
SPECIFICATIONS

Town of Orangeville Operations Centre Expansion

**500 C-Line,
Orangeville, Ontario**

Issued for Tender – January 2025.

**Alaimo Architecture Inc.
Project: 2022-008**

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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 from 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 500 C Line, 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 The Contractor will be required to participate with the balance of the project team by using Procore for the duration of the project.
- 3.3 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.

- 3.4 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.
- 3.5 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.
- 3.6 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 Door Hardware. See 08 70 00 in the specifications (General Contractor to procure 3 quotations).
 - .3 Contingency items at the discretion of the Architect to complete project.

Total Cash Allowance: \$ **225,000.00**.

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 the 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 the 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 the 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 plans 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 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, 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 Statues, 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 m² (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/(sAm²) 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 firestopped 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 Municipality'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 Municipality'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
CMPA	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 sidewalks.

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 (if an elevator is proposed for this project).
- 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 waste 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; Consultant
- .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 were 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 on a daily basis 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



THURBER ENGINEERING LTD.

**GEOTECHNICAL INVESTIGATION REPORT
GARAGE EXPANSION AT TOWN OF ORANGEVILLE OPERATIONS CENTRE (OPC)
500 C-LINE
ORANGEVILLE, ONTARIO**

Report

To

TOWN OF ORANGEVILLE

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Date: August 14, 2023
File: 36304



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APPENDIX F ENVIRONMENTAL LABORATORY CERTIFICATES OF ANALYSIS -
GROUNDWATER



1. INTRODUCTION

This report presents the results of a geotechnical investigation carried out by Thurber Engineering Ltd. (Thurber) for the Town of Orangeville (Town) in support of the design and construction of the proposed garage expansion at the Operations Center (OPC) at 500 C-Line in Orangeville, Ontario.

It is understood the Town plans to expand the OPC by addition of a three-bay garage to the west end of the existing building. The proposed addition will comprise a slab-on-grade structure with plan dimensions of 18.8 by 29.9 m and will include a wash bay, repair garage, and office.

The purpose of the investigation was to explore the subsurface conditions within the project limits, and based on the data obtained, to provide a borehole location drawing, record of borehole sheets, laboratory test results, a written description of the subsurface conditions, and geotechnical comments and recommendations regarding foundation design, floor slab subgrade preparation, excavation, and dewatering.

A limited chemical testing program was completed on selected soil and groundwater samples to evaluate the environmental quality and provide preliminary management options. The scope of the soil testing is not considered adequate to determine soil disposal requirements or meet the requirements of the Ontario Ministry of Environment, Conservation and Parks' (MECP) Ontario Regulation 406/19, On-Site and Excess Soil Management. As a result, additional soil sample collection, analyses and documentation may be required to meet this regulation. The groundwater sampling scope does not include a hydrogeological investigation sufficient to evaluate dewatering volumes during construction and support EASR registration or PTTW application if necessary.

It is a condition of this report that Thurber's performance of its professional services is subject to the attached Statement of Limitations and Conditions.

2. BACKGROUND INFORMATION

2.1 Site Description

The OPC is located at 500 C-Line in the Town of Orangeville and comprises an existing building consisting of an office connected to a four bay maintenance garage. The proposed expansion is located within an asphalt paved area located west of the existing four bay garage. The property is an active operations yard owned by the Town.



2.2 Geology

Based on the information in *The Physiography of Southern Ontario*¹ by Chapman and Putnam (1984), the site is located within the Hillsburgh Sandhills physiographic region. The Hillsburgh Sandhills are characterized by fine-grained sand and rough topography. The OPC is located near the intersection of two different physiographic landforms; a kame moraine to the north of the site and a spillway located south of the site.

Based on *Surficial Geology of Southern Ontario*², the surficial geology is defined by the intersection of the physiographic landforms and comprises sandy silty to silty sand textured till of the kame moraine to the north and glaciofluvial deposits associated with the spillway to the south.

3. INVESTIGATION PROCEDURES

3.1 Borehole Drilling

The field investigation for this project was completed on February 7th, 2023, and comprised a total of five (5) boreholes as summarized in Table 3.1 below. Borehole details are provided in the Record of Borehole sheets included in Appendix A. The approximate locations of the boreholes are shown on Drawing 36304-1 provided in Appendix B.

Table 3.1 - Borehole Details

BH No.(s)	Approx. Ground Elev. (m)	BH Term. Depth (m)	Approx. BH Term. Elev. (m)
BH-1	417.3	6.7	410.6
BH-2	417.6	6.7	410.9
BH-3	417.6	6.7	410.9
BH-4	417.5	6.7	410.8
BH-5	417.7	6.7	411.0

The borehole locations were established in the field by Thurber using a portable GPS receiver and verified relative to existing site features. All borehole locations were cleared of utilities prior to commencement of drilling. The boreholes were repositioned as necessary in consideration of

¹ Chapman, L.J. and Putnam, D.F. 1984. *The Physiography of Southern Ontario*, Ontario Geological Survey Special Volume 2, Third Edition. Accompanied by Map P.2715, Scale 1:600,000.

² Ontario Geological Survey, 2010: *Surficial geology of Southern Ontario*; Ontario Geological Survey, Miscellaneous Release--Data 128-REV



surface features, underground utilities, and restricted site access. The ground surface elevations at the borehole locations were determined using a Trimble R10 GNSS.

The boreholes were advanced using hollow stem augers powered by a track mounted Versadrill GT8 drill rig supplied and operated by Landshark Drilling Inc. Soil samples were obtained at selected intervals using a 50 mm outside diameter split-spoon sampler driven in conjunction with the Standard Penetration Test (SPT).

The field investigation was carried out under the full-time supervision of Thurber technical staff. The boreholes were logged in the field. Soil samples were identified, placed in labelled containers, and transported back to Thurber’s laboratory in Oakville for further examination and testing. Particular attention was applied to visual and olfactory evidence of potential contamination such as odours and staining during field work.

3.2 Groundwater Monitoring

Groundwater conditions were observed in the open boreholes throughout the drilling operations. One (1) monitoring well was installed in Borehole BH-3 to permit monitoring of the groundwater levels at the site. The monitoring well consists of 50 mm diameter PVC pipe with a slotted screen sealed at a selected depth within the borehole. The installation details are summarized in Table 3.2 below.

Table 3.2 – Monitoring Well Details

Borehole/ Monitoring Well (BH/MW) No.	Ground Elevation (ml)	Monitoring Well Tip		Slotted Screen Length (m)	Mid- Screen Depth (m)	Mid- Screen Elev. (m)
		Depth (m)	Elevation (m)			
BH-3	417.6	3.7	414.0	1.5	2.9	414.7

The boreholes in which no monitoring wells were installed were backfilled in general accordance with Ontario Regulation 903.

