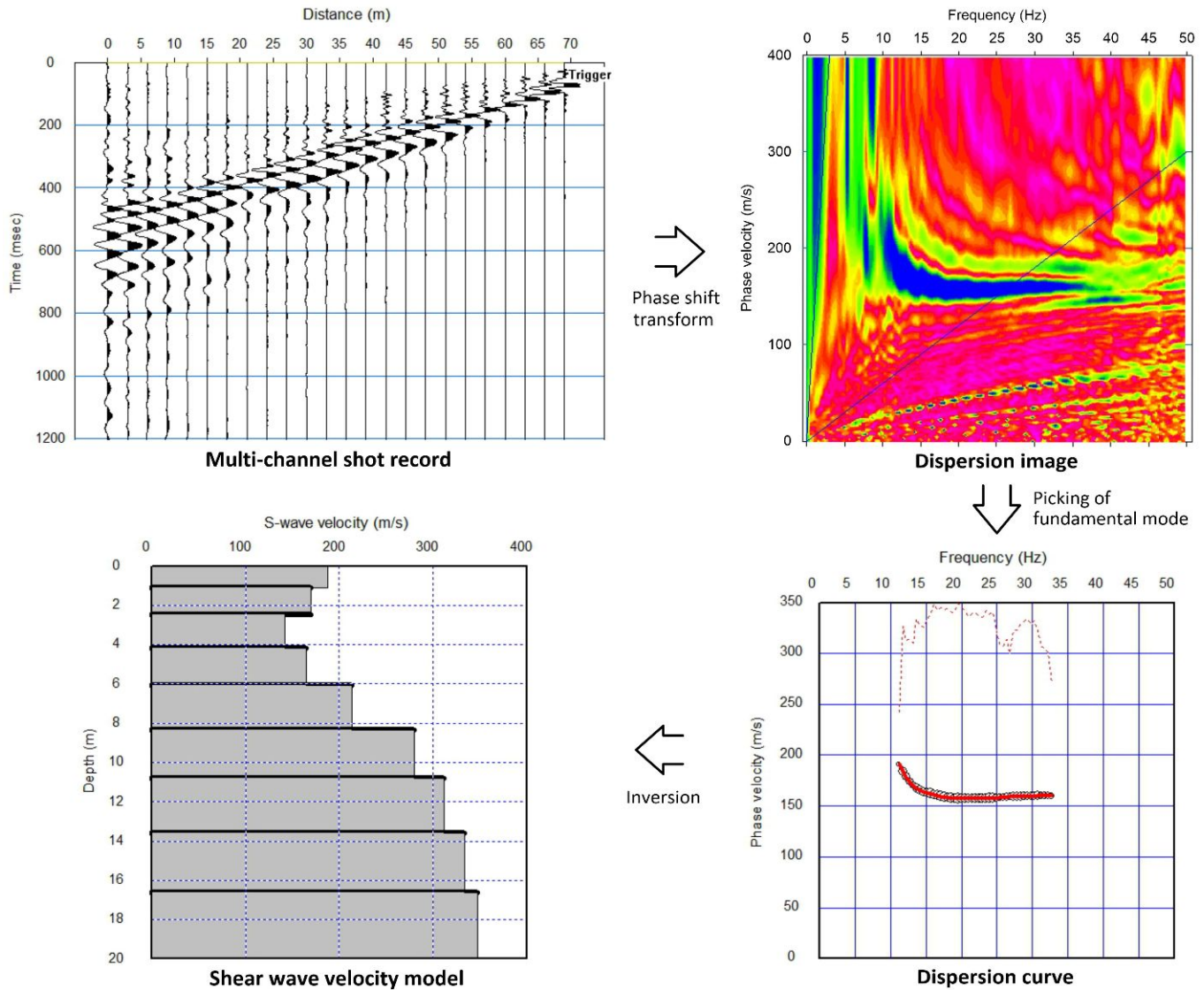
Date: 2025-03-18

File No: F-25289

Title: Survey location plan

Location: 30 Centennial Rd  
Orangeville, ON

Figure:  
**1**



**Figure 2** The procedure of MASW data processing using the SeisImager SW software package.

### Survey Design

The acquisition layout consisted of 24 receivers in a linear array (spread), connected with a multicore cable to a DAQLink 4 seismograph. 4.5 Hz natural frequency vertical geophones were used for this survey. To optimize sampling of different wavelengths, two sets of measurements were conducted with spread lengths of 23 m and 69 m (1 m and 3 m spacing between geophones, respectively). Data collected with longer spreads provide a greater depth of investigation, whereas data collected with shorter geophone spacings ensure better resolution in the uppermost few meters of the subsurface.

An 8-kg sledgehammer was used as an energy source for active acquisition. Shots were executed at five locations per spread: two shots close to the ends of the spread, one shot in the middle of

the spread, and two shots with an offset of 25 m from the ends of the spread. A total of 10 shot records was collected. The record length was set to 1500 ms with a 0.05 ms sampling interval.

For passive acquisition, a linear 24-channel array with 3 m spacing between geophones was used. Ambient wavefield was recorded for 10 minutes with a sampling interval of 2 ms.

### Interpretation

A dispersion curve is obtained from each field record by converting the shot gather into a dispersion image and then identifying and picking the fundamental mode. A shear wave velocity profile is obtained through inversion of the dispersion curve by modelling the subsurface as a horizontally layered medium with the model parameters limited to the number of layers, their thickness and shear-wave velocity.

SeisImager SW software package was used for processing, picking and inversion of the MASW data.

Some variability among the dispersion curves and resulting models obtained from different shot records is always observed due to lateral velocity variations, near and far field effects, different signal-to-noise ratio, etc. Combining independent inversion results from multiple shot records improves the estimation of the actual shear wave velocity and provides an assessment of uncertainty. The results of the interpretation are presented in the form of the average shear wave velocity profile; the observed variability of the MASW data is reported as upper and lower bound velocity profiles.

### Accuracy of the results

The accuracy of MASW generally depends on the complexity of the subsurface and specific site conditions (noise levels, topography, etc.). Lateral velocity variations and steeper bedrock topography increase the dispersion uncertainty. The presence of high velocity contrast layers such as bedrock will require the use of a-priori information to optimize model parameters for more accurate results. Hence, if the a-priori information is not available (e.g. when the data are overly noisy to carry out refraction analysis), the accuracy decreases.

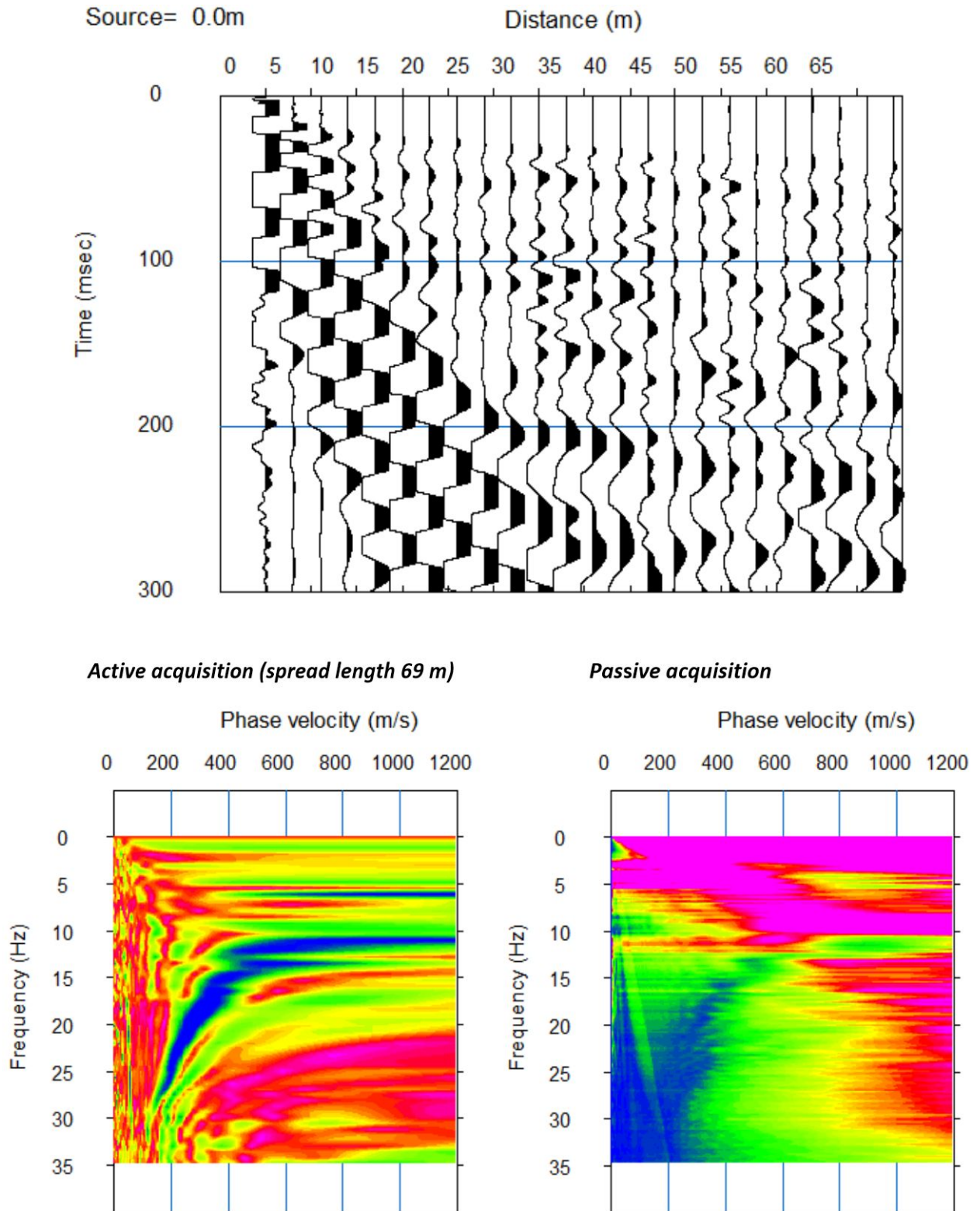
The uncertainty of the resulting S-wave velocity depth profile is evaluated using the upper and lower bound velocity profiles. Typically, the error margin of average  $V_{s30}$  value determined from MASW is within  $\pm 10\%$ .

## **3 RESULTS**

The collected surface wave data were of fair quality; overall, the dispersion images of active and passive data covered a frequency range of approximately 11 to 45 Hz. Example shot record and MASW dispersion images obtained at this site are presented in Figure 3.

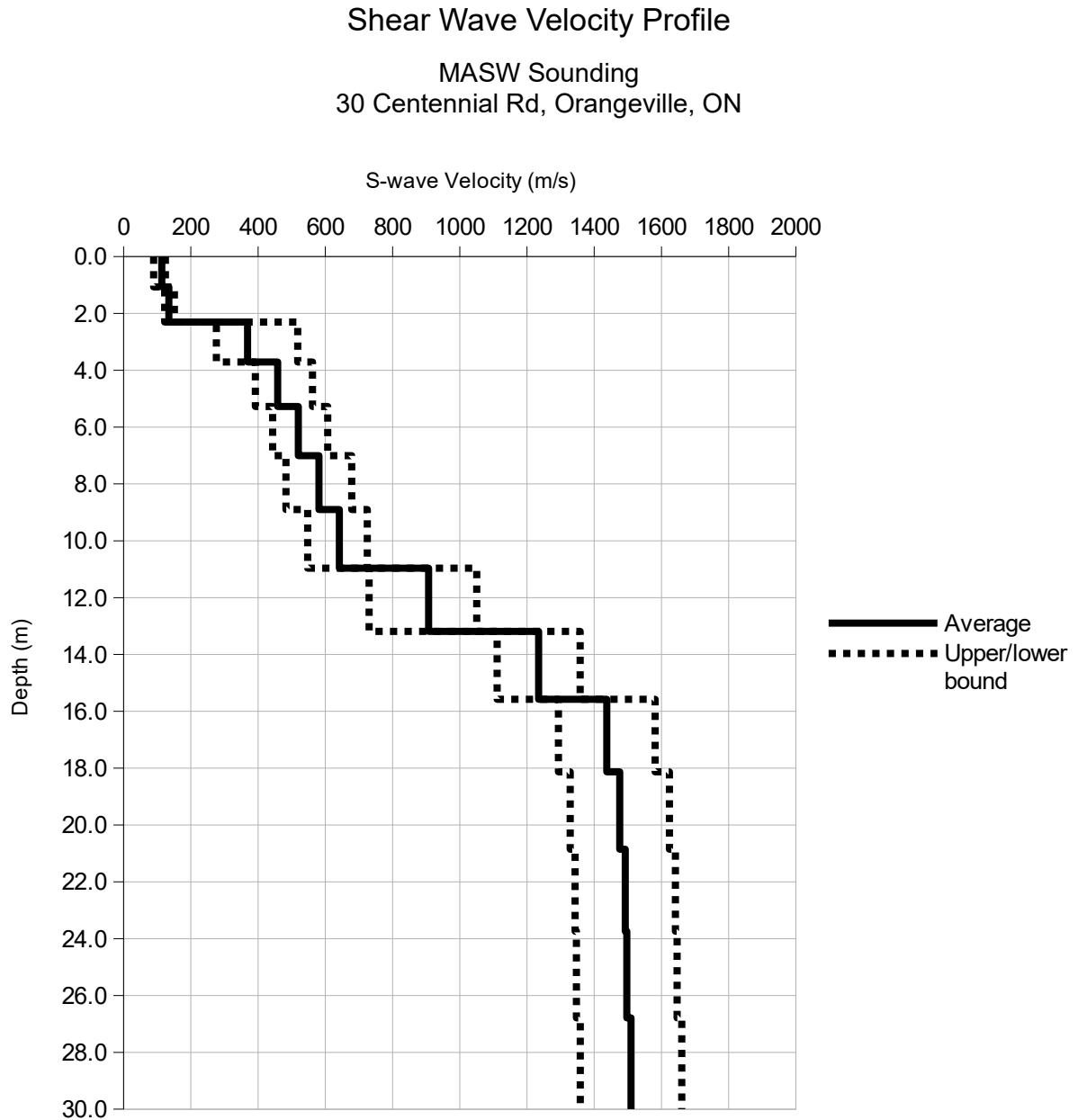
Seismic refraction analysis indicated the presence of a high-velocity layer at a depth of approximately 1.5-2 m. Apparent compressional (P) wave velocity measured in this layer was 2200-2600 m/s. The depth to bedrock at this site could be approximately 10-13 m. P-wave velocity measured in the bedrock was 4220 m/s.





**Figure 3** Example shot record (top) and MASW dispersion images (bottom).

The results of the MASW sounding are presented in Figure 4. The average shear wave velocity profile from the active shot records and passive data is plotted in the chart as a solid line. The dashed lines represent the upper and lower bound S-wave velocity profiles.



**Figure 4** Shear wave velocity profile from MASW sounding.

The tabulated shear wave velocity model is presented in Table 1.

**Table 1** *Shear wave velocities from MASW sounding.*

Depth Interval (m)		S-wave Velocity (m/s)
From	To	
0.0	1.1	113
1.1	2.3	135
2.3	3.7	369
3.7	5.3	458
5.3	7.0	520
7.0	8.9	581
8.9	11.0	642
11.0	13.2	907
13.2	15.6	1235
15.6	18.1	1437
18.1	20.9	1476
20.9	23.7	1492
23.7	26.8	1497
26.8	30.0	1509

The average shear wave velocity within the upper 30 meters ( $V_{s30}$ ) is defined as the travel-time weighted average velocity from surface to a depth of 30 m and calculated using the following formula:

$$V_{s30} = 30 / \Sigma (d/V_s),$$

where  $d$  is the thickness of any layer and  $V_s$  is the layer S-wave velocity. In other words,  $V_{s30}$  is calculated as 30 m divided by the sum of the S-wave travel times for each layer within the topmost 30 m.

The calculated  $V_{s30}$  values are presented in Table 2.

**Table 2**  *$V_{s30}$  values from MASW sounding.*

Depth Range (m)	Minimum $V_{s30}$ (m/s)	Average $V_{s30}$ (m/s)	Maximum $V_{s30}$ (m/s)	NBC 2020 Site Designation
0 to 30	510	<b>603</b>	689	<b>X<sub>603</sub></b>

The  $V_{s30}$  values obtained from the MASW sounding varied from 510 m/s to 689 m/s with an average of 603 m/s.

Based on Sentence 4.1.8.4.(2b) of the National Building Code of Canada 2020 (NBC 2020), the **Site Designation** is **X<sub>603</sub>**.

#### 4 CLOSURE

Shear wave velocity testing involving the multi-channel analysis of surface waves (MASW) method was carried out for the proposed development at 30 Centennial Road in Orangeville, Ontario.

The average shear wave velocity ( $V_{s30}$ ) value calculated from in situ shear wave velocity measurements was **603 m/s**. Based on Sentence 4.1.8.4.(2b) of the National Building Code of Canada 2020 (NBC 2020), the applicable **Site Designation** is **X<sub>603</sub>**.

We hope you find this report satisfactory. Should you have any questions or require additional information, please do not hesitate to contact the undersigned.

**Frontwave Geophysics Inc.**



**Ilia Gusakov, P.Geo.**

Geophysicist

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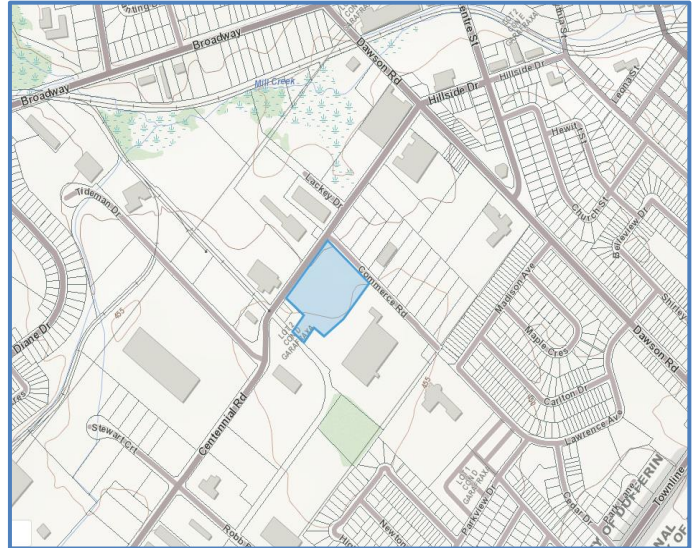
ENGINEERING



LABORATORY



## WATER BALANCE ANALYSIS



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**Prepared for:**

**Town of Orangeville**



Integrated solutions since 1969

Project No. FH24-14037V1

July 26, 2024

Revised June 24, 2025



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## 1.0 INTRODUCTION

Fisher Engineering Limited (Fisher) was commissioned by the Town of Orangeville to conduct a Water Balance Analysis in support of the proposed new fire station at 10 Commerce Road (Part of lot 23, RCP 335, Part 2 RP 7R-6688), in Orangeville, Ontario, herein referred to as the “Site”.

*The report was updated to reflect changes to the site plan and to include post-development mitigation measures as outlined in Section 3.4.3.*

### 1.1 Objective

The purpose of the Water Balance Analysis was to assess the impact of the proposed development on the hydrological characteristics of the Site by evaluating the changes in runoff and infiltration volumes that may be associated with the proposed development.

### 1.2 Scope of Work

The water balance analysis comprised:

- A review of the Site geology, surface water and groundwater conditions from previous investigations,
- Review of historical data relating to precipitation and temperature from the CVSPA,
- Assessment of runoff, infiltration and evapotranspiration from assumed pre-development and post-development conditions, and
- Preparation of a summary report with recommendations.

## 2.0 SITE AND PROJECT DESCRIPTIONS

### 2.1 Site Location

The Site is located at the southwest corner of the intersection of Centennial Road and Commerce Road in a predominantly industrial/commercial area (Orangeville Business Park) west of Dawson Road in Orangeville, Ontario. The site is bounded generally by Commerce Road to the east, beyond which is Georgian College Orangeville Campus, an industrial building to the south (The Taylor Group), an empty lot to the west, beyond which is a Railway Spur, and Centennial Road to the north. The site has an approximate area of 14,902.51m<sup>2</sup> and was vacant during the investigation. Site and Location Plans are presented in Appendix A.