Groundwater levels were collected at the monitoring well location on February 7th and 17th, 2023 using a groundwater level meter.



3.3 Field Screening Measurements

The soil samples recovered from the boreholes were screened for both volatile organic compounds (VOCs), calibrated with isobutylene, and combustible gases, calibrated with methane, using an RKI Eagle 2 instrument. The field screening measured the concentrations of gases/vapours in the headspace of soil samples contained in sealed, plastic bags.

Field screening of soil was conducted to provide a semi-quantitative assessment of volatile parameters in soil which involves the measurement of undifferentiated organic compounds and does not discriminate among the various organic parameters. As such, the gas/vapour readings are not considered to be actual concentrations of gases and vapours in the soil samples but are indicative of the relative concentrations in the samples. The headspace measurements are typically taken to guide the selection of soil samples for chemical analysis of organic compounds such as volatile constituents and/or petroleum hydrocarbons. No unusual concentrations of methane and isobutylene were measured.

4. LABORATORY TESTING

4.1 Geotechnical

Geotechnical laboratory testing was carried out at Thurber's laboratory. All recovered soil samples were subjected to visual identification and to natural moisture content determination. Selected samples were also subjected to grain size distribution analysis (hydrometer and/or sieve) and Atterberg Limits testing, where appropriate.

Results of the geotechnical soil laboratory testing are presented on the Record of Borehole sheets in Appendix A and in detail in Appendix C.

4.2 Corrosivity and Sulphates

Selected soil samples were submitted for chemical testing to assess the corrosion potential of the soil and the potential for sulphate attack on subsurface concrete structures. The analyses were carried out by SGS Canada Inc. (SGS), an independent Canadian Association for Laboratory Accreditation (CALA) accredited laboratory. The laboratory Certificates of Analysis presenting the results of these analyses are included in Appendix D.



4.3 Geoenvironmental

To evaluate the general environmental quality of the soils, representative samples of the soils recovered from the boreholes were submitted to SGS Canada Inc. (SGS) for analysis of selected metals and inorganics (M&I), petroleum hydrocarbons (PHCs), benzene, toluene, ethylbenzene and xylenes (BTEX), volatile organic compounds (VOCs), and polycyclic aromatic hydrocarbons (PAHs) as outlined in O. Reg. 153/04.

The sample locations and material types selected for testing are summarized in Table 4.1.

Table 4.1 – Soil Samples Selected for Analytical Testing

Borehole	Sample ID	Approx. Depth (m)	Sample Description	Analysis Parameters				
				M & I	PHCs	BTEX	VOCs	PAHs
BH-1	BH-1 SS2	0.8 – 1.3	Native sand	☒	☒	☒	☒	☒
BH-2	BH-2 SS1	0.1 – 0.6	Sand fill	☒	☒	☒	☒	☒
BH-3	BH-3 SS2	0.8 – 1.4	Native sand	☒	☒	☒	☒	☒
BH-4	BH-4 SS1	0.1 – 0.6	Sand and gravel fill	☒	☒	☒	☒	☒
BH-4	BH-4 SS3	1.5 – 2.1	Native sand	☒	☒	☒	☒	☒
BH-5	BH-5 SS1	0.1 – 0.6	Sand and gravel fill	☒	☒	☒	☒	☒

In addition to the above, one composite sample of the six tested soil samples was submitted for Toxicity Characteristic Leaching Procedure (TCLP) analysis of metals and inorganic compounds, VOCs, PCBs, benzo(a)pyrene and ignitability in accordance with O. Reg. 347, as amended, to classify materials for transfer to a MECP licenced waste management facility.

The results of the chemical laboratory testing are presented on the laboratory certificates of analysis (COA) in Appendix E.

4.4 Groundwater Quality

Three groundwater samples sets were collected from the monitoring well in Borehole BH-3 on February 17, 2023 for preliminary assessment of dewatering disposal options and potential treatment needs. The groundwater samples were collected using a bailer and submitted to SGS for testing of Town of Orangeville sewer use by-law parameters (Sample ID BH-3) as well as



various parameters such as metals, inorganics and general chemistry under the Provincial Water Quality Objectives (PWQO) (Sample ID BH-3 (PWQO)). A set of field filtered samples (Sample ID BH-3-F (PWQO)) was also submitted to assess the influence of sediment on the measured metal concentrations and the effect of filtering pumped groundwater.

Prior to sampling or in-situ testing, the monitoring well was developed by purging at least three well volumes or until dry to increase the representation of natural groundwater within the well. Development was assessed to be completed based on the number of well volumes purged, stabilization of general chemistry parameters of the pumped groundwater (pH, temperature, conductivity) over time and qualitative observations such as decrease in turbidity of the pumped water. It is noted that during well development and sampling, visual and olfactory indications of possible contamination, namely sheen and hydrocarbon odour, were not observed in the well water of BH-3.

The results of the groundwater chemical testing are provided on the laboratory certificates of analysis (COA) included in Appendix F.

The results are considered representative of the water sampled from the selected well at the time of sampling and provide a general understanding of groundwater quality under those conditions. The water quality at the site may vary based on location, time, meteorological conditions, and construction and dewatering methods.

The concentration of suspended solids in the groundwater or in water that is collected during construction dewatering (e.g., from a sump in an open excavation) will significantly affect the concentrations of many regulated parameters, particularly metals. The value of testing groundwater quality during the investigation is primarily to identify the types of contaminants that may need to be managed, the extent to which they are dissolved and therefore unlikely to be filtered by physical means alone, and the presence of anthropogenic contaminants that are listed in the given discharge criteria that may require specific treatment.

5. DESCRIPTION OF SUBSURFACE CONDITIONS

Details of the encountered soil stratigraphy are presented on the Record of Borehole sheets included in Appendix A. A general description of the stratigraphy, based on the conditions encountered in the boreholes, is given in the following paragraphs. However, the factual data presented on the Record of Borehole sheets takes precedence over this general description and must be used for interpretation of the site conditions. It should be recognized and expected that soil conditions will vary between and beyond borehole locations.



The subsurface stratigraphy encountered in the boreholes generally consisted of a surficial pavement structure (asphalt over granular fill) underlain by sand fill and sand deposits, over deposits of silty clay to clayey silt. Further descriptions of the individual strata are presented below.

5.1 Pavement Structure and Fill

A pavement structure consisting of a 25 to 75 mm thick layer of asphalt over approximately 650 to 1,500 mm of granular fill was encountered at the ground surface of the boreholes. The granular fill comprised sand and gravel to depths of 0.7 to 0.8 m in Boreholes BH-1 and BH-3 to BH-5, sand below this depth in Boreholes BH-4 and BH-5, and sand for the full depth in Borehole BH-2. The fill was penetrated at depths of 0.7 to 1.6 m (Elev. 416.1 to 417.0 m).