## 2.2 Hydrological Conditions

The Site is located in the Credit Valley Source Protection Area. According to the approved Source Protection Plan (April 19, 2024), the Site is not located in a Wellhead Protection Area for Quality but is in a WHPA-Q1/Q2 – indicating that this is a ‘Significant Risk Level area’. WHPA – Q1/Q2 are the areas where groundwater usage and changes in the ability for groundwater to recharge the aquifer could affect the quantity of water available. In the WHPA-Q1/Q2 areas, significant drinking water quantity threats include:

- Activities that take water from an aquifer but do not return water to the same aquifer, and
- Activities that decrease the recharge to an aquifer – if water cannot soak into the ground to replenish the water supply, the long-term yield of the water supply is impaired. Examples of activities that impair water recharge include any conversion of land to an impervious surface (e.g., paving new parking lots, building/construction activities and new land use developments).

The property is not located in any of the following as shown on the Source Protection Map in Appendix B:

- Wellhead Protection Area (WHPA-A to WHPA-D),
- Wellhead Protection Area (WHPA-E),
- Intake Protection Zone,
- Issue Contributing Area,
- Highly Vulnerable Aquifer,
- Event Based Area,
- Intake Protection Zone (1, 2, 3)

## 2.4 Other Investigations

Concurrent to the Water Balance Analysis, Fisher conducted a Geotechnical Investigation and infiltration tests and submitted reports under Project No. FG24-14036 & FG24-14044. Forty-three (43) boreholes were advanced to depths from 1.98m to 8.08m below prevailing grade. The subsurface investigations showed that the soils comprise primarily of 4” (0.10m) to 24” (0.61m) of topsoil, underlain by fill extending to depths of between 0.53m and 2.35m. The fill soils were followed by native silty sand to sandy silt/sand in some areas to depths of 1.07m to 2.90m bgs with silt/clayey silt observed to depths of 2.90m to 6.86m. Brownish grey/grey silt was observed beneath the brown/reddish brown silt extending to depths varying from 5.49m to 6.86m. A layer of brown/reddish brown and/or grey silty sand to sandy silt till was encountered extending to depths of between 7.72m and 8.08m bgs with grey sand in some areas. Three (3) test holes were used to carry out infiltration tests in support of proposed infiltration-based LID facilities.



The Site slopes more than 6m in a northerly direction with elevation changing from 456.94m to 450.04m as shown on the topographic survey plan for the Site.

### 3.0 WATER BALANCE ANALYSIS

#### 3.1 Proposed Development

The proposed development will consist of the construction of a single-storey fire hall to be located towards the front/north to middle-east portion of the Site. The remaining portion of the site will be covered by asphalt paved driveways/parking, landscaping, concrete pads/paved areas and outdoor training areas (gravel area). Site Location Plan, conceptual Site Plan along with Pre- and Post-development Site Plans are presented in Appendix A.

#### 3.2 Climate and Precipitation

Site-specific climatic data from the Credit Valley Conservation Authority (CVC) - CVSPA Water Balance Tool were used to determine the impact of the proposed development on the hydrological regime at the Site. The CVC Water Balance Tool averages Precipitation, Evapotranspiration, Runoff and Recharge (Infiltration) for a specific location based on outputs from the numerical models developed under the Drinking Water Source Protection Program. Average annual CVSPA data for the site are presented in Table 1.

**Table 1. Annual climate data from CVSPA Water Balance Tool**

Location			Precipitation (P) mm/yr	Evapotranspiration (ET)	Runoff (R) mm/yr	Recharge (I) mm/yr
Longitude	Latitude	Elevation, m asl				
-80.107775	43.911245	453	794*	166	532	101

\* It should be noted that, although not having a significant impact on the results, the summation of ET, R and I is not exactly equal to P. This is reflected in the water balance calculations.



### 3.3 Site-Level Water Balance

A Site scale water balance analysis was conducted following the Thornthwaite and Mather (1957) water balance method as outlined in Chapter 3 of the MOECC's SWM Planning and Design Manual (MOECC, 2003). The method accounts for water in the hydrological cycle. Specifically, precipitation (**P**) occurs as rain and snow and can run off towards lakes and streams (**R**), infiltrate to the groundwater table (**I**) or evaporate from surface water and vegetation (**ET**). When long-term average values of **P**, **R**, **I** and **ET** are evaluated, there is negligible change to groundwater storage (**ΔS**).

The annual water budget can therefore be stated as:

$$P = ET + R + I + \Delta S \quad \text{Equation 1}$$

Where:

- P = precipitation in mm/year
- ET = evapotranspiration in mm/year
- R = runoff in mm/year
- I = infiltration in mm/year and
- ΔS = change in groundwater storage in mm/year (taken as zero)

### 3.4 Precipitation, Evapotranspiration, Infiltration and Runoff

The average annual precipitation for the Site area is 794 mm/year with an adjusted potential evapotranspiration of 166 mm/year giving a water surplus of  $794 - 166 = 628$  mm/year. This surplus makes up the infiltration and runoff components of the water budget.

The infiltration rate (which can be broadly referred to as the groundwater recharge) at the Site is however expected to vary based on a number of factors as considered in the infiltration model. The calculated infiltration and runoff volumetric rates in the pre-development and post-development stages are presented in the water balance calculations at Appendix C and are discussed below.

#### 3.4.1 Pre-development

Based on the water balance analysis of the pre-development conditions, infiltration and runoff comprised approximately 79.7% of the total precipitation.



### 3.4.2 Post-development without Mitigation Methods

The proposed development, without the implementation of mitigation methods, is expected to cause the following:

1. Reduction of infiltration by 811 m<sup>3</sup>/yr,
2. Reduction of evapotranspiration by 58 m<sup>3</sup>/yr and
3. Increased total runoff by 829 m<sup>3</sup>/yr.

The proposed development, without the implementation of mitigation methods, is expected to cause a reduction in infiltration as a percentage of total precipitation to 6.9%. Total runoff is expected to increase to 73.0% of total precipitation before any mitigation measures are applied.

Attempts should therefore be made to implement suitable mitigation measures, and or enhance stormwater management plans, to reduce the post-development impact on the water recharge. These measures should be aimed at reducing the worse case of **811 m<sup>3</sup>/yr** development induced infiltration deficit.

### 3.4.3 Post-development with Mitigation Methods

It is understood that, as part of the stormwater management system, 833m<sup>3</sup> of water will be retained on site to be infiltrated into the underlying soils. The volume will be stored within the proposed XERXES underground storage chambers below the outlet elevation and within the bio-retention swale along the northwest property line. Water balance calculations are presented in Section 3.2.3, Quality/LID implementation, of the Storm Water Management Report prepared by Hallex Engineering, dated June 24th, 2025.

Based on the preceding, a total of 833 m<sup>3</sup>/year of water will be infiltrated into the ground to mitigate against the development induced reduction in recharge.

## 4.0 DISCUSSION AND RECOMMENDATIONS

The proposed construction of a fire hall and associated infrastructure, without mitigation methods, will impact the hydrological conditions at the Site mainly in the form of **increased runoff and reduced infiltration** and evapotranspiration. Low impact development methods are proposed to mitigate against the development induced increase in runoff and reduced infiltration rates on the Site.



## 5.0 CLOSURE

We trust that the information contained in this report is complete within our terms of reference. If you have any questions or require further information, please do not hesitate to contact our office.

Sincerely,

**Fisher Engineering Ltd.**



Dave Fisher, C. Chem., P. Eng.,  
President  
[dave@fishereng.com](mailto:dave@fishereng.com)



Clive Wiggan, PhD., PMP. P.Eng.,  
Project Manager  
[Clive@fishereng.com](mailto:Clive@fishereng.com)



## 6.0 REFERENCES

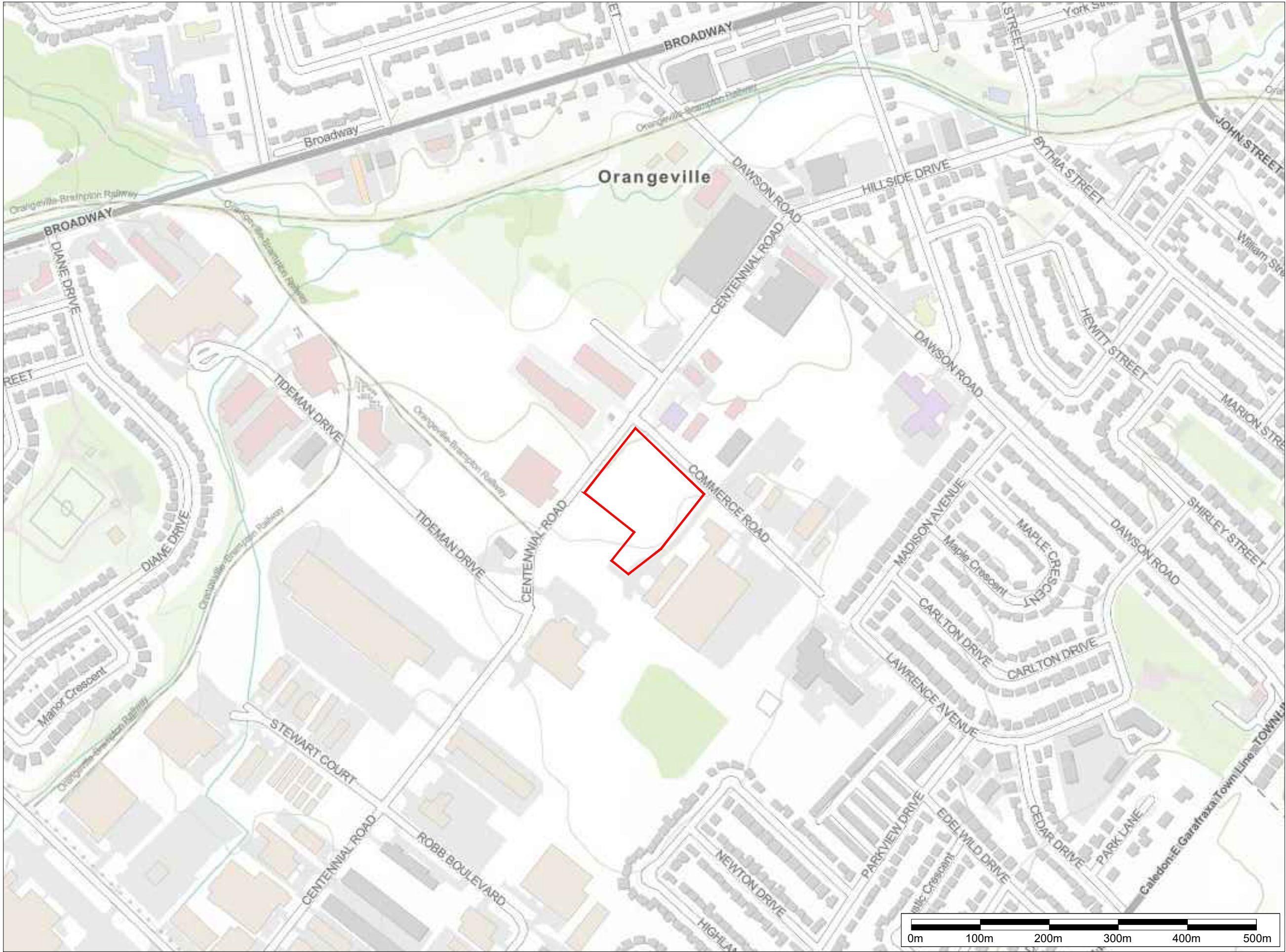
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## **APPENDIX A – SITE LOCATION AND DEVELOPMENT SITE PLANS**

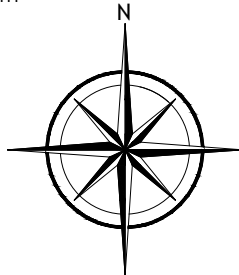




400 Esna Park Dr., #15  
Markham, Ontario  
L3R 3K2

Tel: 905 475-7755

NORTH



LEGEND

— SITE BOUNDARY

PROJECT NAME AND ADDRESS

# WATER BALANCE

10 Commerce Road,  
Orangeville, ON

FIGURE A1:

SITE LOCATION MAP

PROJECT NO.

FE 24-14037

DATE

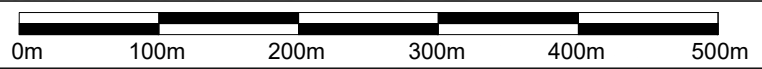
17 July, 2024

SCALE

AS SHOWN

SHEET NO.

A1

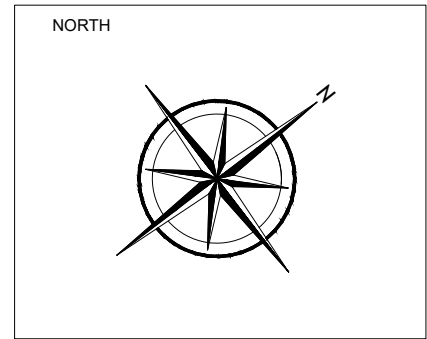






400 Esna Park Dr., #15  
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LEGEND

— SITE BOUNDARY

PERVIOUS AREA

PROJECT NAME AND ADDRESS

**WATER BALANCE**

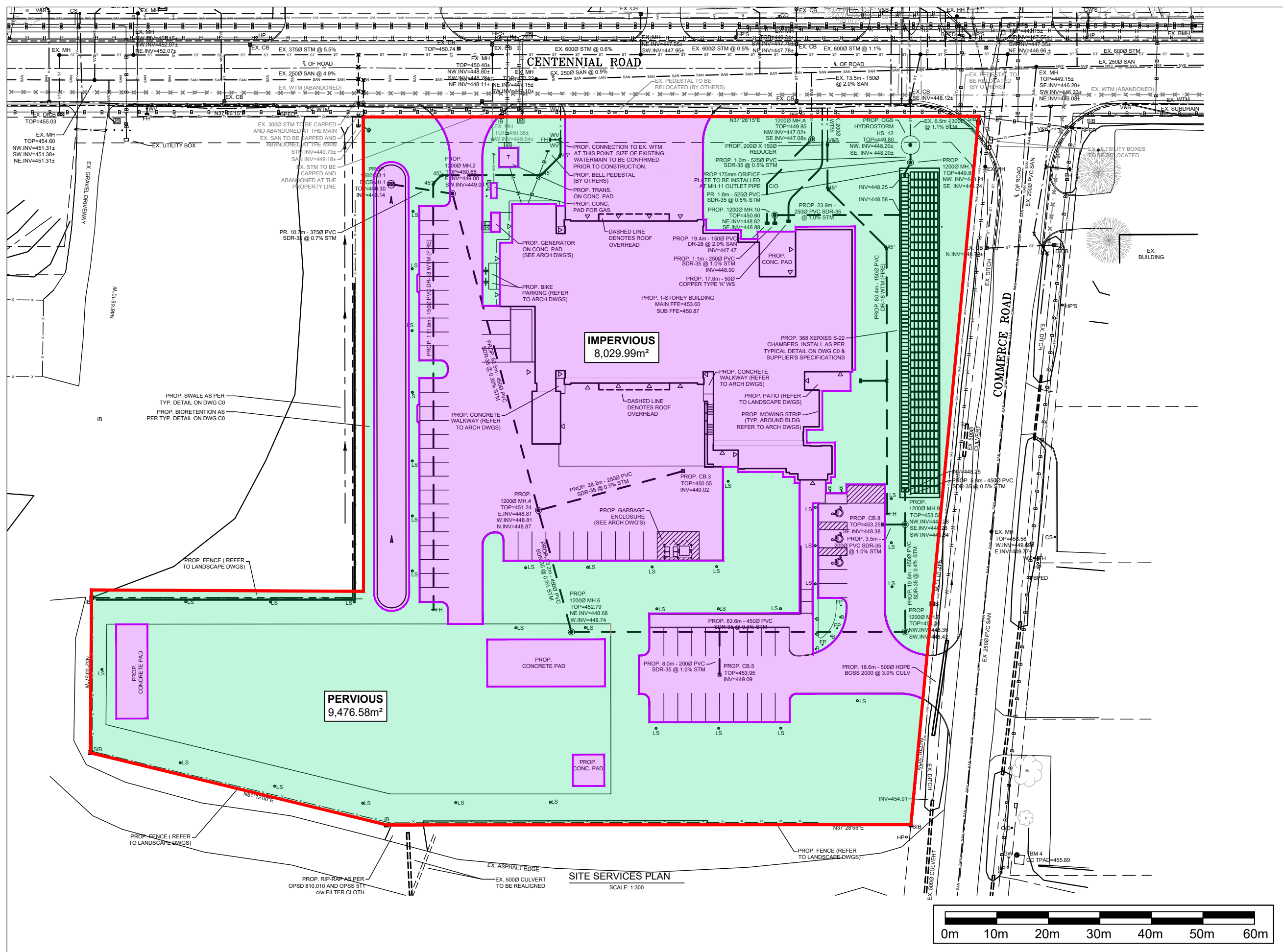
10 Commerce Road,  
Orangeville, ON

FIGURE A2:

**PRE-DEVELOPMENT SITE**

PROJECT NO. FE 24-14037	SHEET NO.  <b>A2</b>
DATE 17 July, 2024	
SCALE AS SHOWN	

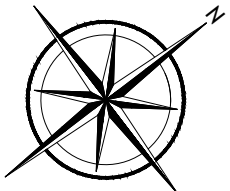




400 Esna Park Dr., #15  
Markham, Ontario  
L3R 3K2

Tel: 905 475-7755

NORTH



LEGEND

- SITE BOUNDARY
- IMPERVIOUS AREA
- PERVIOUS AREA

PROJECT NAME AND ADDRESS

WATER BALANCE

10 Commerce Road,  
Orangeville, ON

FIGURE A3:

POST-DEVELOPMENT SITE

PROJECT NO.

FE 24-14037

DATE

17 July, 2024

SCALE

AS SHOWN

SHEET NO.

**A3**

# CENTENNIAL ROAD

# COMMERCE ROAD

1 SITE PLAN ENLARGED-NORTH  
SCALE: 1 : 150

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No.	Issued For	Date
1	Issued for COA	07 May 2025



Development File Number  
D 00-000

alaimo architecture inc.