SPT 'N' values recorded in the granular fill layer ranged from 16 to 96 blows per 300 mm of penetration, indicating a typically very dense (possibly frozen) condition in the upper 0.8 m, and compact to dense below this level. Measured moisture contents within the granular fill ranged from 2 to 12%.

The results of a grain size distribution analysis completed on a selected sample of the granular fill are presented in Figure C1 in Appendix C. The results indicated 8% gravel, 68% sand, 21% silt, and 3% clay sized particles.

5.2 Sand to Silt and Sand

A cohesionless deposit, ranging in thickness from 0.8 to 3.0 m, was encountered beneath the granular fill at depths of 0.7 to 1.6 m (Elev. 416.1 to 417.0 m) and was penetrated at depths of 2.2 to 4.4 m (Elev. 413.4 to 415.4 m) in the boreholes. Locally in Borehole BH-4, a lower sand layer was encountered below silty clay at a depth of 5.6 m (Elev. 411.8 m) and was contacted to the termination depth of 6.7 m (Elev. 410.8 m). In general, the cohesionless deposit consisted of sand with trace gravel to gravelly, trace to some silt and trace clay. Locally, in Borehole BH-1, a layer of silt and sand was observed from 2.2 m to 3.0 m (Elev. 414.4 to 415.1 m).

SPT 'N' values recorded in the sand layers typically varied from 8 to 25 blows per 300 mm of penetration indicating a relative density of loose to compact. One 'N' value of 34 (dense) was recorded in Borehole BH-3. Moisture contents ranged from 5 to 15%, locally 18% in the lower sand layer in Borehole BH-4.



The results of grain size distribution analyses carried out on selected samples of the sand deposit are presented on Figure C2 in Appendix C. The results of the grain size distribution analyses are summarized in Table 5.1 below.

Table 5.1 – Grain Size Distribution of Sand to Silt and Sand Deposits

Soil Particle	Percentage (%)		
	Gravelly Sand	Sand	Silt and Sand
Gravel	30	0 to 1	0
Sand	56	80 to 85	39
Silt	14	11 to 13	56
Clay		4 to 6	5

5.3 Silty Clay to Clayey Silt

A cohesive deposit of silty clay, locally clayey silt in Borehole BH-1, was encountered below the sand layer at depths of 2.2 to 4.4 m (Elev. 413.4 to 415.4 m) in all boreholes. The clay layer was penetrated at a depth of 5.6 m (Elev. 411.8 m) in Borehole BH-4. Boreholes BH-1 to BH-3 and BH-5 were terminated in the clay layer at depths of 6.7 m (Elev. 410.6 to 411.0 m).

SPT 'N' values recorded in the silty clay and clayey silt typically ranged from 12 to 24 blows per 300 mm penetration, indicating a consistency of stiff to very stiff, with a localized value of 31 indicating a hard condition. Natural moisture contents of the clayey deposits ranged from 14 to 22%, generally increasing with depth.

The results of grain size distribution analyses carried out on selected samples of the silt and clay deposits are presented on Figure C3 in Appendix C. The results of the grain size distribution analyses are summarized in Table 5.2 below.

Table 5.2 – Grain Size Distribution of Silty Clay to Clayey Silt Deposits

Soil Particle	Percentage (%)
Gravel	0
Sand	5 to 6
Silt	66 to 77
Clay	18 to 28

The results of Atterberg Limits testing conducted on two selected samples of the cohesive deposits indicate that the sample tested ranged from slightly plastic clayey silt (CL-ML) to low plastic silty clay (CL). The results of the testing are presented in Figure C4 in Appendix C and are summarized in Table 5.3 below.



Table 5.3 – Atterberg Limits of Silty Clay to Clayey Silt Deposits

Index Property	Percentage (%)
Liquid Limit	19 to 28
Plastic Limit	13 to 16
Plasticity Index	6 to 12

5.4 Groundwater Observations

Upon completion of drilling, water levels measured in the open boreholes ranged from 3.1 m to 5.9 m (Elev. 411.9 to 414.4 m). The groundwater levels observed in the monitoring well installed in Borehole BH-3 are summarized in Table 5.4 below.

Table 5.4 – Measured Groundwater Levels

Borehole/ Monitoring Well No.	Ground Elev. (m)	Mid- Screen Depth (m)	Mid- Screen Elev. (m)	Ground Water Elevation (Depth - m)	
				Feb. 07, 2023	Feb. 17, 2023
BH-3	417.6	2.9	414.7	414.9 (2.7)	415.3 (2.4)

The above groundwater level measurements are short-term observations and seasonal fluctuations are to be expected. Further, groundwater levels may be higher after prolonged periods of precipitation.

6. RESULTS OF CHEMICAL TESTING

6.1 Corrosivity And Sulphate Test Results

Two (2) representative soil samples were submitted for testing of corrosivity potential and sulphate attack. The results are provided on the laboratory certificates of analysis presented in Appendix D and summarized in Table 6.1 below.

Table 6.1 – Corrosivity Test Results

Sample ID	Depth (m)	Description	Sulphide (%)	Chloride (µg/g)	Sulphate (µg/g)	pH	Electrical Conductivity (uS/cm)	Resistivity (ohm.cm)	Redox Potential (mV)
BH-2 SS1	0.1 – 0.7	Sand Fill	<0.04	120	18	9.93	328	3050	189
BH-4 SS2	0.8 – 1.4	Sand Fill	<0.04	360	21	9.26	1150	869	203



6.2 Geoenvironmental

A due diligence level of sampling and testing has been completed to obtain a preliminary understanding of the environmental quality of soils that may be excavated during construction to help assess potential re-use and disposal options.

Visual and olfactory examination of the soil samples was completed on the recovered samples from the geotechnical field investigation program to identify staining or odours indicative of hydrocarbon impact or other contamination and are presented on the borehole logs. In general, there were no visual and olfactory indications of impact observed in the soil samples recovered from the geotechnical field investigation program. Elevated concentrations of methane and isobutylene were not measured in the field screening of volatile organic compounds (VOCs).

6.2.1 Applicable Standards

For preliminary evaluation of the environmental quality of the on-site soils, representative samples recovered from selected boreholes were submitted to SGS Canada Inc. (SGS), an independent Canadian Association for Laboratory Accreditation (CALA) accredited laboratory, for chemical testing of metals and inorganic parameters; PHC Fractions F1 to F4, including BTEX, VOCs, and PAHs in accordance with O. Reg. 153/04. The resulting data were compared to the Soil Quality Standards provided under Ontario Regulation 153/04 in MECP’s document “Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of Environmental Protection Act”, April 15, 2011 (“2011 MECP Document”). The applicable site condition standards were determined through a review of the following criteria (Table 6.2):

Table 6.2 – Ontario Regulation 153/04 Project Classification Criteria

Review of Criteria	Project Area
Area of natural significance	No areas of natural or provincial significance are within 30 m of the project area.
Proximity to a water body	There are no water bodies within 30 m of the project area. ¹
Potable or non-potable groundwater conditions	There are water supply wells reported within approximately 250 m of the site, therefore, the potable condition is applicable.
Soil textures	The onsite soils consisted of native silt and clay deposits, native sand deposits, and fill generally comprising gravel and sand within the proposed excavation depths, therefore, the more stringent standard for coarse textured soil is considered.
Soil pH	pH values in the recovered samples exceeded the pH range of 5 to 9.
Full depth or stratified approach	Full depth approach is adopted for this subsurface investigation.
Soil (Overburden) thickness	Bedrock was not encountered in the boreholes advanced to depths of 6.71 m. On this basis, the Project Area is not categorized as a “shallow soil property”.
Property Use	OPC is considered “industrial, commercial, and community land use”, therefore, Industrial/Commercial/Community Property uses is selected as the appropriate land use for the Project Area.



Note 1: An observed pond on site was constructed for the purpose of controlling surface water drainage and therefore does not constitute a “water body” as defined by O. Reg 153/04.

Soil pH values from soil samples recovered on site range from 7.63 to 9.93, therefore the MECP Table 1: Full Depth Background Site Condition Standards for residential / parkland / institutional / industrial / commercial / community (RPI/ICC) property uses (MECP Table 1 Standards) were considered to be the applicable site condition standards (SCS) for soil which may be excavated on site.

6.2.2 Chemical Testing Results

The results of the laboratory testing indicate that the concentrations of the tested parameters are below MECP Table 1 RPI/ICC Standards, with the exception of sodium adsorption ratio (SAR) in all the samples tested, and electrical conductivity (EC) in five out of the six samples tested. The results are shown in the COAs in Appendix E.

To classify excess soils for disposal at a MECP licenced landfill or treatment facility, the TCLP results were compared to the leachate quality criteria defined in Schedule 4 of O. Reg. 347 as amended by O. Reg. 558/00. The measured concentrations of the parameters tested in the TCLP analyses were below the leachate quality criteria defined in Schedule 4 of O. Reg. 347. Additionally, the samples were not ignitable, and PCBs were not detected. The results are shown in the COAs in Appendix E. Based on these results, the soils may be classified as non-hazardous for disposal to a waste management facility with an Environmental Compliance Approval (ECA) to receive this material (pending approval of receiving site authorities).

6.3 Groundwater Quality Results

The results of the laboratory testing indicate that four (4) of the tested parameters (total suspended solids, aluminum, iron, and chloride) exceed the Town of Orangeville Sanitary Sewer limits and five (5) of the tested parameters (total suspended solids, copper, lead, nickel, and zinc) exceed the Town Storm Sewer limits in the unfiltered sample. The exceedances of the samples are summarized in Tables 6.3 and 6.4.

The results indicate that thirteen (13) of the tested parameters (aluminum, arsenic, lead, cadmium, cobalt, copper, iron, nickel, phosphorus, silver, thallium, vanadium and zinc) exceed the Provincial Water Quality Objectives (PWQOs) in the unfiltered sample (BH-3 (PWQO)). The exceedances of the unfiltered sample are summarized in Tables 6.5. It is noted that exceedances were not detected in the filtered sample (BH-3-F (PWQO)).



Table 6.3 – Town of Orangeville Sanitary Sewer Exceedances

Sample ID	Parameter	Units	Town of Orangeville Sanitary Sewer Limit	Measured Concentration
BH-3	Total Suspended Solids	mg/L	350	5050
	Aluminum	mg/L	50	62
	Iron	mg/L	50	103
	Chloride	mg/L	1500	2800

Table 6.4 – Town of Orangeville Storm Sewer Exceedances

Sample ID	Parameter	Units	Town of Orangeville Storm Sewer Limit	Measured Concentration
BH-3	Total Suspended Solids	mg/L	15	5050
	Copper	mg/L	0.01	0.150
	Lead	mg/L	0.05	0.0775
	Nickel	mg/L	0.05	0.118
	Zinc	mg/L	0.05	0.37

Table 6.5 – PWQO Exceedances (unfiltered)

Sample ID	Parameter	Units	PWQO Limit	Interim PWQO Limit	Measured Concentration
BH-3 (PWQO)	Aluminum (total)	mg/L	-	0.075	25.9
	Arsenic (total)	mg/L	0.1	0.005	0.0119
	Lead (total)	mg/L	-	0.025	0.033
	Cadmium (total)	mg/L	0.0002	0.0005	0.000272
	Cobalt (total)	mg/L	-	0.0009	0.0189
	Copper (total)	mg/L	-	0.005	0.0534
	Iron (total)	mg/L	0.3	-	43.2
	Nickel (total)	mg/L	0.025	-	0.039
	Phosphorus (total)	mg/L	-	0.01-0.03 (site specific)	1.3
	Silver (total)	mg/L	0.0001	-	0.00015
	Thallium (total)	mg/L	-	0.0003	0.000411
	Vanadium (total)	mg/L	-	0.005	0.0606
	Zinc (total)	mg/L	-	0.006	0.121



Based on a review of the results, groundwater of the quality that was observed herein could not be discharged to storm or sanitary sewers or the natural environment without pre-treatment.

7. ENGINEERING DISCUSSION AND RECOMMENDATIONS

This section of the report presents interpretation of the data obtained during the field and laboratory investigation and presents geotechnical comments and recommendations regarding foundation design, floor slab subgrade preparation, excavation, and dewatering.

It is understood the Town plans to expand the OPC by addition of a three-bay garage to the west side of the existing building. The proposed addition will comprise a slab-on-grade structure with plan dimensions of 18.8 by 29.9 m and will include a wash bay, repair garage, and office. It is assumed the finished floor slab elevation (FFE) will match the existing building, near elevation 417.5 m.

The comments and recommendations presented in this report are based on the subsurface soil and groundwater conditions encountered during the investigation. The soil conditions may vary between and beyond the borehole locations, and accordingly geotechnical observation during construction is important to assess any variation of subsurface conditions and to provide additional recommendations if necessitated by such variations.

The interpretation and recommendations are intended for the use of the design consultant and the owner and shall not be relied upon by any other parties including the construction contractor or used for any purposes other than development of the project design. Comments on construction methodology and equipment, where presented, are provided only to highlight those aspects that could affect the design of the project. Contractors must make their own assessment of the information presented in previous sections of the report, and the implications on equipment selection, construction methodology, and scheduling.