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Woodbridge, ON L4L 9R4  
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info@alaimoarchitecture.com

Drawing Title  
**SITE PLAN ENLARGED  
NORTH**

Project  
**TOWN OF ORANGEVILLE  
FIRE STATION PROJECT**

**10 COMMERCE ROAD  
ORANGEVILLE, ON L9W 1P8**

Scale  
As indicated  
Issued by  
F.A.  
File No.  
2021-020  
Plot Date  
05.07.2025

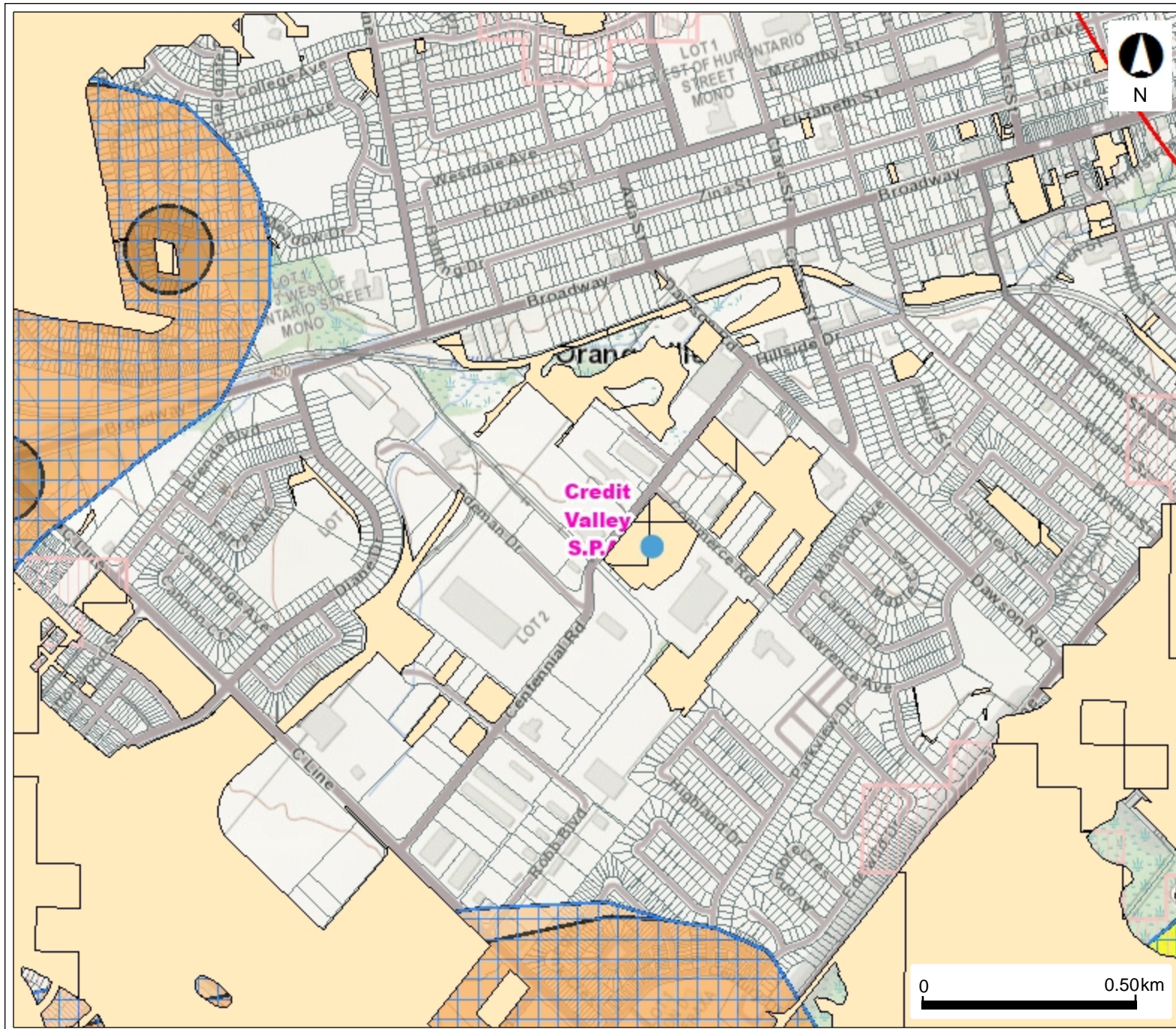
A-102

## **APPENDIX B – SOURCE WATER PROTECTION REPORT**





# WHPA - 10 Commerce Rd, Orangeville



## Legend

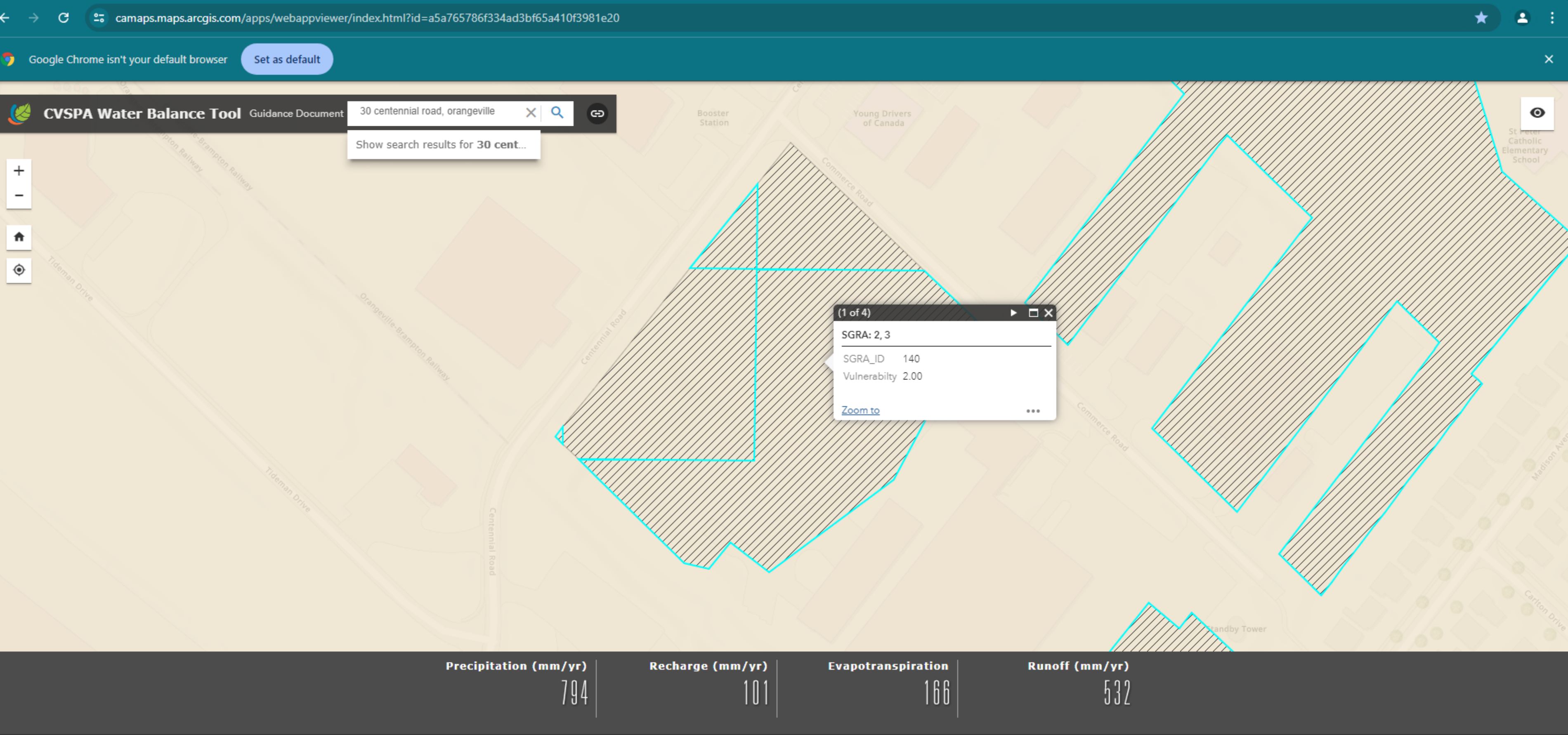
- Intake Protection Zone Q
- Wellhead Protection Area Q1
- Wellhead Protection Area Q2
- Significant Groundwater Recharge Area
  - N/A
  - 0
  - 2
  - 4
  - 6
- Issue Contributing Areas
- Highly Vulnerable Aquifers
- Wellhead Protection Area
  - A
  - B
  - C
  - C1
  - D
  - F
- Intake Protection Zone 1
- Event Based Areas
- Intake Protection Zone 2
- Intake Protection Zone 3
- Vulnerable Scoring Area - (WHPA-E)
  - 4.1 - 7.9
  - 8 - 8.9
  - 9 - 10
- Greenbelt

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 Environment, Conservation and Parks (MECP) shall not be liable in any way for the use or any information on this map. of, or reliance upon, this map.

## **APPENDIX C – WATER BALANCE CALCULATIONS**









### Water Balance Calculation (Using CVSPA data)

		AREA (m <sup>2</sup> )	PRECIPITATION DATA		CALCULATED <sup>(2)</sup>	
			P <sup>(1)</sup> mm/yr	E <sup>(2)</sup> mm/yr	I mm/yr (m <sup>3</sup> /y)	R mm/y (m <sup>3</sup> /y)
PRE-DEVELOPMENT						
Impervious area		0.00	794.00	158.80	0.00	635.20
				0.00	0.00	0.00
Pervious area		17506.57	794.00	166.00	101.00	532.00
				2906.09	1768.16	9313.50
	Pre-Development Sub-total			2906.09	1768.16	9313.50
POST-DEVELOPMENT						
Impervious area		8029.99	794.00	158.80	0.00	635.20
				1275.16	0.00	5100.65
Pervious area		9476.58	794.00	166.00	101.00	532.00
				1573.11	957.13	5041.54
	Post-Development Sub-total			2848.27	957.13	10142.19
Change Due to Development (Post-Pre)				-57.82	-811.03	828.69

(1) Precipitation (P), Evapotranspiration (E), Runoff (R) and Infiltration (I) obtained from TRSPA digital data for 1983-2013 for the Site.

(2) Evapotranspiration for impervious areas taken as 20% of Precipitation.



### WATER BUDGET SUMMARY CVSPA

Measurement	Pre - Development	Post - Development	Overall Change (Pre to Post) (m <sup>3</sup> /yr)	Percentage Change (Pre- to Post-)
<b>Inputs (Volumes)</b>				
Precipitation (m <sup>3</sup> /yr)	13900	13900	0	0%
Run-On (m <sup>3</sup> /yr)	0	0	0	0%
Other Inputs (m <sup>3</sup> /yr)	0	0	0	0%
<b>Outputs (Volumes)</b>				
Evapotranspiration (m <sup>3</sup> /yr)	2906	2848	58	2%
Infiltration (m <sup>3</sup> /yr)	1768	957	811	46%
Runoff Pervious Areas	9313	5042	4272	46%
Runoff Impervious Areas	0	5101	-5101	-
<b>Total Runoff (m<sup>3</sup>/yr)</b>	<b>9313</b>	<b>10142</b>	<b>-829</b>	<b>-9%</b>

### Effect of Development on Hydrologic Input and Output Characteristics of the Site

Category	Pre-Development	Post-Development
	Percentage of Precipitation	Percentage of Precipitation
Evapotranspiration	20.9%	20.5%
Infiltration	12.7%	6.9%
Runoff Pervious Areas	67.0%	36.3%
Runoff Impervious Areas	0.0%	36.7%
<b>Total Runoff</b>	<b>67.0%</b>	<b>73.0%</b>

	Pre Development		Post Development	
	Pervious	Impervious	Pervious	Impervious
Land Area, m <sup>2</sup>	17506.57	0	9477	8029.99
Precipitation, mm/yr	794	794	794	794
Evapotranspiration, mm/yr	166	158.8	166	158.8
Infiltration (mm/yr)	101	0	101	0
RunOff pervious areas, mm/yr	532	-	532.0	-
RunOff impervious areas, mm/yr	-	635.2	-	635.2

## TABLE 6 – COMPARISON OF STRUCTURAL LID PRACTICES



Table 6: Comparison of site constraints for a range of structural LID SWM practices

LID Stormwater Management Practice	Depth to high water table or bedrock <sup>1</sup> (m)	Typical Ratio of Impervious Drainage Area to Treatment Facility Area	Native Soil Infiltration Rate (mm/hr) <sup>3</sup>	Head <sup>4</sup> (m)	Space <sup>5</sup> %	Slope <sup>6</sup> %	Pollution Hot Spots <sup>7</sup>	Set backs <sup>8</sup>
Rain barrel	Not applicable	[5 to 50 m <sup>2</sup> ] <sup>2</sup>	Not applicable	1	0	NA	Yes	None
Cistern	1	[50 to 3000 m <sup>2</sup> ] <sup>2</sup>	Not applicable	1 to 2	0 to 1	NA	Yes	U, T
Green roof	Not applicable	1:1	Not applicable	0	0	0	Yes	None
Roof downspout disconnection	Not applicable	[5 to 100 m <sup>2</sup> ] <sup>2</sup>	Amend if < 15 mm/hr <sup>9</sup>	0.5	5 to 20	1 to 5	Yes	B
Soakaway, infiltration trench or chamber	1	5:1 to 20:1	Not a constraint	1 to 2	0 to 1	< 15%	No	B, U, T, W
Bioretention	1	5:1 to 15:1	Underdrain required if < 15 mm/hr	1 to 2	5 to 10	0 to 2	No	B, U, W
Biofilter (filtration only Bioretention design)	Not applicable	5:1	Not applicable	1 to 2	2 to 5	0 to 2	Yes	B, T
Vegetated filter strip	1	5:1	Amend if < 15 mm/hr <sup>9</sup>	0 to 1	15 to 20	1 to 5	No	None
Permeable pavement	1	1:1 to 1.2:1	Underdrain required if < 15 mm/hr	0.5 to 1	0	1 to 5	No	U, W
Enhanced grass swale	1	5:1 to 10:1	Not applicable	1 to 3	5 to 15	0.5 to 6	No	B, U
Dry swale	1	5:1 to 15:1	Underdrain required if < 15 mm/hr	1 to 3	5 to 10	0.5 to 6	No	B, U, W
Perforated pipe system	1	5:1 to 10:1	Not a constraint	1 to 3	0	< 15%	No	B, U, T, W

**Notes:**

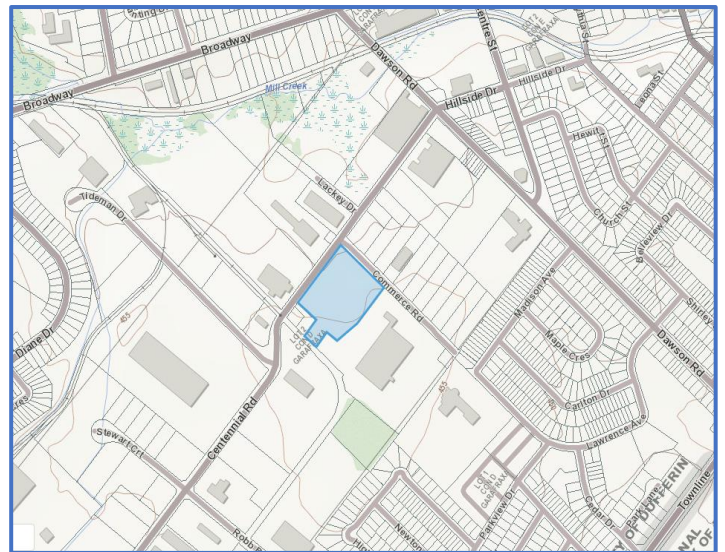
1. Minimum depth between the base of the facility and the elevation of the seasonally high water table or top of bedrock.
2. Values for rain barrels, cisterns and roof downspout disconnection represent typical ranges for impervious drainage area treated.
3. Infiltration rate estimates based on measurements of hydraulic conductivity under field saturated conditions at the proposed location and depth of the practice.
4. Vertical distance between the inlet and outlet of the LID practice.
5. Percent of open pervious land on the site that is required for the LID practice.
6. Slope at the LID practice location.
7. Suitable in pollution hot spots or runoff source areas where land uses or activities have the potential to generate highly contaminated runoff (e.g., vehicle fueling, servicing or demolition areas, outdoor storage or handling areas for hazardous materials and some heavy industry sites).
8. Setback codes: B = Building foundation; U = Underground utilities; T = Trees; W = drinking water wellhead protection areas.
9. Native soils should be tilled and amended with compost to improve infiltration rate, moisture retention capacity and fertility.



LABORATORY



## FIELD INFILTRATION TEST



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**PROPOSED NEW DEVELOPMENT  
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ORANGEVILLE, ON  
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**Prepared for:  
Town of Orangeville**

**Project No. FG24-14044**

**July 26, 2024**

**Issued to:** Town of Orangeville  
87 Broadway,  
Orangeville, ON L9W 1K1

**Contact:** Charles Cosgrove,  
Manager Facilities and Parks  
[ccosgrove@orangeville.ca](mailto:ccosgrove@orangeville.ca)

**Project Name:** Infiltration Tests for Proposed New Fire Hall

**Project Address:** 10 Commerce Road, Orangeville, ON

**Project Number:** FG 24-14044

**Issued on:** July 26, 2024

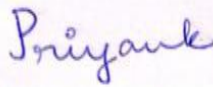
**Project Manager:**  
(Primary Contact)



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## 1. FIELD INFILTRATION TESTS

Fisher Engineering Limited (Fisher) was commissioned by Town of Orangeville to carry out field Infiltration Tests at the property located at 10 Commerce Road (formally 30 Centennial Road), Orangeville, Ontario. The tests were carried out on July 17<sup>th</sup>, 2024.

The purpose of the tests was to assess suitability of the subsurface soils for utilizing infiltration facilities for the proposed development at the site. In order to accomplish this objective, Fisher performed the following services:

- Site reconnaissance to determine the most suitable test borehole locations for Infiltration tests.
- Drilled four (4) test boreholes.
- Submitted soil samples to the laboratory for moisture content, grain size and hydrometer analyses.
- Conducted infiltration tests in four test boreholes, and
- Prepared a report summarizing the test results along with recommendations

### 1.1. *Subsurface Exploration*

Drilling of the four (4) test boreholes was carried out under direct supervision of Fisher Engineering staff on July 9, 2024. Test boreholes, TH1 to TH4, were drilled to depths of 1.98m below prevailing grade (453.75m to 455.14m asl). Depth/elevations of the test holes are presented in Table 1. Eight boreholes, BH101 to BH108, were drilled in the location of the test holes. Three of the boreholes were instrumented as monitoring wells (MW102, MW104 and MW106). Site plan showing the location of the test boreholes is presented in Appendix A.

**Table 1: Depth & Elevations of Test Holes.**

Well No.	Approx. Elev. at Ground (m)	Test hole depths	
		m bgs	m asl
TH1	456.93	1.98	454.95
TH2	456.90	1.98	454.92
TH3	455.73	1.98	453.75
TH4	457.12	1.98	455.14



## **1.2. Subsurface Conditions**

The sub-surface soil investigation conducted within test boreholes TH1 to TH4 (Appendix B), in addition to boreholes drilled in the vicinity of the test boreholes during previous geotechnical investigations, showed that the subsurface soils comprised primarily of:

**Fill:** - Brown to dark brown, moist, sandy silt with trace to some clay, rootlets, topsoil & gravel were encountered below the approximately 0.15m thick layer of topsoil in test holes TH1 to TH3.

**Clayey Silt:** - Layers of brown, moist to wet, firm to stiff, clayey silt with trace sand were encountered below the fill layer of soil in test hole TH1 and below the topsoil layer in TH4 extending to termination depth at 1.98m bgs (454.95m & 455.14m asl) in TH1 & TH4 respectively.

**Sandy Silt:** - Brown, moist, sandy silt deposits, with pockets/ seams of clayey silt and trace to some gravel, were encountered below the fill layer of soil in test hole TH2 and TH3 extending to termination depth at 1.98m bgs (454.92m & 453.75m asl respectively).

Laboratory analyses confirmed that the soils below the fill material are clayey silt to sandy silt with pockets/seams/ layer of clayey silt and trace to some gravel & sand.

## **1.3. Groundwater Conditions**

The test holes were observed to be dry on completion of drilling. Standing water was observed generally at depths of 1.22m to 4.27m bgs (449.01m to 452.47m asl) in borehole BH101 and BH104 to BH108 on completion of drilling while BH102 & BH103 were observed to be dry. Static groundwater levels were measured at depths of 1.35m, 1.91m and 1.63m bgs (455.54m, 455.0m and 455.17m asl) on July 17, 2024 and at depths of 1.46m, 1.90m and 2.50m bgs (455.43m, 455.01m and 454.3m asl) on July 24, 2024 in MW102, MW104 and MW106. Moisture content values for soil samples selected from the base of the test boreholes are 11.8% to 26.1% indicating moist to wet conditions.



## 1.4. *Field Percolation Tests*

The subsoil at the tested depths in test holes TH1 to TH4 are dominated by clayey silt to sandy silt with pockets/seams/layers of clayey silt and trace to some gravel & sand. Initial tests showed that more than 15cm of water seeped away in 25 mins in test hole TH1. Less than 15cm of water seeped away in 25 mins in test holes TH2 to TH4 and consequently pre-soaking was required in test holes TH2 to TH4 (22 hours). Average columns of water seeping away in the initial tests were 19.0cm in 25mins for TH1 while 10.0 cm, 10.75cm and 11.50cm in test holes TH2 to TH4 respectively.

Potable water was added to the test holes for infiltration tests following the initial tests/presoaking. The fall in water levels was taken every 5mins in TH1 and 20 mins in TH2 to TH4. An average of the last three drop in water levels observed during the final tests, in each hole, was used to estimate the percolation rates.