7.1 Foundation Design

The subsurface stratigraphy encountered in the boreholes generally consisted of a surficial asphalt pavement structure and sand fill layer overlying native loose to compact sand contacted at depths of 0.7 to 1.6 m (Elev. 417.0 to 416.1 m). The sand layer was 0.8 to 3.0 m thick and typically underlain by stiff to very stiff silty clay to clayey silt contacted at depths of 2.2 to 4.4 m depth (Elev. 415.4 to 413.4 m). The cohesive clay/silt generally extended to the borehole termination depth. Upon completion of drilling, water levels measured in the open boreholes ranged from 3.1 m to 5.9 m (Elev. 411.9 to 414.4 m). Groundwater was measured at a depth of 2.4 m (Elev. 415.3 m) in the monitoring well.



Based on the borehole information, supporting the building addition on spread footings constructed on the native soils at or below a frost penetration depth of 1.4 m is considered feasible. The following options may be considered:

- Footings constructed on the loose to compact native sand at 1.4 m depth (approximate Elev. 416.0 m) may be designed using factored geotechnical resistances of 200 kPa at ULS and 100 kPa at SLS.
- Footings extended down to found on compact native sand or very stiff silty clay to clayey silt at 2.2 m depth (approximate Elev. 415.2 m) may be designed using factored geotechnical resistances of 225 kPa at ULS and 150 kPa at SLS.

It is noted that the lower founding level (Elev. 415.2 m) is approximately coincident with the measured groundwater level, and the groundwater level may vary subject to seasonal variations and precipitation patterns. From a construction viewpoint, placing the footings at the higher level (Elev. 416.0 m,) is preferred to maintain the footing excavation above the groundwater level and avoid the potential need for dewatering.

The resistance at SLS is based on a foundation settlement of 25 mm. Differential settlement is expected to be less than 75% of this value.

The resistance values are for footings subjected to vertical, concentric loads. Where eccentric or inclined loads are applied, the resistance values used in design must be reduced in accordance with the Canadian Foundation Engineering Manual.

Resistance to lateral forces/sliding between cast-in-place concrete footings and the underlying native overburden should be evaluated assuming an unfactored ultimate coefficient of friction of 0.40. An unfactored value of 0.6 may be assumed for footings on Granular A engineered fill.

All footing excavations must be inspected by qualified geotechnical personnel prior to placing concrete to confirm that the soil conditions exposed at the founding level are consistent with the design assumptions and that the base has been adequately cleaned of disturbed material. The footing bases should be kept free of water and a 75 mm skim slab provided over the founding surface if structural concrete cannot be placed within 24 hours of excavation.

Where founding levels of adjacent footings vary, the founding elevation between footings should be stepped in maximum 0.6 m steps at a maximum inclination of 10 (ten) horizontal to 7 (seven) vertical. If adequate stepping of the footings is not possible due to site or design limitations, the need for underpinning of the foundations should be evaluated.



7.2 Frost Cover

The depth of frost penetration at this site is 1.4 m. All spread footings subject to freezing temperatures should be provided with a minimum of 1.4 m of earth cover or provided with an equivalent thickness of thermal insulation as protection against frost action, in accordance with OPSD 3090.101 (Foundation Frost Penetration Depths for Southern Ontario). A 25 mm thick layer of polystyrene insulation is thermally equivalent to 600 mm of soil cover. Insulation must extend a minimum of 1.4 m laterally from the edge of the footings.

7.3 Seismic Considerations

In accordance with Section 4.1.8 of the Ontario Building Code (OBC) (O. Reg. 332/12), the selection of the seismic site class is based on the soil conditions anticipated in the upper 30 m of the ground profile. As per Table 4.1.8.4.A of the OBC, this site may be classified as Seismic Site Class D (stiff soil).

Based on the National Building Code of Canada (NBC 2020), the peak horizontal ground acceleration (PGA), corresponding to a design earthquake having a 2 percent probability of being exceeded in 50 years (i.e. 2,475 year return period) is 0.147 g at the site for a Seismic Site Class D.

7.4 Floor Slab Construction

Preparation of the floor slab subgrade should consist of removal of the existing asphalt surface, grading to the design subgrade level, and proof rolling with a heavy roller to confirm uniform adequate support. Excessively loose, soft or unstable areas identified by the proof rolling should be subexcavated and replaced with OPSS Granular "A" or Granular "B" Type II material placed in maximum 200 mm thick lifts and compacted to 100% of SPMDD at a moisture content within 2% of optimum.

A minimum 150 mm thick layer of well compacted free draining clear stone (or Granular A compacted to 98% SPMDD) meeting OPSS 1010 specifications is recommended directly beneath the floor slab. A polyethylene vapour barrier can be placed under the slab if a moisture sensitive finish is to be placed on the floor, as further guided by the floor finish manufacturer.

Exterior grades should be maintained at least 150 mm below the floor slab level and sloped to promote drainage away from the structure or alternative measures be employed to achieve equivalent drainage.



7.5 Excavation and Groundwater Control

It is anticipated that excavation for foundation construction will advance approximately 1.4 m to 2.2 m below existing grade. Based on the borehole information, the excavation will extend through the granular/sand fill into the underlying native sand deposits.

All temporary excavations must be carried out in accordance with the current Occupational Health and Safety Act (OHSA) of Ontario and local regulations. Provided adequate ground water control is achieved, the soils are classified as Type 3 soils under OHSA. Slopes of temporarily unsupported trenches should conform with the requirements of OHSA but should not be steeper than 1H:1V. Flatter slopes may be required at locations where water seepage or sloughing occurs during excavation. The excavation slopes should be continuously monitored for evidence of instability. Where space restrictions preclude excavation of inclined slopes, a trench box or braced excavation should be employed.

Temporary shoring, if employed, should be designed by a licensed Professional Engineer experienced in design of shoring systems. The design of all members in the shoring system should include the effects of surcharge loads such as those imposed by adjacent utilities and construction equipment. Soil should not be stockpiled adjacent to the excavation.

Use of a hydraulic excavator should be suitable for excavation in the overburden soils. The selection of the method of excavation is the responsibility of the contractor and must be based on their equipment, experience, and interpretation of the site conditions. Provision should be made for handling of the existing pavement structure and possible buried obstructions in the fill.

All footings must be constructed in the dry. Dewatering of shallow foundation excavations above the groundwater level using sumps and pumps is considered feasible, however, the possibility of requiring additional pumps and/or perimeter wells should not be overlooked. Surface water runoff must be always diverted away from the excavations during construction.

If possible, it is recommended that excavations take place during the dry summer months, when groundwater levels are typically at the lowest to reduce the potential that groundwater may be encountered in the excavations.

Based on a review of the of chemical testing results, groundwater of the quality that was observed herein could not be discharged to storm or sanitary sewers or the natural environment without pre-treatment.