## 2. ESTIMATED COEFFICIENTS OF K AND T

The results of grain size distribution and moisture content analyses are summarized in Table 2 along with hydraulic conductivity estimated from grain size analyses. Based on the field soil description (Unified Soil Classification System) and Grain Size Distribution analyses, the soils within the target depths can be classified as;

- **ML, for TH1 & TH4-** Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, clayey silts with slight plasticity with estimated coefficient of permeability  $k$  values in the order of  $10^{-5}$  to  $10^{-6}$  cm/s based on Table 3 of the Supplementary Guidelines to the Ontario Building Code, 1997. Corresponding percolation times  $T$  are 20 – 50 mins/cm, indicating medium permeability.
- **SM, for TH2 & TH3-** Silty sands, sand-silt mixtures with estimated coefficient of permeability  $k$  values in the order of  $10^{-3}$  to  $10^{-5}$  cm/s based on Table 2 of the Supplementary Guidelines to the Ontario Building Code, 1997. Corresponding percolation times  $T$  are 8 – 20 mins/cm, indicating medium permeability. Laboratory results are presented in Appendix C.



**Table 2: Grain Size and Moisture Content Analyses.**

Location	Depth of soil sample (m)	Soil Classification	Estimated coefficient of permeability (k-m/sec)	Estimated percolation time – T mins/cm	Moisture Content (%)	Estimated Hydraulic Conductivity from Grain Size	
						m/s	m/day
<b>TH1</b>	1.53-1.98	Clayey Silt with trace sand ( <b>ML</b> )	$10^{-7}$ to $10^{-8}$	20 – 50	26.1	$6.4 \times 10^{-9}$	0.00055
<b>TH2</b>	1.53-1.98	Sandy silt with some clay & gravel ( <b>SM</b> )	$10^{-5}$ to $10^{-7}$	8 – 20	11.8	$1.0 \times 10^{-8}$	0.00086
<b>TH3</b>	1.53-1.98	Sandy silt with some clay & trace gravel ( <b>SM</b> )	$10^{-5}$ to $10^{-7}$	8 – 20	16.7	$3.6 \times 10^{-9}$	0.00031
<b>TH4</b>	1.53-1.98	Clayey Silt with trace sand ( <b>ML</b> )	$10^{-7}$ to $10^{-8}$	20– 50	15.2	$4.9 \times 10^{-9}$	0.00042

### 3. OBSERVED PERCOLATION TIME (T) AND INFILTRATION RATES

Based on the field investigation, using the last three observed stable successive intervals or the average of the last results for each test hole, percolation rates (Time T) for test holes TH1 to TH4 were computed at 10.0, 21.11, 25.0 and 28.57 min/cm respectively. Corresponding infiltration rates, calculated as  $1/T$ , are 0.10, 0.047, 0.04 and 0.035 cm/min respectively. Percolation data sheets are presented in Appendix D. Infiltration rates for TH1 to TH4, using a factor of safety 2.5 are: 24.0, 11.37, 9.60 and 8.40 mm/hour respectively.



#### 4. CONCLUSION AND RECOMMENDATIONS

For the subject site, at the tested depths, percolation rates calculated from onsite observation, Times (T), in the locations tested are 10.0, 21.11, 25.0 and 28.57 min/cm. Corresponding infiltration rates are 0.10, 0.047, 0.04 and 0.035 cm/min respectively. **Factored infiltration rates (FS=2.5) are,**

- **24.0 mm/hour for TH1, and**
- **11.40, 9.60 and 8.40 mm/hour for TH2, TH3 and TH4 respectively.**

Based on a minimum percolation design criterion of  $4.17 \times 10^{-4}$  cm/sec (15 mm/h) as recommended by the *Ontario MOE Storm water Management Planning and Design Manual 2003* for infiltration trenches, it is expected that the subject site would be suitable for the construction of infiltration facilities within the **tested depths at the proposed locations for TH1.**

The high permeability in TH1 may be attributed to seam layer of sand & silt which may not have been observed in laboratory results. Test hole locations at **TH2 to TH4** have relatively lower factored infiltration rates and may not be suitable for infiltration gallery/chambers. As such further test pits investigation to be carried out at the invert of infiltration gallery to determine the best infiltration rates for design in specific areas of the site.

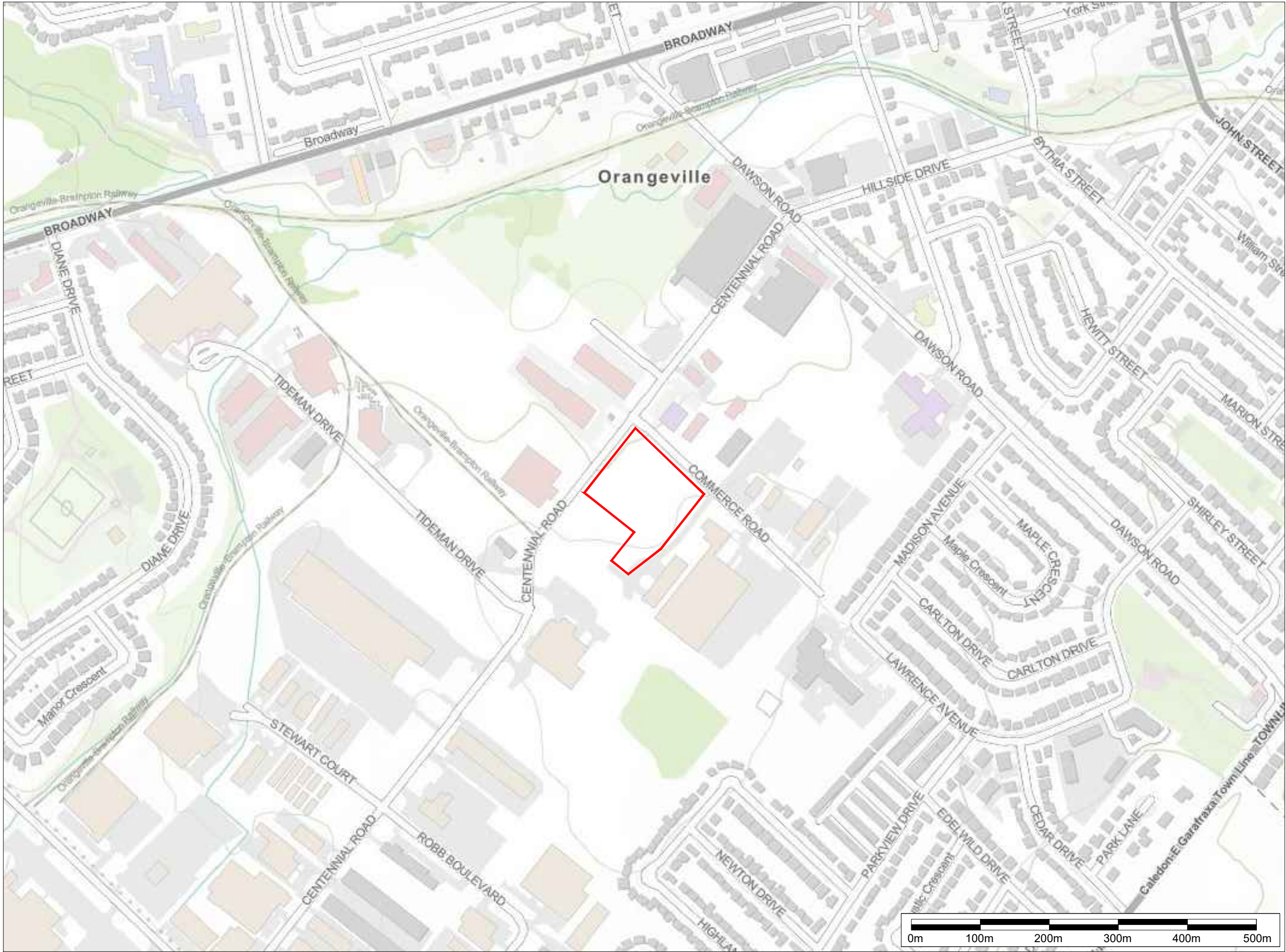
Groundwater levels are been monitored during the rainy season to determine seasonal highwater levels at the site. It should be noted that groundwater levels vary across the site and are reflective of varying soil conditions observed during the investigation. The location of the infiltration facilities should be carefully selected in order to maintain at least 1m between the invert of the infiltration facility and the highest observed groundwater level. It should also be noted that grading of the site and construction activity will improve site drainage condition hence depressing the higher water levels observe in some areas of the site.



## **APPENDIX A – SITE AND LOCATION PLANS**



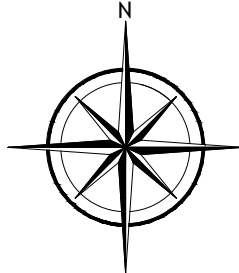




400 Esna Park Dr., #15  
Markham, Ontario  
L3R 3K2

Tel: 905 475-7755

NORTH



LEGEND

— SITE BOUNDARY

PROJECT NAME AND ADDRESS

INFILTRATION  
TEST

30 Centennial Road,  
Orangeville, ON

FIGURE A1:

SITE LOCATION MAP

PROJECT NO.

FE 24-14044

DATE

12 July 2024

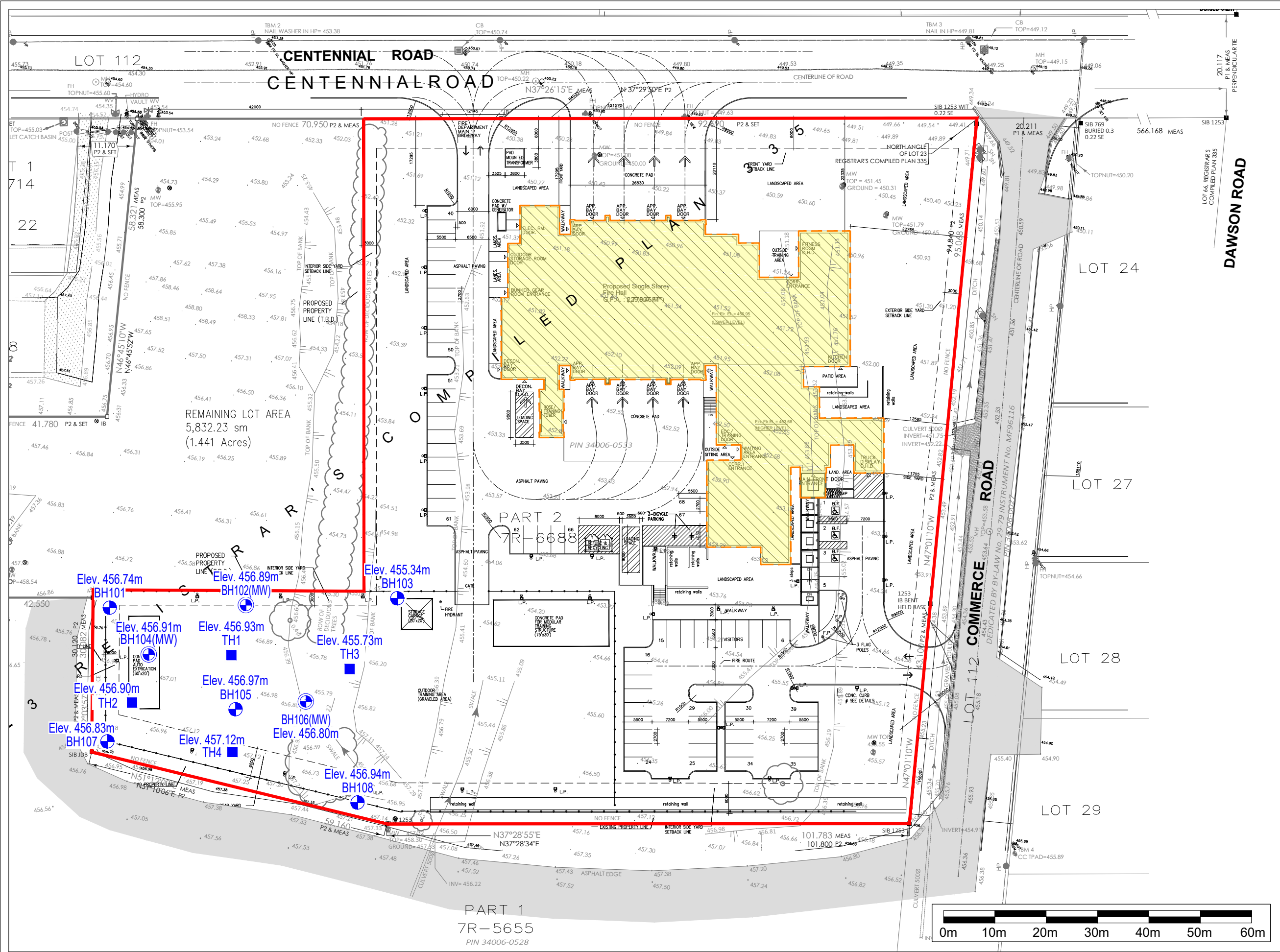
SCALE

AS SHOWN

SHEET NO.

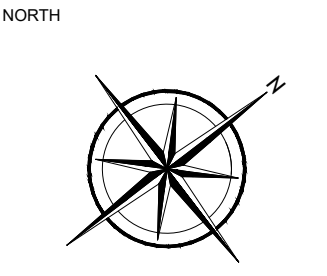
A1





400 Esna Park Dr., #15  
Markham, Ontario  
L3R 3K2

Tel: 905 475-7755



LEGEND

- SITE BOUNDARY
- BOREHOLE LOCATION
- TEST HOLE LOCATION
- PROPOSED BUILDING FOOTPRINT

PROJECT NAME AND ADDRESS

INFILTRATION TEST

30 Centennial Road,  
Orangeville, ON

FIGURE A2:  
GRAVEL TRAINING AREA WITH  
BOREHOLE AND TEST HOLE  
LOCATIONS

PROJECT NO. FE 24-14044	SHEET NO.  <b>A2</b>
DATE 12 July 2024	
SCALE AS SHOWN	



## **APPENDIX B – LOG OF BOREHOLES**





LOG OF BOREHOLE

NO. TH1 SHEET. 1 of 1

PROJECT NO.: FE 24-14044

PROJECT NAME: INFILTRATION

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: D-50 Track, Solid Stem Auger

DRILLING DATE: 9 July, 2024

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE									
							SHEAR STRENGTH (Kpo) ■				MOISTURE CONTENT (%) ●				
0	0		456.93				20	40	60	80	20	40	60	80	<div><div></div><div>Concrete</div><div>2" Slotted Pipe</div><div>Silica Sand</div><div>1.98m bgs</div></div>
	TOPSOIL		0.15 / 456.78												
	FILL: Brown to dark brown sandy silt, moist, trace clay, rootlets, topsoil, gravel														
2															
1															
4			1.37 / 455.56												<div><div></div><div>Concrete</div><div>2" Slotted Pipe</div><div>Silica Sand</div><div>1.98m bgs</div></div>
	CLAYEY SILT: Brown, wet, trace sand														
6				SS-1	7	▲									
2	End of test hole at 1.98m		1.98 / 454.95												
8															
															<div><div></div><div>Concrete</div><div>2" Slotted Pipe</div><div>Silica Sand</div><div>1.98m bgs</div></div>
10															
12															
14															
16															
5															<div><div></div><div>Concrete</div><div>2" Slotted Pipe</div><div>Silica Sand</div><div>1.98m bgs</div></div>
18															

Groundwater Depth (m): on completion: Dry

DRAWN: T.L.

LOGGED: D.G.

CHECKED: C.W.

PROJECT NAME: INFILTRATION

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: D-50 Track, Solid Stem Auger

DRILLING DATE: 9 July, 2024

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80				
							SHEAR STRENGTH (Kpa) ➤				MOISTURE CONTENT (%) ●				
0	0		456.90												
		TOPSOIL	0.15 / 456.75												
		FILL: Brown to dark brown sandy silt, moist, trace clay, rootlets, topsoil, gravel													
2															
	1														
4															
		SANDY SILT: Brown, moist, with pockets/seam layers of clayey silt and some gravel	1.40 / 455.50												
6					SS-1	17	▲								
2		End of test hole at 1.98m	1.98 / 454.92												
8															
10	3														
12															
4															
14															
16	5														
18															

2" Slotted Pipe

Concrete

Silica Sand

1.98m bgs

Groundwater Depth (m): on completion: Dry

DRAWN: T.L.

LOGGED: D.G.

CHECKED: C.W.

PROJECT NAME: INFILTRATION

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: D-50 Track, Solid Stem Auger

DRILLING DATE: 9 July, 2024

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80				
							SHEAR STRENGTH (Kpo) ➤				MOISTURE CONTENT (%) ●				
0	0		455.73												<div><div>2" Slotted Pipe</div><div>Concrete</div><div>Silica Sand</div><div>1.98m bgs</div></div>
	TOPSOIL		0.15 / 455.58												
	FILL: Brown to dark brown sandy silt, moist, some clay, trace rootlets, topsoil, gravel														
2															
1															
4															
	SANDY SILT: Brown, moist, with pockets/seam layers of clayey silt and trace gravel		1.40 / 454.33												
6					SS-1	9	▲								
2	End of test hole at 1.98m		1.98 / 453.75												
8															
10															
12															
4															
14															
16															
5															
18															

Groundwater Depth (m): on completion: Dry

DRAWN: T.L.

LOGGED: D.G.

CHECKED: C.W.

PROJECT NAME: INFILTRATION

LOCATION: 30 Centennial Road, Orangeville, ON

DRILLING METHOD: D-50 Track, Solid Stem Auger

DRILLING DATE: 9 July, 2024

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80				
							SHEAR STRENGTH (Kpo) ➤				MOISTURE CONTENT (%) ●				
0	0		457.12				40	80	120	160	10	20	30	40	<div><div>2" Slotted Pipe</div><div>Concrete</div><div>Silica Sand</div><div>1.98m bgs</div></div>
	TOPSOIL		0.15 / 456.97												
	CLAYEY SILT: Brown, moist, trace sand														
2															
6				SS-1	13		▲								
2	End of test hole at 1.98m		1.98 / 455.14												

Groundwater Depth (m): on completion: Dry

DRAWN: T.L.

LOGGED: D.G.

CHECKED: C.W.