It is noted that where anticipated dewatering rates range between 50,000 and 400,000 L/day, the water taking must be registered on the MECP's Environmental Activity and Sector Registry. If anticipated dewatering rates exceed 400,000 litres per day a Permit-to-Take-Water MECP will be required, including a hydrogeological site assessment report to support of the application.

7.6 Geoenvironmental Considerations

The chemical sampling and testing program carried out during this investigation was completed for due diligence purposes to obtain a general understanding of the environmental quality of the soils on site. The environmental characteristics of the soils were inferred from a limited number of samples and sampling locations, and the extent of materials that may be encountered during construction was not delineated. As such, the environmental data and comments are provided as guidance to the contractor on the requirements for reuse or disposal of materials generated during construction and should not be used to estimate quantities.

Where excavation of existing pavement structures is required, the asphalt from the existing pavement structure may be separated for transfer to a recycling facility, although asbestos testing should be carried out prior to stripping. Asphalt should not be mixed with excess soil as fill receivers may not accept excess soils containing asphalt.

The results of the chemical laboratory testing indicate that the concentrations of the tested parameters are below MECP Table 1 RPI/ICC with the exception of electrical conductivity (EC) and sodium adsorption ratio (SAR) exceedances throughout the project site. Elevated EC and SAR are likely the result of de-icing activities in the yard. The presence of SAR or EC does not impose a risk to human health, but rather may only impact the physical composition of the soil which could affect the growth of vegetation. Where salt has been applied on a highway for the purposes of keeping the highway safe for traffic under conditions of snow or ice or both, the applicable site conditions standard is deemed not to be exceeded under Section 48 (3) of O. Reg. 153/04.

Based on the results of the bulk environmental testing, materials that are free of staining and odour may generally be suitable for reuse on Site provided the excavated materials are appropriate from a geotechnical perspective, or possibly reused off-site at properties requiring fill for a beneficial purpose. Prior to reuse, the environmental quality of the materials should be reviewed to verify an appropriate end use. This can be completed through additional testing prior to construction, or screening during construction through segregating into separate stockpiles followed by sampling and testing. Alternatively, the excavated materials may be disposed of off-site at a licensed landfill facility with an ECA to receive this waste type.



There may be restrictions to the on- and off-site re-use of the fill materials due to the marginally elevated SAR value (e.g. placed in areas more than 30 m from the waterbody, 2 m from the groundwater table, and at least 100 m from a potable water supply etc.). Receiving site authorities will need to be notified of the salt-related impacts and provide consent in writing of their acceptance of the materials.

Based on the results of toxicity characteristic leaching procedure (TCLP) chemical testing, the soils may be classified as non-hazardous for disposal to a waste management facility with an Environmental Compliance Approval (ECA) to receive this material (pending approval of receiving site authorities).

Due to the inherent variability of subsurface conditions, environmental screening will be required during construction to confirm that the quality of the excess excavated soils is consistent with the conditions documented during this investigation. Soils encountered during excavation that exhibit visual or olfactory evidence of environmental impact (i.e. staining or odours) will need to be segregated under the direction of an O. Reg. 153/04 Qualified Person (QP) into separate stockpiles to determine appropriate handling options. Impacted soil will need to be tested by the Contractor and reassessed at that time to determine if the stockpiled materials can be reused or will need to be handled as waste and disposed of at a licensed facility.

O. Reg. 406/19 may or may not apply to the project subject to specific design details (i.e. excavated quantities, soil management strategies involving excess soils that are to be reused off-site, receiving site chemical concentration requirements). If the regulation applies, additional documentation, sampling and testing procedures (including prescribed leachate analysis) may be required to meet the criteria of O. Reg. 406/19. The regulation does not apply to the reuse of excavated soils on Site, and the project may be exempt from the registration, planning and sampling requirements of the regulation if excess soils are to be reused as part of another infrastructure project owned by the Project Leader (as defined by the Regulation) or public body.

No statement made herein should be construed as relieving the Contractor's responsibility to comply with all applicable federal and provincial regulations, municipal by-laws and guidelines related to the handling or disposal of excavated materials (and/or discharge of extracted groundwater).

7.7 Construction Observation and Testing

The successful performance of the proposed works will depend largely on good workmanship and quality control during construction. It is therefore recommended that geotechnical observation and testing by qualified personnel be provided during construction. The observation and testing should



include examination of subgrade conditions, concrete testing, compaction testing of backfill and granular materials, and asphalt testing.

8. CLOSURE

We trust the above provides the information you require at this time. If you have any questions regarding this report, please do not hesitate to contact us.



APPENDIX A RECORD OF BOREHOLE SHEETS

SYMBOLS, ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES

1. TEXTURAL CLASSIFICATION OF SOILS

CLASSIFICATION	PARTICLE SIZE	VISUAL IDENTIFICATION
Boulders	Greater than 200mm	same
Cobbles	75 to 200mm	same
Gravel	4.75 to 75mm	5 to 75mm
Sand	0.075 to 4.75mm	Not visible particles to 5mm
Silt	0.002 to 0.075mm	Non-plastic particles, not visible to the naked eye
Clay	Less than 0.002mm	Plastic particles, not visible to the naked eye

2. COARSE GRAIN SOIL DESCRIPTION (50% greater than 0.075mm)

TERMINOLOGY	PROPORTION
Trace or Occasional	Less than 10%
Some	10 to 20%
Adjective (e.g. silty or sandy)	20 to 35%
And (e.g. sand and gravel)	35 to 50%

3. TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

DESCRIPTIVE TERM	UNDRAINED SHEAR STRENGTH (kPa)	APPROXIMATE SPT ⁽¹⁾ 'N' VALUE
Very Soft	12 or less	Less than 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	Greater than 200	Greater than 30

NOTE: Hierarchy of Soil Strength Prediction

- 1) Laboratory Triaxial Testing
- 2) Field Insitu Vane Testing
- 3) Laboratory Vane Testing
- 4) SPT value
- 5) Pocket Penetrometer


4. TERMS DESCRIBING DENSITY (COHESIONLESS SOILS ONLY)

DESCRIPTIVE TERM	SPT "N" VALUE
Very Loose	Less than 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	Greater than 50

5. LEGEND FOR RECORDS OF BOREHOLES

SYMBOLS AND ABBREVIATIONS FOR SAMPLE TYPE	SS Split Spoon Sample	WS Wash Sample	AS Auger (Grab) Sample
	TW Thin Wall Shelby Tube Sample	TP Thin Wall Piston Sample	
	PH Sampler Advanced by Hydraulic Pressure	PM Sampler Advanced by Manual Pressure	
	WH Sampler Advanced by Self Static Weight	RC Rock Core	SC Soil Core

$$\text{Sensitivity} = \frac{\text{Undisturbed Shear Strength}}{\text{Remoulded Shear Strength}}$$

 Water Level
 C_{pen} Shear Strength Determination by Pocket Penetrometer

- (1) SPT 'N' Value Standard Penetration Test 'N' Value – refers to the number of blows from a 63.5kg hammer free falling a height of 0.76m to advance a standard 50 mm outside diameter split spoon sampler for 0.3 m depth into undisturbed ground.
- (2) DCPT Dynamic Cone Penetration Test – Continuous penetration of a 50 mm outside diameter, 60° conical steel point attached to "A" size rods driven by a 63.5 kg hammer free falling a height of 0.76 m. The resistance to cone penetration is the number of hammer blows required for each 0.3 m advance of the conical point into undisturbed ground.

RECORD OF BOREHOLE BH-1

PROJECT : Garage Expansion at Town of Orangeville OPC
 LOCATION : 500 C - Line, Orangeville, Ontario
 STARTED : February 7, 2023
 COMPLETED : February 7, 2023

Project No. 36304

SHEET 1 OF 1

N 4 861 164.6 E 571 393.6

DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE		SAMPLES		COMMENTS	SHEAR STRENGTH: Cu, KPa		ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER TYPE		BLOWS/0.3m	nat V - ● rem V - ●		
		GROUND SURFACE		417.34						
		ASPHALT: (65mm)		0.06						
		SAND and GRAVEL, trace to some silt, dense, brown, wet: (FILL)			1	SS 47				
1		SAND, some silt, trace clay, loose to compact, brown, moist		416.58 0.76						
					2	SS 23				
2										
					3	SS 9				
3		SILT and SAND, trace clay, compact, brown, wet		415.13 2.21						
					4	SS 16	Grain Size Analysis: Gr 0%/ Sa 39%/ Si 56%/ Cl 5%			
4										
					5	SS 12	Grain Size Analysis: Gr 0%/ Sa 5%/ Si 77%/ Cl 18% CL-ML			
5		SILT, clayey, trace sand, stiff, brown, wet		414.37 2.97						
6										
					6	SS 22				
7		CLAY, silty, trace sand and gravel, very stiff, grey, wet		412.77 4.57						
8										
					7	SS 24				
9										
		END OF BOREHOLE AT 6.71m. BOREHOLE OPEN TO 6.71m AND WATER LEVEL AT 5.21m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG FROM 6.71m TO 0.30m, THEN SAND TO 0.15m, THEN ASPHALT PATCH TO SURFACE.		410.63 6.71						

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : GA

CHECKED : KF



RECORD OF BOREHOLE BH-2

PROJECT : Garage Expansion at Town of Orangeville OPC
 LOCATION : 500 C - Line, Orangeville, Ontario
 STARTED : February 7, 2023
 COMPLETED : February 7, 2023

Project No. 36304

SHEET 1 OF 1

N 4 861 173.9 E 571 400.1

DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE		SAMPLES		COMMENTS	SHEAR STRENGTH: Cu, KPa		ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER TYPE		BLOWS/0.3m	nat V - ● rem V - ●		
		GROUND SURFACE		417.64						
		ASPHALT: (75mm)		0.08						
1		SAND, trace gravel, very dense to compact, brown, damp to moist: (FILL)			1 SS 54					
					2 SS 16					
				416.19						
2		SAND, some silt, trace clay, trace gravel, loose, brown, damp		1.45	3 SS 9	Grain Size Analysis: Gr 1%/ Sa 80%/ Si 13%/ Cl 6%				
				415.43						
3		CLAY, silty, trace gravel, trace sand, very stiff, grey, wet		2.21	4 SS 19					
					5 SS 18					
4	Hollow Stem Augers									
5					6 SS 23					
6										
7					7 SS 19					
				410.93						
7		END OF BOREHOLE AT 6.71m. BOREHOLE OPEN TO 6.71m AND WATER LEVEL AT 5.18m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG FROM 6.71m TO 0.30m, THEN SAND TO 0.15m, THEN ASPHALT PATCH TO SURFACE.		6.71						

GROUNDWATER ELEVATIONS



WATER LEVEL UPON COMPLETION



WATER LEVEL IN WELL/PIEZOMETER

LOGGED : GA

CHECKED : KF



RECORD OF BOREHOLE BH-3

PROJECT : Garage Expansion at Town of Orangeville OPC
 LOCATION : 500 C - Line, Orangeville, Ontario
 STARTED : February 7, 2023
 COMPLETED : February 7, 2023

Project No. 36304

SHEET 1 OF 1

N 4 861 160.2 E 571 408.6

DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE		SAMPLES		COMMENTS	SHEAR STRENGTH: Cu, KPa		ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		DESCRIPTION	STRATA PLOT	NUMBER	TYPE		nat V - ●	Q - ▲		
		GROUND SURFACE								
		ASPHALT: (25mm)	417.64							
		SAND and GRAVEL, trace silt, very dense, brown, damp: (FILL)	0.02	1	SS	96	○			Flushmount Well Protector Set in Concrete
1		SAND, some silt, dense to compact, brown, damp	416.95	2	SS	34	○			Bentonite
			0.69							
2				3	SS	15	○			Sand
		Wet								▼
3		Becoming gravelly		4	SS	21	○			Slotted Screen
				5	SS	20	○			
			413.91							Sand
4		CLAY, silty, trace sand, very stiff, grey, wet	3.73							
				6	SS	18	○			
5										
				7	SS	20	○			Bentonite
6										
			410.93							
7		END OF BOREHOLE AT 6.71m. BOREHOLE OPEN TO 6.71m AND WATER LEVEL AT 5.49m UPON COMPLETION. Well installation consists of 50mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.	6.71							
8		WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Feb 07/23 2.71 414.93 Feb 17/23 2.36 415.28								
9										

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER

February 17, 2023

LOGGED : GA

CHECKED : KF



RECORD OF BOREHOLE BH-4

PROJECT : Garage Expansion at Town of Orangeville OPC
 LOCATION : 500 C - Line, Orangeville, Ontario
 STARTED : February 7, 2023
 COMPLETED : February 7, 2023

Project No. 36304

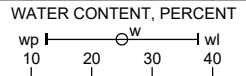
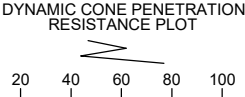
SHEET 1 OF 1