## **APPENDIX C – GRAIN SIZE AND HYDROMETER TESTS RESULTS**



**Project Name:** Geotechnical Investigation

**F.E. Lab #:** 24-432

**Client:** Town of Orangeville

**Date Sampled:** 9-Jul-2024

**Project ID:** 24-14036

**Date Received:** 11-Jul-2024

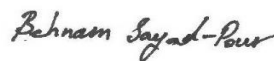
**Location:** 30 Centennial Road,  
Orangeville, Ontario

**Date Reported:** 22-Jul-2024

## Certificate of Analysis

Analyses	Matrix	Quantity	Testing Date	Method Reference
Moisture Content	Soil	16	11-Jul-24	ASTM D2216
Grain Size (Sieve Analysis)	Soil	0	N.A.	LS-602
Grain Size (Hydrometer)	Soil	4	12-Jul-24	LS-702
Atterberg test	Soil	0	N.A.	LS-703/704

Authorized by:



Behnam Sayad Pour Zanjani  
Geo-Lab Supervisor

400 Esna Park Drive, Unit 15, Markham, ON L3R 3K2  
Tel:(905) 475-7755      [www.fishereng.com](http://www.fishereng.com)

## Certificate of Analysis

<b>Analysis Requested:</b>	Moisture Content	<b>Sample Description:</b>	16 Soil Sample(s)
----------------------------	------------------	----------------------------	-------------------

<b>Sample Info</b>	BH1 SS2	BH1 SS3	BH1 SS4	BH1 SS5	BH3 SS2	BH3 SS3
<b>Sample Depth (m)</b>	0.76-1.22	1.53-1.98	2.29-2.75	3.05-3.51	0.76-1.22	1.53-1.98
<b>Moisture Content (%)</b>	17.9	19.8	13.2	17.8	9.7	16.3

<b>Sample Info</b>	BH3 SS4	BH3 SS5	BH5 SS2	BH5 SS3	BH5 SS4	BH5 SS5
<b>Sample Depth (m)</b>	2.29-2.75	3.05-3.51	0.76-1.22	1.53-1.98	2.29-2.75	3.05-3.51
<b>Moisture Content (%)</b>	11.6	11.2	8.9	10.2	18.9	20.1

<b>Sample Info</b>	TH1	TH2	TH3	TH4		
<b>Sample Depth (m)</b>	1.53-1.98	1.53-1.98	1.53-1.98	1.53-1.98		
<b>Moisture Content (%)</b>	26.1	11.8	16.7	15.2		



## Certificate of Analysis

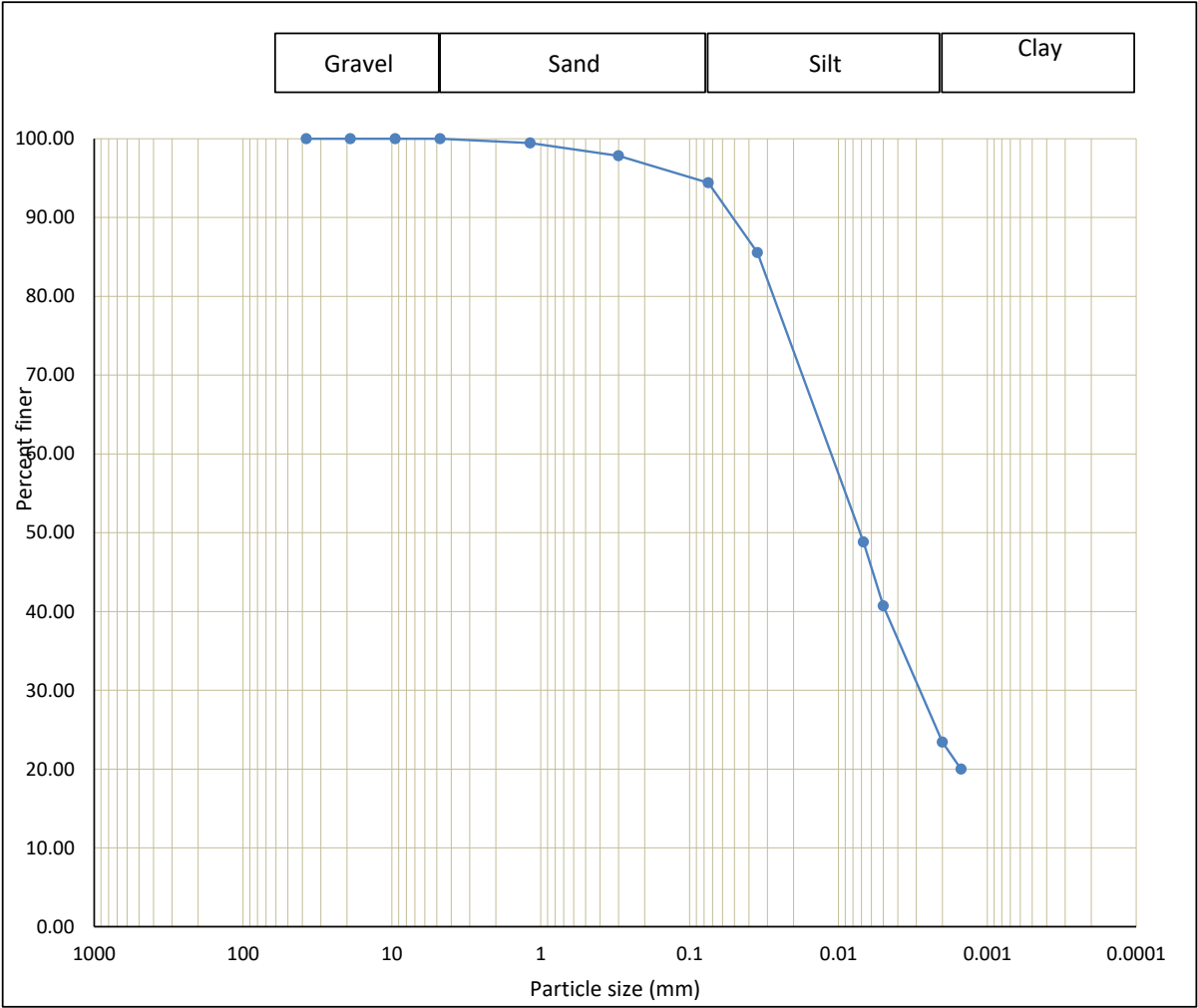
<b>Analysis Requested:</b>	Grain Size (Hydrometer)
<b>Sample Description:</b>	4 Soil Sample(s)

Sample Info	24-433 TH1	24-434 TH2	24-435 TH3	24-436 TH4		
Sample Depth (m)	1.53-1.98	1.53-1.98	1.53-1.98	1.53-1.98		
<b>Grain Size (%)</b>						
>19mm	0.0	10.9	0.0	0.0		
9.5mm-19mm	0.0	2.3	0.0	0.0		
4.75mm-9.5mm	0.0	1.6	2.1	0.0		
1.18mm-4.75mm	0.5	1.7	2.4	1.0		
300um-1.18mm	1.6	4.8	5.5	1.3		
75um-300um	3.4	17.3	14.2	4.3		
5um-75um	53.7	39.4	43.4	39.9		
2um-5um	17.3	8.1	12.4	22.3		
<2um	23.4	13.8	20.1	31.3		
Clay	23.4	13.8	20.1	31.3		
Silt	71.0	47.5	55.8	62.1		
Sand	5.6	23.9	22.0	6.6		
Gravel	0.0	14.8	2.1	0.0		

Grain Size Distribution

Sample ID: 24-433 TH1 (1.53-1.98m)

Gravel: 0%      Sand: 5.6%      Silt: 71%      Clay: 23.4%

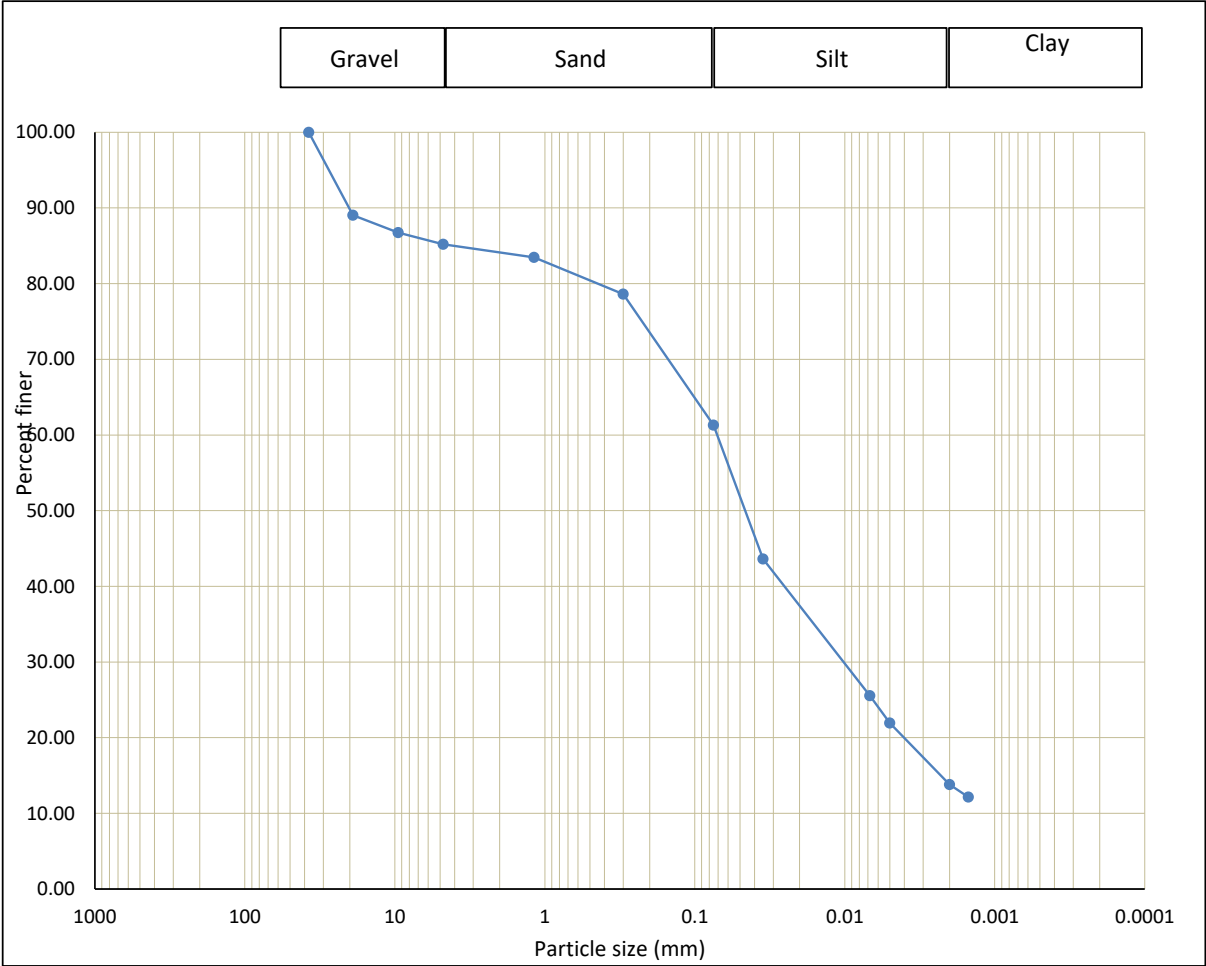


Sample ID: 24-433 TH1 (1.53-1.98m)		
Diameter	Weight (%)	Grain Size
>4.75mm	0.0	Gravel
1.18mm-4.75mm	0.5	Coarse Sand
300um-1.18mm	1.6	Medium Sand
75um-300um	3.4	Fine Sand
5um-75um	53.7	Silt
2um-5um	17.3	
<2um	23.4	Clay

Grain Size Distribution

Sample ID: 24-434 TH2 (1.53-1.98m)

Gravel: 14.8%      Sand: 23.9%      Silt: 47.5%      Clay: 13.8%

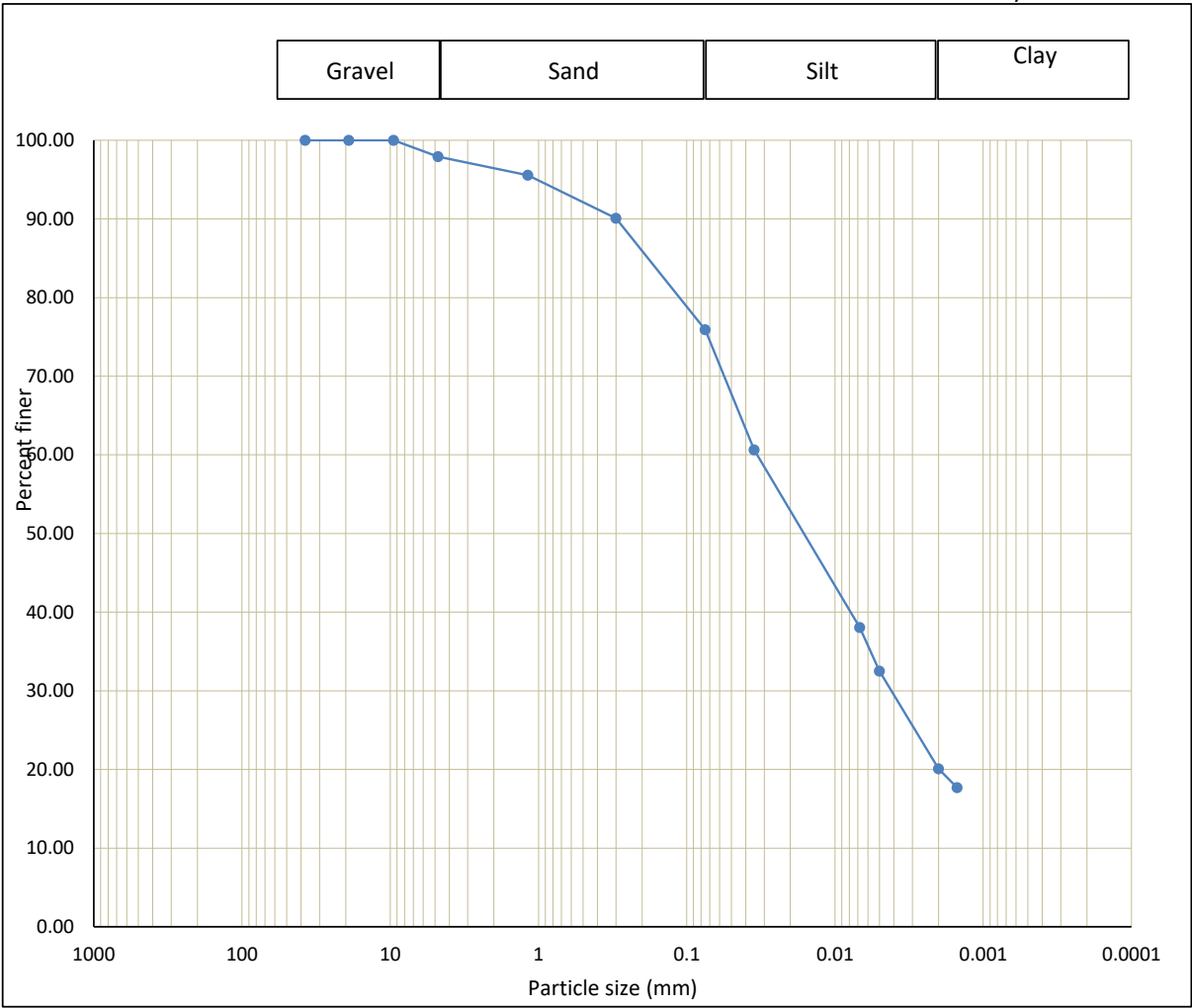


Sample ID: 24-434 TH2 (1.53-1.98m)		
Diameter	Weight (%)	Grain Size
>4.75mm	14.8	Gravel
1.18mm-4.75mm	1.7	Coarse Sand
300um-1.18mm	4.8	Medium Sand
75um-300um	17.3	Fine Sand
5um-75um	39.4	Silt
2um-5um	8.1	
<2um	13.8	Clay

Grain Size Distribution

Sample ID: 24-435 TH3 (1.53-1.98m)

Gravel: 2.1%      Sand: 22%      Silt: 55.8%      Clay: 20.1%

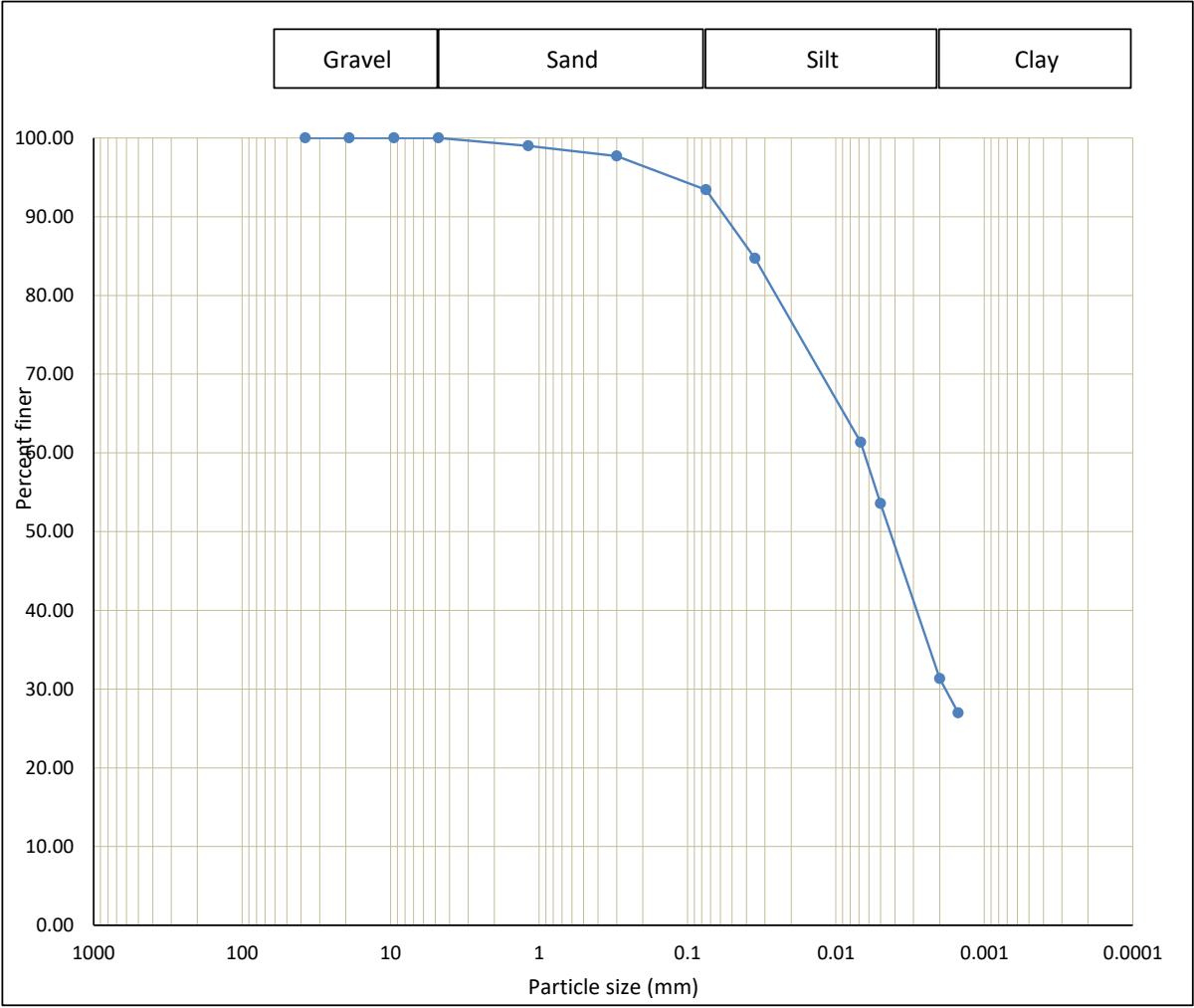


Sample ID: 24-435 TH3 (1.53-1.98m)		
Diameter	Weight (%)	Grain Size
>4.75mm	2.1	Gravel
1.18mm-4.75mm	2.4	Coarse Sand
300um-1.18mm	5.5	Medium Sand
75um-300um	14.2	Fine Sand
5um-75um	43.4	Silt
2um-5um	12.4	
<2um	20.1	Clay

Grain Size Distribution

Sample ID: 24-436 TH4 (1.53-1.98m)

Gravel: 0%      Sand: 6.6%      Silt: 62.1%      Clay: 31.3%



Sample ID: 24-436 TH4 (1.53-1.98m)		
Diameter	Weight (%)	Grain Size
>4.75mm	0.0	Gravel
1.18mm-4.75mm	1.0	Coarse Sand
300um-1.18mm	1.3	Medium Sand
75um-300um	4.3	Fine Sand
5um-75um	39.9	Silt
2um-5um	22.3	
<2um	31.3	Clay

LAB JOB No: 24-482 **Standard Laboratory Request Form: Chain of Custody** Page 1 of 1

<b>CLIENT INFORMATION</b> Name: Contact: Address: <u>30 Centennial Road</u> <u>Orangeville</u> Email: Fax: Phone:	<b>PROJECT INFORMATION</b> Project Name: <u>Geotechnical Investigation</u> Project ID: <u>24-14036</u> Sampled By: <u>David</u> <b>TURNAROUND TIME (TAT):</b> Check ONE if all samples are the same/or see below. <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:33%;">STD - Standard (5-7 bus. days)</td> <td style="width:33%; text-align: center;"><input checked="" type="checkbox"/></td> <td style="width:34%;">Standard Charge</td> </tr> <tr> <td>3D - Three-Day (72 hrs.)</td> <td style="text-align: center;"><input type="checkbox"/></td> <td> <b>SURCHARGES MAY APPLY</b>  Custom quotations (if applicable) will be reflected on final billing.  CALL for Emergencies, Bulk Quotes, or other Questions. </td> </tr> </table>	STD - Standard (5-7 bus. days)	<input checked="" type="checkbox"/>	Standard Charge	3D - Three-Day (72 hrs.)	<input type="checkbox"/>	<b>SURCHARGES MAY APPLY</b> Custom quotations (if applicable) will be reflected on final billing. CALL for Emergencies, Bulk Quotes, or other Questions.	<b>BILLING INFORMATION</b> Purchase Order No: Verbal Authorization: Credit Card Type (e.g. MC/Visa/AMEX...): Credit Card #: Expiry Date:
STD - Standard (5-7 bus. days)	<input checked="" type="checkbox"/>	Standard Charge						
3D - Three-Day (72 hrs.)	<input type="checkbox"/>	<b>SURCHARGES MAY APPLY</b> Custom quotations (if applicable) will be reflected on final billing. CALL for Emergencies, Bulk Quotes, or other Questions.						

LAB  SAMPLE ID	CLIENT'S SAMPLE ID  AND DESCRIPTION	SAMPLING  DATE/TIME	SAMPLE  MATRIX	CONTAINER  NO. and TYPE	TAT  (Above)	ANALYSIS REQUESTED (Check or Specify)										NOTES
						Moisture Content	Sieve Analysis	Hydrometer	Atterberg Limits	Proctor						
	BH1, BH3, BH5	July 9, 24	Soil	Bag	STD	✓										
	(2.5-4')					✓										
	(5-6.5')					✓										
	(7.5-9')					✓										
	(10-11.5')					✓										
	TH1, TH2, TH3, TH4					✓			✓							

<b>Relinquished by:</b> Name: (print) Signature: <u>Clive</u> Date & Time: Method of Shipment: <u>July 11, 2024</u>	<b>Client's Comments:</b>   	<b>Regulatory Requirements:</b> OPSS Reg.  Purpose for sampling: <table style="width:100%;"> <tr> <td>Road Base</td> <td>Engineering Fill</td> </tr> <tr> <td>Road Subbase</td> <td>Soil Classification</td> </tr> <tr> <td>Subgrade</td> <td>Other</td> </tr> <tr> <td>Backfill</td> <td></td> </tr> </table>	Road Base	Engineering Fill	Road Subbase	Soil Classification	Subgrade	Other	Backfill	
Road Base	Engineering Fill									
Road Subbase	Soil Classification									
Subgrade	Other									
Backfill										
<b>Received by (Internal):</b> Name: Date & Time:	<b>Arrival Temperature " C:</b> Laboratory Remarks:									

## **APPENDIX D – FIELD PERCOLATION TEST RESULTS**



Percolation Test Data Sheet							
Project:	30 Centennial Road, Orangeville		Project No	24-14044		Date:	7/17/2024
Test Hole No:		TH1	Tested By: Priyank				
Depth of Test Hole, $D_T$ :		1.98	USCS Soil Classification:		SM		
Test Hole Dimensions (cm)					Length	Width	
Radius (if round)=		4"	Sides (if rectangular)=				
Sandy Soil Criteria Tests							
Trial No.	Start Time	Stop Time	Time Interval (min)	Initial Depth to Water (cm)	Final Depth to Water (cm)	Change in Water Level (cm)	Greater than or Equal to 6"
1	8:30	8:55	0:25	44	64	20	Greater
2	9:00	9:25	0:25	40	58	18	Greater
<p>If two consecutive measurements show that six inches of water seeps away in less than 25 minutes (150mm), the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".</p>							
Test No.	Start Time	Stop Time	$\Delta t$ Time Interval (min)	$D_0$ Initial Depth to Water (cm)	$D_f$ Final Depth to Water (cm)	$\Delta D$ Change in Water Level (cm)	Percolation Rate (min/cm)
1	10:00	10:05	5.00	54.0	72.5	18.50	0.27
2	10:05	10:10	5.00	72.5	81.0	8.50	0.59
3	10:10	10:15	5.00	81.0	86.0	5.00	1.00
4	10:15	10:20	5.00	86.0	90.0	4.00	1.25
5	10:20	10:25	5.00	90.0	94.0	4.00	1.25
6	10:25	10:30	5.00	94.0	96.5	2.50	2.00
7	10:30	10:35	5.00	96.5	98.5	2.00	2.50
8	10:35	10:40	5.00	98.5	100.0	1.50	3.33
9	10:40	10:45	5.00	100.0	100.5	0.50	10.00
10	10:45	10:50	5.00	100.5	101.0	0.50	10.00
11	10:50	10:55	5.00	101.0	101.5	0.50	10.00
COMMENTS: Cloudy (22°C).							



Percolation Test Data Sheet							
Project:	30 Centennial Road, Orangeville		Project No	24-14044		Date:	7/17/2024
Test Hole No:		TH2	Tested By:	Priyank			
Depth of Test Hole, $D_T$ :		1.98	USCS Soil Classification:	SM			
Test Hole Dimensions (cm)					Length	Width	
Radius (if round)=		4"	Sides (if rectangular)=				
Sandy Soil Criteria Tests							
Trial No.	StartTime	StopTime	Time Interval (min)	Initial Depth to Water (cm)	Final Depth to Water (cm)	Change in Water Level (cm)	Greater than or Equal to 6"
1	8:35	9:00	0:25	50	59	9	Less
2	9:05	9:30	0:25	45	56	11	Less
<p>If two consecutive measurements show that six inches of water seeps away in less than 25 minutes (150mm), the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".</p>							
Test No.	Start Time	Stop Time	$\Delta t$ Time Interval (min)	$D_0$ Initial Depth to Water (cm)	$D_f$ Final Depth to Water (cm)	$\Delta D$ Change in Water Level (cm)	Percolation Rate (min/cm)
1	10:05	10:25	20.00	48.5	52.0	3.50	5.71
2	10:25	10:45	20.00	52.0	55.0	3.00	6.67
3	10:45	11:05	20.00	55.0	56.5	1.50	13.33
4	11:05	11:25	20.00	56.5	57.5	1.00	20.00
5	11:25	11:45	20.00	57.5	58.5	1.00	20.00
6	11:45	12:05	20.00	58.5	59.5	1.00	20.00
7	12:05	12:25	20.00	70.0	74.0	4.00	5.00
8	12:25	12:45	20.00	74.0	76.5	2.50	8.00
9	12:45	13:05	20.00	76.5	78.0	1.50	13.33
10	13:05	13:25	20.00	78.0	78.9	0.90	22.22
11	13:25	13:45	20.00	78.9	79.8	0.90	22.22
12	13:45	14:05	20.00	79.8	80.7	0.90	22.22
COMMENTS: Cloudy (22°C)							

Percolation Test Data Sheet							
Project:	30 Centennial Road, Orangeville		Project No	24-14044		Date:	7/17/2024
Test Hole No:		TH3	Tested By: Priyank				
Depth of Test Hole, $D_T$ :		1.98	USCS Soil Classification:		SM		
Test Hole Dimensions (cm)					Length	Width	
Radius (if round)=		4"	Sides (if rectangular)=				
Sandy Soil Criteria Tests							
Trial No.	StartTime	Stop Time	Time Interval (min)	Initial Depth to Water (cm)	Final Depth to Water (cm)	Change in Water Level (cm)	Greater than or Equal to 6"
1	8:40	9:05	0:25	45	54.5	9.5	Less
2	9:10	9:35	0:25	53	65	12	Less
<p>If two consecutive measurements show that six inches of water seeps away in less than 25 minutes (150mm), the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".</p>							
Test No.	Start Time	Stop Time	$\Delta t$ Time Interval (min)	$D_0$ Initial Depth to Water (cm)	$D_f$ Final Depth to Water (cm)	$\Delta D$ Change in Water Level (cm)	Percolation Rate (min/cm)
1	10:00	10:20	20.00	58.0	65.0	7.00	2.86
2	10:20	10:40	20.00	65.0	69.0	4.00	5.00
3	10:40	11:00	20.00	69.0	72.5	3.50	5.71
4	11:00	11:20	20.00	72.5	75.5	3.00	6.67
5	11:20	11:40	20.00	75.5	78.5	3.00	6.67
6	11:40	12:00	20.00	78.5	81.0	2.50	8.00
7	12:00	12:20	20.00	81.0	83.0	2.00	10.00
8	12:20	12:40	20.00	83.0	85.0	2.00	10.00
9	12:40	13:00	20.00	85.0	86.5	1.50	13.33
10	13:00	13:20	20.00	86.5	88.0	1.50	13.33
11	13:20	13:40	20.00	88.0	88.8	0.80	25.00
12	13:40	14:00	20.00	88.8	89.6	0.80	25.00
13	14:00	14:20	20.00	89.6	90.4	0.80	25.00
COMMENTS: Cloudy (22°C)							

Percolation Test Data Sheet							
Project:	30 Centennial Road, Orangeville		Project No	24-14044		Date:	7/17/2024
Test Hole No:		TH4	Tested By:		Priyank		
Depth of Test Hole, $D_T$ :		1.98	USCS Soil Classification:		SM		
Test Hole Dimensions (cm)					Length	Width	
Radius (if round)=		4"	Sides (if rectangular)=				
Sandy Soil Criteria Tests							
Trial No.	StartTime	Stop Time	Time Interval (min)	Initial Depth to Water (cm)	Final Depth to Water (cm)	Change in Water Level (cm)	Greater than or Equal to 6"
1	8:45	9:10	0:25	44	55	11	Less
2	9:15	9:40	0:25	40.5	52.5	12	Less
<p>If two consecutive measurements show that six inches of water seeps away in less than 25 minutes (150mm), the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".</p>							
Test No.	Start Time	Stop Time	$\Delta t$ Time Interval (min)	$D_o$ Initial Depth to Water (cm)	$D_f$ Final Depth to Water (cm)	$\Delta D$ Change in Water Level (cm)	Percolation Rate (min/cm)
1	10:00	10:20	20.00	62.5	68.0	5.50	3.64
2	10:20	10:40	20.00	68.0	71.5	3.50	5.71
3	10:40	11:00	20.00	71.5	74.0	2.50	8.00
4	11:00	11:20	20.00	74.0	76.5	2.50	8.00
5	11:20	11:40	20.00	76.5	78.5	2.00	10.00
6	11:40	12:00	20.00	78.5	80.5	2.00	10.00
7	12:00	12:20	20.00	80.5	82.0	1.50	13.33
8	12:20	12:40	20.00	82.0	83.2	1.20	16.67
9	12:40	13:00	20.00	83.2	84.3	1.10	18.18
10	13:00	13:20	20.00	84.3	85.3	1.00	20.00
11	13:20	13:40	20.00	85.3	86.0	0.70	28.57
12	13:40	14:00	20.00	86.0	86.7	0.70	28.57
13	14:00	14:20	20.00	86.7	87.4	0.70	28.57
COMMENTS: Cloudy (22°C)							

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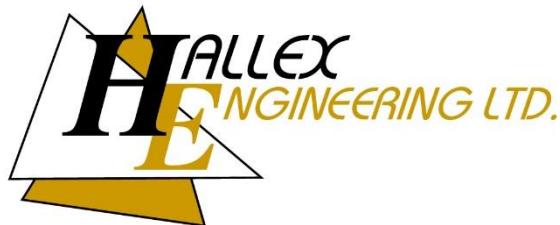
# **PROPOSED ORANGEVILLE FIRE STATION DEVELOPMENT 10 COMMERCE ROAD, ORANGEVILLE**

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## **STORM WATER MANAGEMENT DESIGN BRIEF NEW DEVELOPMENT DRAINAGE SYSTEM**

REV 3 – June 24, 2025

**PREPARED BY:**



HALLEX PROJECT #220705

HALLEX NIAGARA  
4999 VICTORIA AVENUE  
NIAGARA FALLS, ON L2E 4C9

HALLEX HAMILTON  
745 SOUTH SERVICE ROAD, UNIT 205  
STONEY CREEK, ON L8E 5Z2

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## **1. PRE-DEVELOPMENT CONDITIONS**

### **1.1 LOCATION**

The proposed Fire Station development is located at 10 Commerce Road, which is south of the Commerce Road and Centennial Road intersection in the Town of Orangeville, ON.

### **1.2 DRAINAGE PATTERN**

The current drainage path for the site consists of overland sheet flow to the existing 600mm municipal storm sewer at Centennial Road. Given the development will take place on the entire site, the proposed stormwater management controls will ensure the one-hundred-year post development flow rate is controlled to the five-year pre-development flow rate to the existing municipal sewer at Centennial Road.

## **2. PROPOSED WORK**

### **2.1 GRADING**

The objective of the design is to utilize the existing natural slope and achieve the minimum and maximum slopes in the grading of the granular and asphalt surfaces. This will ensure the surface not only drains as per the design but is not too steep. The grading of the site also ensures that the storm water flow will mostly drain through the onsite drainage system for storm water quantity and quality controls. The proposed drainage system onsite has been designed according to the five and one-hundred-year storm events as per the Town of Orangeville intensity-duration-frequency curve.

### **2.2 DRAINAGE**

The proposed design requires 260.5 metres of storm sewer piping, 81.1 meters of bioretention swale, 75.5 meters of V-swale, three precast catch basin, seven precast maintenance holes, a double ditch inlet catch basin maintenance hole, a HydroStorm HS12 oil and grit separator and 368 Xerxes Model S-22 underground storage chambers.

## **3. DESIGN CONSIDERATIONS**

### **3.1 PRE-DEVELOPMENT**

#### **3.1.1 Peak Runoff**

The total drainage area for the development is 1.990 hectares with an existing runoff coefficient of 0.27 based on the existing grass and paved surfaces.

The time of concentration is determined to be 10 minutes to the start of the existing drainage system as required by the Town of Orangeville municipal standards.

Using the Rational Method, the peak flow rates are  $Q = \frac{CiA}{360}$

Subcatchment	Description	Draining to	Area, ha	Tc, min
Area.1	Sheet	Centennial Road	1.990	10
5-year Storm	A,ha	C	i,mm/h	Q, L/s
Area.1	1.990	0.27	96	142.5

Therefore, the total pre-development flow for the subject site is 142.5L/s for the five-year storm.

### 3.1.2 Quantity

There is no known storm quantity control measure in place for the pre-development condition.

### 3.1.3 Quality

There is no known storm quality control measure in place for the pre-development condition.

## 3.2 POST-DEVELOPMENT SITE DRAINAGE

### 3.2.1 Peak Runoff

The proposed Fire Station development consists of the construction of a new building, asphalt laneway & parking areas, gravel areas and grass areas. The resulting runoff coefficient in the post-development condition of the site is 0.61.

The proposed development will drain through the proposed onsite storm drainage system and shall discharge to the existing 600mm municipal storm sewer at Centennial Road Street as per the existing site condition. Part of the site will continue to drain directly to Centennial Road, via sheet flow, similar to the pre-development condition.

The site's storm sewer pipes are designed according to the 5-year minor storm. Utilizing the minimum recommended time of concentration of 10 minutes, the time for storm water to flow from the farthest drainage area to the municipal storm sewer at Centennial Road, as outlined in Exhibit #1, is calculated to be 12.97 minutes.

Using the Rational Method, the peak flow rates are as follows:

Subcatchment	Description	Draining to	Area, ha	Tc, min
Area.1	Sheet	Centennial Road	0.354	10
Prop. Sewer	Sewer	Centennial Road	1.636	10
5-year Storm	A,ha	C	i,mm/h	Q, L/s
Area.1	0.354	0.39	96	37.4
Prop. Sewer	1.636	0.66	96	249.2
<b>TOTAL</b>	<b>1.990</b>	<b>0.61</b>	<b>96</b>	<b>286.6</b>
100-year Storm	A,ha	C	i,mm/h	Q, L/s
Area.1	0.354	0.39	152	59.3
Prop. Sewer	1.636	0.65	152	394.7
<b>TOTAL</b>	<b>1.990</b>	<b>0.61</b>	<b>152</b>	<b>454.0</b>

Therefore, the total post-development flow for the subject site is 286.6L/s for the five-year storm and 454.0L/s for the one-hundred-year storm. The flows and other design information are contained in Exhibit #1 for the five-year storm and Exhibit #2 for the one-hundred-year storm at the end of the design brief.

### 3.2.2 Quantity

The post-development storm water runoff to the existing 600mm municipal storm sewer at Centennial Road is higher than the pre-development runoff. As such, storm water detention is required to ensure that the existing municipal sewer does not surcharge as a result of the proposed development.

Stormwater quantity controls for the site will be achieved by utilizing a 175mm diameter orifice plate at the outlet side of MH.10. The orifice plate will ensure the one-hundred-year post-development runoff is controlled to the five-year pre-development flow rate. The resulting 356m<sup>3</sup> volume generated from the one-hundred-year storm will be contained within the proposed Xerxes Model S-22 underground storage chambers.

The following table summarizes the pre-development flow rates, the post-development uncontrolled flow rates and the post-development-controlled flow rates for the subject site:

	5-Year Pre- Development Flow Rate (L/s)	100-Year Post- Development Uncontrolled Flow Rate (L/s)	100-Year Post- Development Controlled Flow Rate (L/s)
<b>5-year Storm</b>			
Area.1	142.5	59.3	59.3
Prop. Sewer	N/A	394.7	81.8
<b>TOTAL</b>	<b>142.5</b>	<b>454.0</b>	<b>141.1</b>

The orifice plate sizing and subsequent storage volume for the detained flow are indicated in Exhibit #3 for the one-hundred-year storm at the end of the design brief.



### 3.2.3 Quality / LID implementation

The storm water collected in the proposed development passes through a HydroStorm HS12, which achieves a total suspended solids removal of at least 80%. This value is equal to the required 'enhanced' treatment of 80% as indicated in the MOE Stormwater Management Planning and Design Manual, dated March 2003 (refer to Chapter 3: Environmental Design Criteria, Section 3.3.1.1. Level of Protection). The design calculations from the manufacturer as well as the drawings for the unit are included in Appendix 'A' of this report.

Additionally, a bioretention swale is proposed for the development to convey runoff from grass, gravel and asphalt surfaces to the proposed storm sewer on-site. The bioretention swale has been designed in accordance with section 4.8 of the 'Low Impact Development Stormwater Management Planning and Design Guide', to support storm water conveyance and quality enhancement.

To mitigate the hydrological effects of the proposed development and the increase in the number of impervious surfaces, 833 cubic meters of storage has been retained on site and will dissipate through infiltration. The volume will be stored within the proposed XERXES underground storage chambers below the outlet elevation and within the bio-retention swale along the Northwest property line. The water balance calculations are indicated within section 3.2.3 Quality/Lid implementation of the Storm Water Management Report prepared by Hallex Engineering, dated June 24<sup>th</sup>, 2025. The corresponding calculations can be found in Exhibit #4 at the end of this report.

### 3.2.4 Maintenance Recommendations

The storm sewer system includes pipes, catchbasins, maintenance holes, swales, the oil/grit separator and underground storage chambers. It is important to regularly inspect the elements to ensure that storm water is flowing as originally designed. Debris and sediment commonly clog the system and reduce the overall effectiveness.

The following maintenance and inspection tasks should be done:

1. Inspect the inlet pipes and outlet pipes for structural integrity. (Annually) Check inlet/ outlet pipes for structural integrity to ensure they aren't crumbling or broken.
2. Conduct routine inspections for trash or other debris that may be blocking the inlet and outlet pipes. (Monthly and after rain events) Remove all trash and debris.
3. Inspect and clean the storm sewer system (Every 5 years or as needed). Catchbasins to be inspected annually and debris removed when the debris reaches a depth of  $\frac{1}{2}$  from the bottom of the sump to the bottom of the pipe.
4. Inspect for sediment accumulation at pipes (Semi-annually and after rain events). It is important to clean out sediment that might be restricting water flow.
5. Do not dump any materials in the storm sewer system.
6. Inspect the HydroStorm Oil/Grit Separator (Annually). Procedures for inspection are provided in the HydroStorm Owner's Manual. A vacuum truck is to be used for maintenance of the HydroStorm.

7. Inspect the Xerxes Model S-22 chambers (Annually). Procedures for inspection are provided in the Triton Stormwater Solutions Main Header Row Operation and Maintenance Manual. A vacuum truck is to be used for maintenance of the Triton chamber system.

#### 4. CONCLUSION

The aforementioned calculations and recommendations for the storm drainage system are based on the current design for the site as of writing this report.

We trust this report meets your approval. Please contact the undersigned should you have any questions or comments.

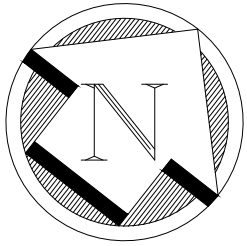
Yours truly,  
HALLEX ENGINEERING LTD



Jim Halucha, P.Eng  
Civil/Structural Engineer

A handwritten signature in cursive script that reads "Anthony Infurna".

Anthony Infurna, C.E.T., rcji  
Project Manager

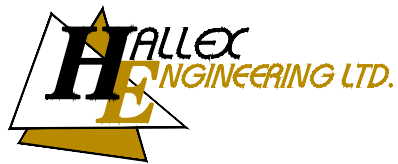
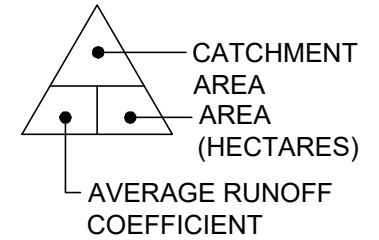


CENTENNIAL ROAD

COMMERCE ROAD



**LEGEND**



4999 Victoria Avenue, Niagara Falls, ON L2E 4C9  
Tel: 905-357-4015 Fax: 905-353-1105

745 South Service Rd. Unit 205,  
Stoney Creek, ON L8E 5Z2  
Tel: 905-561-4016 Fax: 905-561-1105

**PROJECT:**  
PROPOSED ORANGEVILLE FIRE STATION  
10 COMMERCE ROAD, ORANGEVILLE, ON

**SHEET TITLE:**  
PRE-DEVELOPMENT CATCHMENT AREA PLAN

**DATE:** 2025/06/24

**SCALE:** 1:1200

**DR. BY:** MA

**CH. BY:** AI/JH

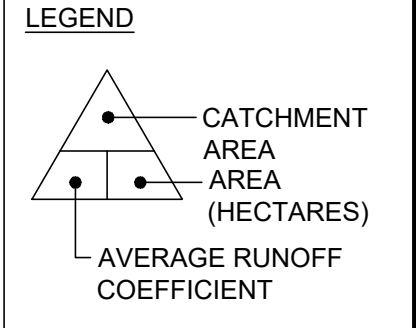
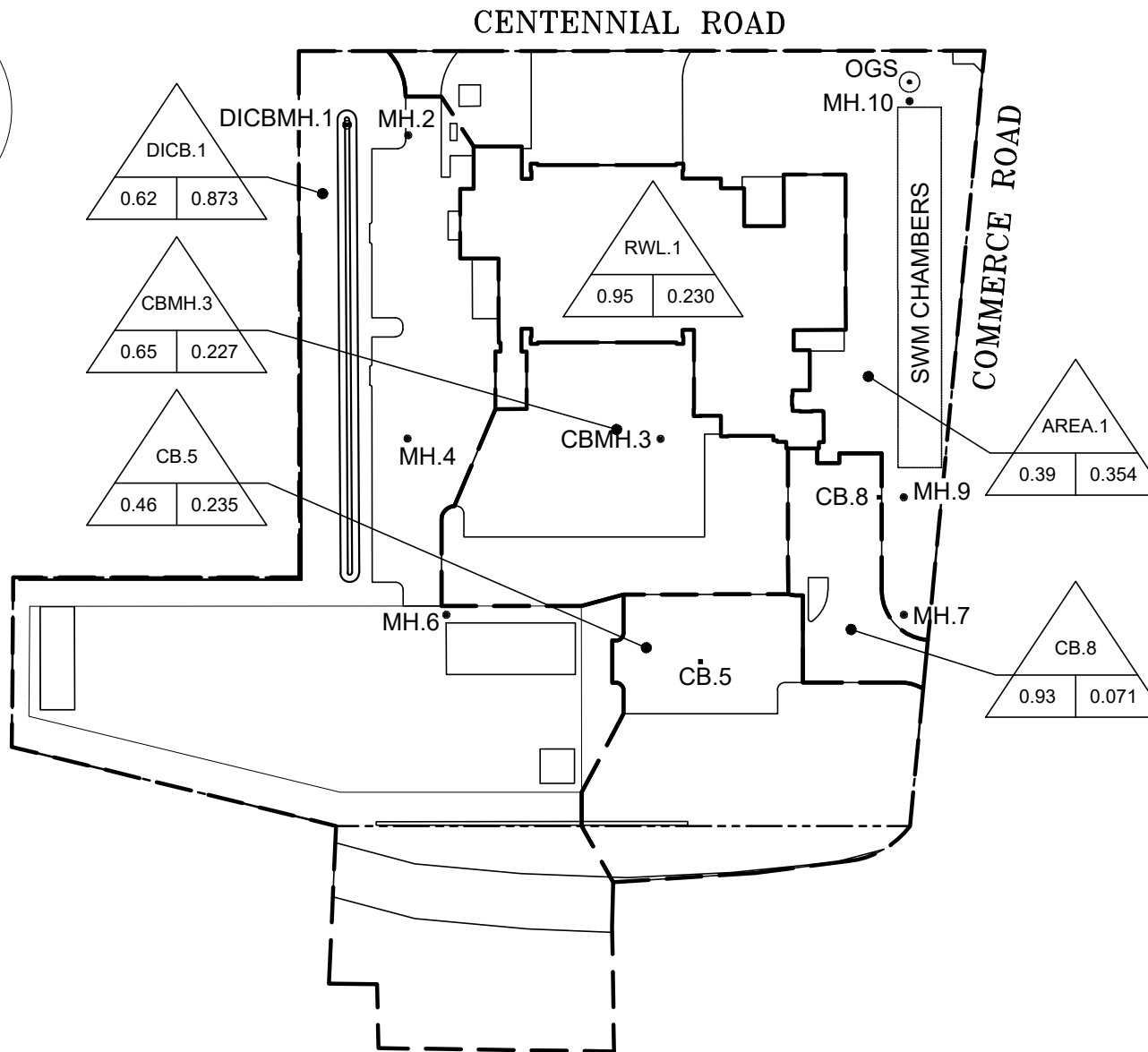
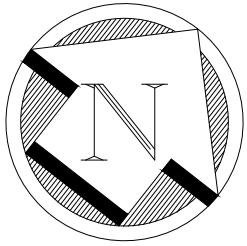
**JOB No.:** 220705

**DWG.**

**REV.**

CSK1

2





# **Proposed Orangeville Fire Station** **Exhibit #1 - 5 Year Post - Development Calculations**

2025-06-24  
 Job: 220705

MUNICIPALITY: **Orangeville**

<u>Rainfall Intensity Values =</u>	A= 1166.822	<u>manning's n =</u>	0.013 PVC Pipe
	B= 11.326		0.013 Conc Pipe
	C= 0.816		0.024 Corr. Stl Pipe
			0.035 Grass Swale

Location			Length of Pipe	Area		Flow Time		Rainfall Intensity	Unit rate of Runoff	Design Flows		Flow Control	Sewer/Channel Design				Invert Elevations	
Pipe	From Node	To Node		Incre- ment	Cum Total	To Upper	In Section			Cum Flow	Cum Flow		Slope	Capacity Full	Velocity Full	*Dia/ Depth	Up- stream	Down- stream
1	Area 1	Prpty 1	N/A	0.354	0.354	10.00	N/A	96	27670	3235.1	0.0374	0.0374	0.1000	N/A	N/A	0.100	N/A	N/A
Paved	-	-	-	0.074	-	-	-	-	21905.3	1621.0	-	-	-	-	-	-	-	-
Grass	-	-	-	0.280	-	-	-	-	5764.6	1614.1	-	-	-	-	-	-	-	-
2	DI CB. 1	MH. 2	10.7	0.873	0.873	10.00	0.14	96	47269	12484.9	0.1445	0.1445	0.0070	0.1467	1.3282	0.375	449.14	449.06
Paved	-	-	-	0.226	-	-	-	-	21905.3	4950.6	-	-	-	-	-	-	-	-
Gravel	-	-	-	0.275	-	-	-	-	19599.5	5389.9	-	-	-	-	-	-	-	-
Grass	-	-	-	0.372	-	-	-	-	5764.6	2144.4	-	-	-	-	-	-	-	-
3	MH. 2	MH. 4	62.5	0.000	0.873	10.14	1.07	96	0	12484.9	0.1445	0.1445	0.0030	0.1562	0.9819	0.450	449.00	448.81
4	CB. 3	MH. 4	28.2	0.000	0.000	10.00	0.55	96	0	0.0	0.0000	0.0000	0.0050	0.0420	0.8566	0.250	449.02	448.87
5	MH. 4	MH. 6	23.2	0.000	0.873	11.21	0.40	92	0	12484.9	0.1445	0.1445	0.0030	0.1562	0.9819	0.450	448.81	448.74
6	CB. 5	MH. 6	8	0.235	0.235	10.00	0.13	96	27670	2484.5	0.0288	0.0288	0.0100	0.0328	1.0440	0.200	449.09	449.01
Paved	-	-	-	0.070	-	-	-	-	21905.3	1533.4	-	-	-	-	-	-	-	-
Grass	-	-	-	0.165	-	-	-	-	5764.6	951.2	-	-	-	-	-	-	-	-
7	MH. 6	MH. 7	63.6	0.000	1.108	11.61	0.94	91	0	14969.4	0.1733	0.1733	0.0040	0.1803	1.1338	0.450	448.68	448.42
8	MH. 7	MH. 9	19.6	0.000	1.108	12.55	0.29	88	0	14969.4	0.1733	0.1733	0.0040	0.1803	1.1338	0.450	448.36	448.28
9	CB. 8	MH. 9	3.5	0.071	0.071	10.00	0.06	96	27670	1523.0	0.0176	0.0176	0.0100	0.0328	1.0440	0.200	448.38	448.34
Paved	-	-	-	0.069	-	-	-	-	21905.3	1511.5	-	-	-	-	-	-	-	-
Grass	-	-	-	0.002	-	-	-	-	5764.6	11.5	-	-	-	-	-	-	-	-
10	MH. 9	CHMBR 1	5.8	0.000	1.179	12.84	0.08	87	0	16492.4	0.1909	0.1909	0.0050	0.2016	1.2676	0.450	448.28	448.25
11	RWL. 1	MH. 10	1.1	0.230	0.230	10.00	0.02	96	21905	5038.2	0.0583	0.0583	0.0100	0.0595	1.2115	0.250	448.90	448.88
Roof	-	-	-	0.230	-	-	-	-	21905.3	5038.2	-	-	-	-	-	-	-	-
12	MH. 10	CHMBR 1	23.9	0.000	0.230	10.02	0.33	96	0	5038.2	0.0583	0.0583	0.0100	0.0595	1.2115	0.250	448.82	448.58
13	CHMBR 1	MH. 11	1.8	0.000	1.409	12.92	0.03	87	0	21530.6	0.2492	0.2492	0.0050	0.3041	1.4048	0.525	448.25	448.24
14	MH. 11	OGS 1	1	0.000	1.409	12.95	0.02	86	0	21530.6	0.2492	0.2492	0.0050	0.3041	1.4048	0.525	448.21	448.20
15	OGS 1	Street 1	7.6	0.000	1.409	12.97	0.09	86	0	21530.6	0.2492	0.2492	0.0110	0.1014	1.4348	0.300	448.20	448.12

Run-off Coefficients Used:

Velocity Range:

Time of Concentration:

Roof Structure	C = 0.95	Minimum Velocity =	0.60 m/s	Time of Concentration =	10 min
Paved Surface	C = 0.95	Maximum Velocity =	6.00 m/s		
Gravel Surface	C = 0.85				
Grass Surface	C = 0.25				



## Proposed Orangeville Fire Station Exhibit #2 - 100 Year Post - Development Calculations

2025-06-24  
Job: 220705

MUNICIPALITY: **Orangeville**

<u>Rainfall Intensity Values =</u>	A= 4338.383 B= 27.408 C= 0.925	<u>manning's n =</u> 0.013 PVC Pipe 0.013 Conc Pipe 0.024 Corr. Stl Pipe 0.035 Grass Swale
------------------------------------	--------------------------------------	---

Location			Length of Pipe	Area		Flow Time		Rainfall Intensity	Unit rate of Runoff	Design Flows		Flow Control	Sewer/Channel Design				Invert Elevations	
Pipe	From Node	To Node		Incre- ment	Cum Total	To Upper	In Section			Cum Flow	Cum Flow		Slope	Capacity Full	Velocity Full	*Dia/ Depth	Up- stream	Down- stream
				(m)	(ha)	(min)	(min)			(m <sup>3</sup> /d)	(m <sup>3</sup> /s)		(m/m)	(m <sup>3</sup> /s)	(m/s)	(m)	(m)	(m)
<b>1</b>	<b>Area 1</b>	<b>Prpty 1</b>	<b>N/A</b>	<b>0.354</b>	<b>0.354</b>	<b>10.00</b>	<b>N/A</b>	<b>152</b>	<b>43826</b>	<b>5123.9</b>	<b>0.0593</b>	<b>0.0593</b>	<b>0.1000</b>	<b>N/A</b>	<b>N/A</b>	<b>0.100</b>	<b>N/A</b>	<b>N/A</b>
Paved	-	-	-	0.074	-	-	-	-	34695.3	2567.5	-	-	-	-	-	-	-	-
Grass	-	-	-	0.280	-	-	-	-	9130.3	2556.5	-	-	-	-	-	-	-	-
<b>2</b>	<b>DI CB. 1</b>	<b>MH. 2</b>	<b>10.7</b>	<b>0.873</b>	<b>0.873</b>	<b>10.00</b>	<b>0.14</b>	<b>152</b>	<b>74869</b>	<b>19774.5</b>	<b>0.2289</b>	<b>0.2289</b>	<b>0.0070</b>	<b>0.1467</b>	<b>1.3282</b>	<b>0.375</b>	<b>449.14</b>	<b>449.06</b>
Paved	-	-	-	0.226	-	-	-	-	34695.3	7841.1	-	-	-	-	-	-	-	-
Gravel	-	-	-	0.275	-	-	-	-	31043.2	8536.9	-	-	-	-	-	-	-	-
Grass	-	-	-	0.372	-	-	-	-	9130.3	3396.5	-	-	-	-	-	-	-	-
<b>3</b>	<b>MH. 2</b>	<b>MH. 4</b>	<b>62.5</b>	<b>0.000</b>	<b>0.873</b>	<b>10.14</b>	<b>1.07</b>	<b>152</b>	<b>0</b>	<b>19774.5</b>	<b>0.2289</b>	<b>0.2289</b>	<b>0.0030</b>	<b>0.1562</b>	<b>0.9819</b>	<b>0.450</b>	<b>449.00</b>	<b>448.81</b>
<b>4</b>	<b>CB. 3</b>	<b>MH. 4</b>	<b>28.2</b>	<b>0.000</b>	<b>0.000</b>	<b>10.00</b>	<b>0.55</b>	<b>152</b>	<b>0</b>	<b>0.0</b>	<b>0.0000</b>	<b>0.0000</b>	<b>0.0050</b>	<b>0.0420</b>	<b>0.8566</b>	<b>0.250</b>	<b>449.02</b>	<b>448.87</b>
<b>5</b>	<b>MH. 4</b>	<b>MH. 6</b>	<b>23.2</b>	<b>0.000</b>	<b>0.873</b>	<b>11.21</b>	<b>0.40</b>	<b>148</b>	<b>0</b>	<b>19774.5</b>	<b>0.2289</b>	<b>0.2289</b>	<b>0.0030</b>	<b>0.1562</b>	<b>0.9819</b>	<b>0.450</b>	<b>448.81</b>	<b>448.74</b>
<b>6</b>	<b>CB. 5</b>	<b>MH. 6</b>	<b>8</b>	<b>0.235</b>	<b>0.235</b>	<b>10.00</b>	<b>0.13</b>	<b>152</b>	<b>43826</b>	<b>3935.2</b>	<b>0.0455</b>	<b>0.0455</b>	<b>0.0100</b>	<b>0.0328</b>	<b>1.0440</b>	<b>0.200</b>	<b>449.09</b>	<b>449.01</b>
Paved	-	-	-	0.070	-	-	-	-	34695.3	2428.7	-	-	-	-	-	-	-	-
Grass	-	-	-	0.165	-	-	-	-	9130.3	1506.5	-	-	-	-	-	-	-	-
<b>7</b>	<b>MH. 6</b>	<b>MH. 7</b>	<b>63.6</b>	<b>0.000</b>	<b>1.108</b>	<b>11.61</b>	<b>0.94</b>	<b>146</b>	<b>0</b>	<b>23709.7</b>	<b>0.2744</b>	<b>0.2744</b>	<b>0.0040</b>	<b>0.1803</b>	<b>1.1338</b>	<b>0.450</b>	<b>448.68</b>	<b>448.42</b>
<b>8</b>	<b>MH. 7</b>	<b>MH. 9</b>	<b>19.6</b>	<b>0.000</b>	<b>1.108</b>	<b>12.55</b>	<b>0.29</b>	<b>143</b>	<b>0</b>	<b>23709.7</b>	<b>0.2744</b>	<b>0.2744</b>	<b>0.0040</b>	<b>0.1803</b>	<b>1.1338</b>	<b>0.450</b>	<b>448.36</b>	<b>448.28</b>
<b>9</b>	<b>CB. 8</b>	<b>MH. 9</b>	<b>3.5</b>	<b>0.071</b>	<b>0.071</b>	<b>10.00</b>	<b>0.06</b>	<b>152</b>	<b>43826</b>	<b>2412.2</b>	<b>0.0279</b>	<b>0.0279</b>	<b>0.0100</b>	<b>0.0328</b>	<b>1.0440</b>	<b>0.200</b>	<b>448.38</b>	<b>448.34</b>
Paved	-	-	-	0.069	-	-	-	-	34695.3	2394.0	-	-	-	-	-	-	-	-
Grass	-	-	-	0.002	-	-	-	-	9130.3	18.3	-	-	-	-	-	-	-	-
<b>10</b>	<b>MH. 9</b>	<b>CHMBR 1</b>	<b>5.8</b>	<b>0.000</b>	<b>1.179</b>	<b>12.84</b>	<b>0.08</b>	<b>142</b>	<b>0</b>	<b>26121.9</b>	<b>0.3023</b>	<b>0.3023</b>	<b>0.0050</b>	<b>0.2016</b>	<b>1.2676</b>	<b>0.450</b>	<b>448.28</b>	<b>448.25</b>
<b>11</b>	<b>RWL. 1</b>	<b>MH. 10</b>	<b>1.1</b>	<b>0.230</b>	<b>0.230</b>	<b>10.00</b>	<b>0.02</b>	<b>152</b>	<b>34695</b>	<b>7979.9</b>	<b>0.0924</b>	<b>0.0924</b>	<b>0.0100</b>	<b>0.0595</b>	<b>1.2115</b>	<b>0.250</b>	<b>448.90</b>	<b>448.88</b>
Roof	-	-	-	0.230	-	-	-	-	34695.3	7979.9	-	-	-	-	-	-	-	-
<b>12</b>	<b>MH. 10</b>	<b>CHMBR 1</b>	<b>23.9</b>	<b>0.000</b>	<b>0.230</b>	<b>10.02</b>	<b>0.33</b>	<b>152</b>	<b>0</b>	<b>7979.9</b>	<b>0.0924</b>	<b>0.0924</b>	<b>0.0100</b>	<b>0.0595</b>	<b>1.2115</b>	<b>0.250</b>	<b>448.82</b>	<b>448.58</b>
<b>13</b>	<b>CHMBR 1</b>	<b>MH. 11</b>	<b>1.8</b>	<b>0.000</b>	<b>1.409</b>	<b>12.92</b>	<b>0.03</b>	<b>142</b>	<b>0</b>	<b>34101.8</b>	<b>0.3947</b>	<b>0.3947</b>	<b>0.0050</b>	<b>0.3041</b>	<b>1.4048</b>	<b>0.525</b>	<b>448.25</b>	<b>448.24</b>
<b>14</b>	<b>MH. 11</b>	<b>OGS 1</b>	<b>1</b>	<b>0.000</b>	<b>1.409</b>	<b>12.95</b>	<b>0.02</b>	<b>142</b>	<b>0</b>	<b>34101.8</b>	<b>0.3947</b>	<b>0.0818</b>	<b>0.0050</b>	<b>0.3041</b>	<b>1.4048</b>	<b>0.525</b>	<b>448.21</b>	<b>448.20</b>
<b>15</b>	<b>OGS 1</b>	<b>Street 1</b>	<b>7.6</b>	<b>0.000</b>	<b>1.409</b>	<b>12.97</b>	<b>0.09</b>	<b>142</b>	<b>0</b>	<b>34101.8</b>	<b>0.3947</b>	<b>0.0818</b>	<b>0.0110</b>	<b>0.1014</b>	<b>1.4348</b>	<b>0.300</b>	<b>448.20</b>	<b>448.12</b>

Run-off Coefficients Used:

Velocity Range:

Time of Concentration:

Roof Structure	C = 0.95	Minimum Velocity =	0.60 m/s	Time of Concentration =	10 min
Paved Surface	C = 0.95	Maximum Velocity =	6.00 m/s		
Gravel Surface	C = 0.85				
Grass Surface	C = 0.25				



# **Proposed Orangeville Fire Station** **Exhibit #3 - 100 Year Orifice Plate and** **Storage Volume Calcs**

2025-06-24  
 Job: 220705

## **Site Data**

Site Discharge	Flow (m <sup>3</sup> /s)	Adj. Flow (w/o Surface Runoff) (m <sup>3</sup> /s)	Total Storm Volume (m <sup>3</sup> )
5YR - Pre - Develop.	0.1425	0.0832	<del>0.0832</del>
100YR - Post - Develop.	0.4540	0.3947	356.0

## **Control Node Data**

Outlet Pipe	Storm Control Node	Outlet Pipe Size (m)	Outlet Invert Elev. (m)	Elev. @ Orifice (m)
14	MH. 11	0.525	448.21	448.30

\* Volume calculated using SWMM 5.1 modelling software in accordance with the flow rate for actual size of the orifice.

## **Head Height**

1.53 m

## **Storm Retention Elev. Check**

**449.83 m**

## **Triton System Storage**

Model #	# of Chambers	Storage Volume (m <sup>3</sup> )
S-22	368	377.0

**Total Storage = 377.0 m<sup>3</sup> Required Storage Achieved**

## **Orifice Diameter Calculation ( $A=Q/(Cd*\sqrt{2*g*h})$ )**

Coefficient of Discharge	Cd = 0.62 (sharp)	0.62 Sharp Orifice coefficient of discharge
Allowable Flow Rate	Q = 0.0832 m <sup>3</sup> /s	0.80 Tube coefficient of discharge
Force of Gravity	g = 9.81 m/s/s	
Head Height	h = 1.53 m	

Dia of Max. Orifice      dia = 176.55 mm      Use - 175 mm

## **Flow Rate for Actual Size of Hole ( $Q=Cd*A*\sqrt{2*g*h}$ )**

Area of Orifice	A = 0.0241 m <sup>2</sup>
Flow Rate through Orifice	Q = 0.0818 m <sup>3</sup> /s



# Proposed Orangeville Fire Station Exhibit #4 - Water Balance and Storage Volume Calcs

2025-06-24  
Job: 220705

<u>On Site Storage - Storm Chambers</u>		
Area of S-22 Chamber Bed	493.2	m <sup>2</sup>
S-22 Chamber Outlet Elevation	448.25	m
Groundwater elevation	442.80	m
Required Storage as per Geotech	833.0	m <sup>3</sup>
Proposed Stone Depth	2.88	m
Proposed Bottom of Stone Elevation	445.37	m
Storage below elevation 448.25	568.2	m <sup>3</sup>

\* Given the groundwater has not been observed within the boreholes in the area adjacent to the underground Chamber System, the end of deepest borehole is considered as a groundwater elevation.

\* Volume includes 40% stone void

<u>On Site Storage - Bioretention Swale</u>		
Area of Bioretention Swale	474.6	m <sup>2</sup>
Bottom of Choking Layer Elevation	448.82	m
Groundwater elevation	447.38	m
Required Storage as per Geotech	833.0	m <sup>3</sup>
Proposed Stone Depth	1.40	m
Proposed Bottom of Stone Elevation	447.42	m
Storage below elevation 448.82	265.8	m <sup>3</sup>

\* Volume includes 40% stone void

<b>Total Storage =</b>	<b>833.9 m<sup>3</sup></b>	<b>Required Storage Achieved</b>
------------------------	----------------------------	----------------------------------

T-Time	T <sub>t</sub> =	10 min/cm
Infiltration Rate	i=	24 mm/hr
Void Ratio	V <sub>r</sub> =	0.4
Time to Drain	T <sub>s</sub> =	48 hr
Max Reservoir Depth	Dr <sub>max</sub> =	2.88 m

\* Percolation Time and Infiltration Rate are based on Fisher Engineering Report FG24-14044, dated July 26, 2024. Used factor of safety FS=2.5

\* Given the designed depths of the granular storagesares less than the maximum required reservoir depth, the required storm volume will therefore drain in less than 48 hours.



# **APPENDIX ‘A’**

HydroStorm HS12

Sizing Calculations and Schematic



## **Hydroworks Sizing Summary**

### **Orangeville Fire Station**

**10 Commerce Rd, Orangeville**

**05-13-2025**

### **Recommended Size: HydroStorm HS 12**

Hydroworks Sizing Program Version 5.8.5

A HydroStorm HS 12 is recommended to provide 80 % annual TSS removal based on a drainage area of 1.63 (ha) with an imperviousness of 65 % and Toronto Central, Ontario rainfall for the ETV particle size distribution.

The recommended HydroStorm HS 12 treats 99 % of the annual runoff and provides 81 % annual TSS removal for the Toronto Central rainfall records and ETV particle size distribution.

The HydroStorm has a headloss coefficient (K) of 1.04. Since a peak flow was not specified, headloss was calculated using the full pipe flow of .1 (m<sup>3</sup>/s) for the given 300 (mm) pipe diameter at 1.1% slope. The headloss was calculated to be 109 (mm) based on a flow depth of 300 (mm) (full pipe flow).

This summary report provides the main parameters that were used for sizing. These parameters are shown on the summary tables and graphs provided in this report.

If you have any questions regarding this sizing summary please do not hesitate to contact Hydroworks at 888-290-7900 or email us at [support@hydroworks.com](mailto:support@hydroworks.com).

The sizing program is for sizing purposes only and does not address any site specific parameters such as hydraulic gradeline, tailwater submergence, groundwater, soils bearing capacity, etc. Headloss calculations are not a hydraulic gradeline calculation since this requires a starting water level and an analysis of the entire system downstream of the HydroStorm .

## TSS Removal Sizing Summary

Hydroworks Hydrodynamic Separator Sizing Program - HydroStorm

File Product Units CAD Video Help

Main Dimensions Rainfall Site TSS PSD TSS Load Site Storage By-Pass Custom CAD Video Other

Site Parameters  
 Area (ha) 1.63  
 Imperviousness (%) 65

Units  
☐ U.S.  
☒ Metric

Rainfall Station  
 Toronto Central Ontario  
 1982 To 1999 Rainfall Timestep = 15 min.

Project Title (2 lines)  
 Orangeville Fire Station  
 10 Commerce Rd, Orangeville

ETV Lab Testing Results ☐ Post Treatment Recharge

Outlet Pipe  
 Diam. (mm) 300 Peak Design Flow (m3/s)  
 Slope (%) 1.1

HydroStorm Annual Sizing Results

Model #	Qlow (m3/s)	Qtot (m3/s)	Flow Capture (%)	TSS Removal (%)
Unavailable	.019	.101	87 %	34 %
HS 4	.032	.101	93 %	45 %
HS 5	.04	.101	94 %	54 %
HS 6	.048	.101	95 %	60 %
Unavailable	.068	.101	97 %	64 %
HS 8	.089	.101	98 %	68 %
HS 10	.101	.101	99 %	76 %
HS 12	.101	.101	99 %	81 %

Particle Size Distribution

Size (um)	%	SG
1	5	2.65
4	5	2.65
6	5	2.65
7	5	2.65
18	15	2.65
45	10	2.65
70	5	2.65
90	10	2.65
125	15	2.65
200	15	2.65

Note: Results vary significantly based on particle size distribution

Simulate

## TSS Particle Size Distribution

Hydroworks Hydrodynamic Separator Sizing Program - HydroStorm

File Product Units CAD Video Help

Main Dimensions Rainfall Site TSS PSD TSS Load Site Storage By-Pass Custom CAD Video Other

TSS Particle Size Distribution

Size (um)	%	SG
1	5	2.65
4	5	2.65
6	5	2.65
7	5	2.65
18	15	2.65
45	10	2.65
70	5	2.65
90	10	2.65
125	15	2.65
200	15	2.65
400	5	2.65
850	5	2.65
*		

Notes:

1. To change data just click a cell and type in the new value(s)
2. To add a row just go to the bottom of the table and start typing.
3. To delete a row, select the row by clicking on the first pointer column, then press delete
4. To sort the table click on one of the column headings

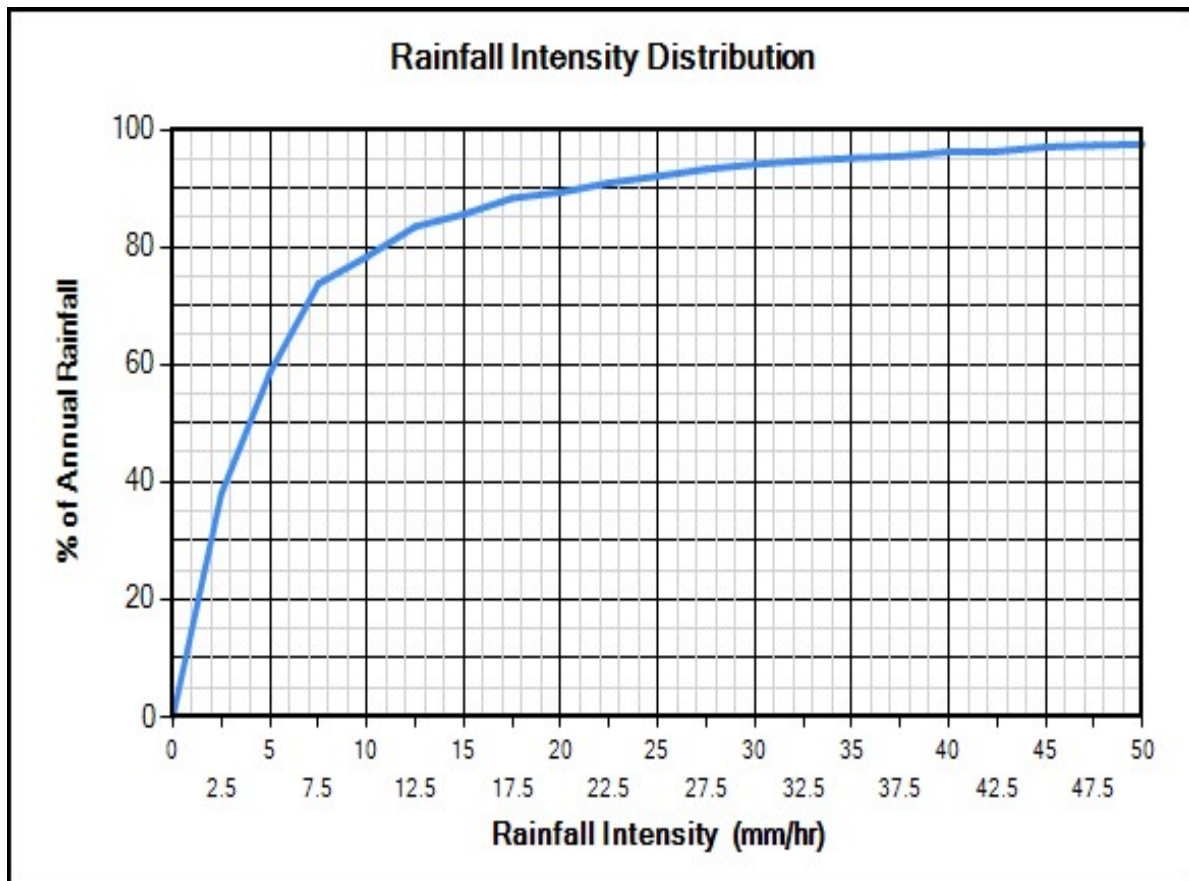
TSS Distributions

- ☒ ETV Canada
- ☐ Standard HDS Design
- ☐ Alden Laboratory
- ☐ OK110
- ☐ Toronto
- ☐ Ontario Fine
- ☐ ETV Canada (Calgary)
- ☐ Calgary Forebay
- ☐ Kitchener
- ☐ User Defined

Clear

You must select a particle size distribution for TSS to simulate TSS removal

Water Temp (C) 20



## Site Physical Characteristics

Hydroworks Hydrodynamic Separator Sizing Program - HydroStorm

File Product Units CAD Video Help

Main Dimensions Rainfall Site TSS PSD TSS Load Site Storage By-Pass Custom CAD Video Other

**Catchment Parameters**

Width (m)  Imperv. Mannings n  Maintenance Frequency (months)

Perv Mannings n

Slope (%)  Imp. Depress. Storage (mm)

Perv. Depress. Storage (mm)

**Daily Evaporation (mm/day)**

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	2.54	2.54	3.81	3.81	3.81	2.54	2.54	0	0

**Infiltration**

Max. Infiltration Rate (mm/hr)

Min. Infiltration Rate (mm/hr)

Infiltration Decay Rate (1/s)

Infiltration Regen. Rate (1/s)

**Catch Basins**

# of Catch basins

**Constant Baseflow**

Roof Runoff (m3/s)

Resets all parameters excluding input catchment width.

## Dimensions And Capacities

Hydroworks Hydrodynamic Separator Sizing Program - HydroStorm

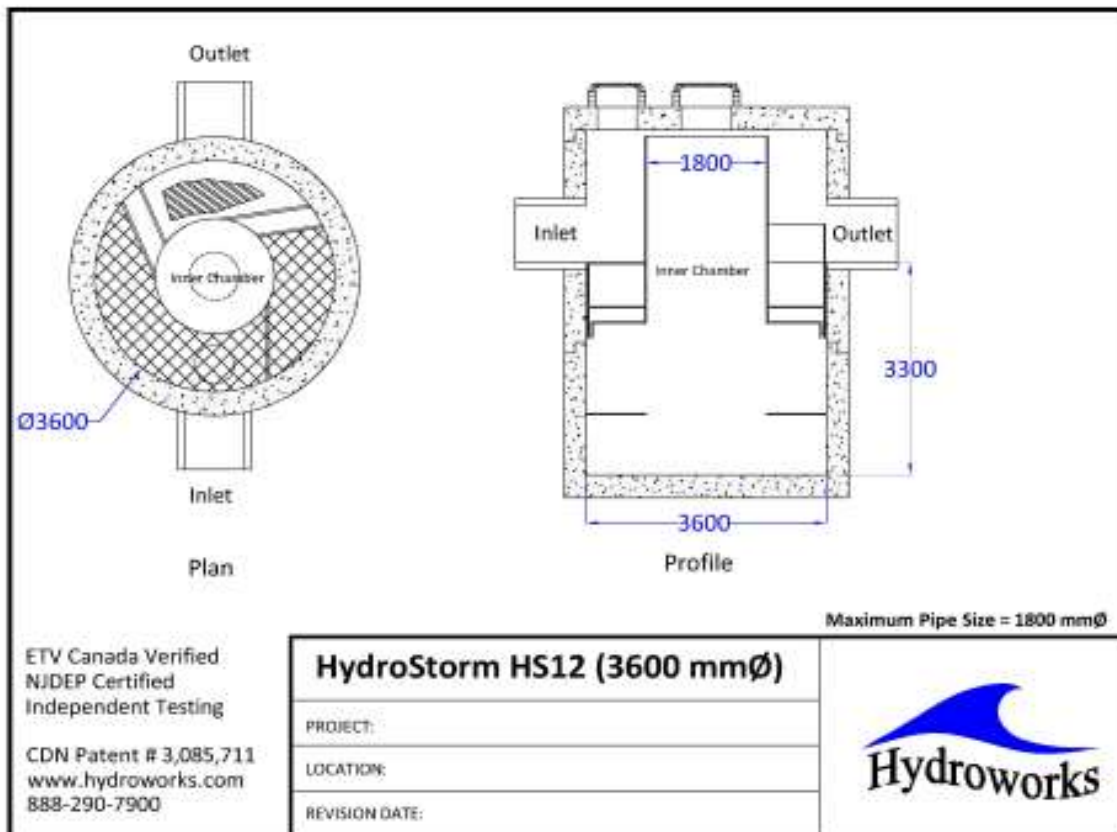
File Product Units CAD Video Help

Main Dimensions Rainfall Site TSS PSD TSS Load Site Storage By-Pass Custom CAD Video Other

Dimensions and Capacities					
Model	Diam. (m)	Depth (m)	Float. Vol. (L)	Sediment Vol. (m3)	Total Vol. (m3)
HS 3	0.91	1.07	185	0.4	0.7
HS 4	1.22	1.22	381	0.9	1.4
HS 5	1.52	1.52	642	1.8	2.8
HS 6	1.83	1.83	1041	3.2	4.8
HS 7	2.13	1.98	1575	4.6	7.1
HS 8	2.44	2.13	2354	6.3	10
HS 10	3.05	2.74	4327	13.2	20
HS 12	3.66	3.35	7164	23.8	35.2

Depth = Depth from outlet invert to inside bottom of tank

## Generic HS 12 CAD Drawing



## TSS Buildup And Washoff

Hydroworks Hydrodynamic Separator Sizing Program - HydroStorm

File Product Units CAD Video Help

Main Dimensions Rainfall Site TSS PSD TSS Load Site Storage By-Pass Custom CAD Video Other

**TSS Buildup**

☐ Power Linear  
☒ Exponential  
☐ Michaelis-Menton  
☐ No Buildup Required

**TSS Washoff**

☒ Power-Exponential  
☐ Rating Curve (no upper limit)  
☐ Rating Curve (limited to buildup)  
☐ Event Mean Concentration

**Street Sweeping**

Efficiency (%)   
Start Month   
Stop Month   
Frequency (days)   
Available Fraction

**Soil Erosion**

☐ Add Erosion to TSS

**Reset to Default Values**

**TSS Buildup Parameters**

Limit (kg/ha)   
Coeff (kg/ha)   
Exponent

**TSS Washoff Parameters**

Coefficient   
Exponent

**TSS Buildup**

☒ Based on Area  
☐ Based on Curb Length

## Upstream Quantity Storage

Hydroworks Hydrodynamic Separator Sizing Program - HydroStorm

File Product Units CAD Video Help

Main Dimensions Rainfall Site TSS PSD TSS Load Site Storage By-Pass Custom CAD Video Other

**Quantity Control Storage**

	Storage (m3)	Discharge (m3/s)
▶	0	0
•		

**Clear**



## Other Parameters

The screenshot shows the 'Hydroworks Hydrodynamic Separator Sizing Program - HydroStorm' window. The 'Other' tab is selected, displaying several parameter groups:

- Scaling Law**
  - ☒ Peclet Scaling based on diameter x depth
  - ☐ Peclet Scaling based on surface area (diameter x diameter)
- TSS Removal Extrapolation**
  - ☒ Extrapolate TSS Removal for flows lower than tested
  - ☐ No TSS Removal extrapolation for flows lower than tested
  - ☐ No TSS Removal extrapolation for lower flows or inter-event periods
- Lab Testing**
  - ☐ Use NJDEP Lab Testing Results
  - ☒ Use ETV Canada Lab Testing Results
- Oil / Sediment Storage**
  - ☒ Oil Spill Storage in Pretreatment Area
  - ☐ Sediment Storage in Pretreatment Area
  - ☐ 50% Oil Spill / 50% Sediment Storage in Pretreatment Area
- TSS Removal Results**
  - ☒ Required TSS Removal
  - ☐ Choose Model #
- TSS Removal Required**
  - TSS Removal (%)  Enter required TSS Removal (%)

## Flagged Issues

None

**Hydroworks Sizing Program - Version 5.8.5**

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