N 4 861 148.1 E 571 410.7

DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE		SAMPLES		COMMENTS	SHEAR STRENGTH: Cu, KPa		ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER TYPE		BLOWS/0.3m	nat V - ●		
		GROUND SURFACE		417.47						
		ASPHALT: (50mm)		0.05						
		SAND and GRAVEL, trace to some silt, very dense, brown, damp: (FILL)			1	SS 55				
1		SAND, silty, trace gravel, trace clay, dense, brown, damp: (FILL)		416.78 0.69		2	SS 42			
		SAND, trace gravel, loose, brown, damp		416.17 1.30						
2					3	SS 8				
		Becoming compact, grey, wet			4	SS 20				
3					5	SS 15				
		CLAY, silty, trace sand, stiff, grey, wet		413.43 4.04						
5					6	SS 13				
		SAND, trace silt, compact, grey, wet		411.83 5.64						
6					7	SS 23				
7		END OF BOREHOLE AT 6.71m. BOREHOLE OPEN TO 6.71m AND WATER LEVEL AT 3.10m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG FROM 6.71m TO 0.30m, THEN SAND TO 0.15m, THEN ASPHALT PATCH TO SURFACE.		410.76 6.71						

Grain Size Analysis:
 Gr 8%/ Sa 68%/ Si 21%/ Cl 3%



▽

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : GA

CHECKED : KF



RECORD OF BOREHOLE BH-5

PROJECT : Garage Expansion at Town of Orangeville OPC
 LOCATION : 500 C - Line, Orangeville, Ontario
 STARTED : February 7, 2023
 COMPLETED : February 7, 2023

Project No. 36304

SHEET 1 OF 1

N 4 861 160.5 E 571 417.3

DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE		SAMPLES		COMMENTS	SHEAR STRENGTH: Cu, KPa		ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		DESCRIPTION	STRATA PLOT	NUMBER	TYPE		nat V - ●	Q - ▲		
		GROUND SURFACE								
		ASPHALT: (75mm)	417.74							
		SAND and GRAVEL, very dense, brown, damp: (FILL)	0.08	1	SS	51	○			
1		SAND, occasional gravel, compact, brown, damp: (FILL)	416.90 0.84	2	SS	25	○			
2		SAND, some silt, trace clay, compact, brown, damp to wet	416.14 1.60	3	SS	23	○			
3				4	SS	16	○			
4				5	SS	25	○			
5		CLAY, silty, trace sand, very stiff, brown, wet	413.37 4.37	6	SS	23	○	▲		
6				7	SS	31	○		▽	
7		END OF BOREHOLE AT 6.71m. BOREHOLE OPEN TO 6.71m AND WATER LEVEL AT 5.87m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG FROM 6.71m TO 0.30m, THEN SAND TO 0.15m, THEN ASPHALT PATCH TO SURFACE.	411.03 6.71						▲	

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▲ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : GA

CHECKED : KF





APPENDIX B BOREHOLE LOCATION PLAN




KEYPLAN

LEGEND:

- BOREHOLE (BH) LOCATION
- BOREHOLE (BH) LOCATION WITH MONITORING WELL

TOWN OF ORANGEVILLE
 GARAGE EXPANSION AT OPC
 500 C LINE
 ORANGEVILLE, ON
 BOREHOLE LOCATION PLAN

JOB# 36304



THURBER ENGINEERING LTD.

ENGINEER:	GS	DRAWN:	AN	APPROVED:	KF
DATE:	JUNE 2023	SCALE:	1:400	DRAWING No.	36304-1

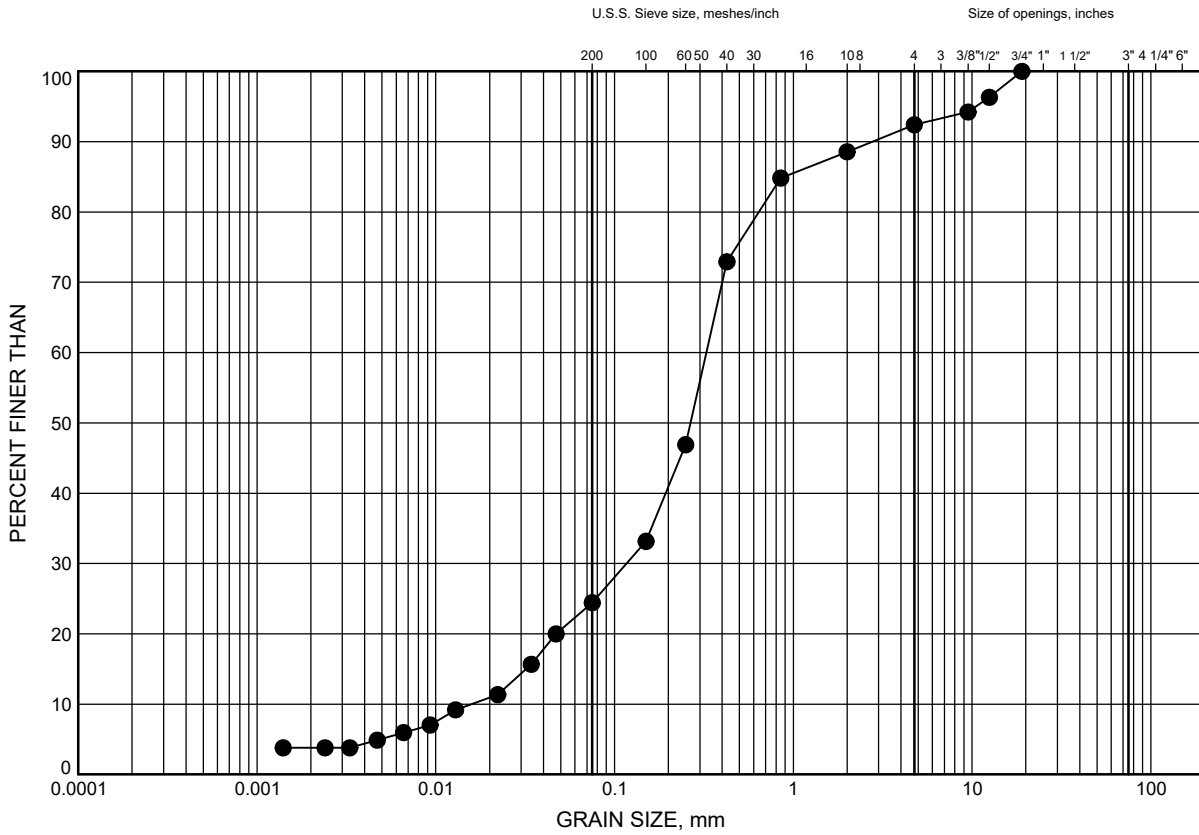


APPENDIX C GEOTECHNICAL LABORATORY SOIL TEST RESULTS

Garage Expansion at Town of Orangeville OPC
GRAIN SIZE DISTRIBUTION

FIGURE C1

SAND FILL



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BH-4	1.07	416.40

GRAIN SIZE DISTRIBUTION - THURBER TEL-36304.GPJ 6/19/23

Date June 2023
 Project 36304

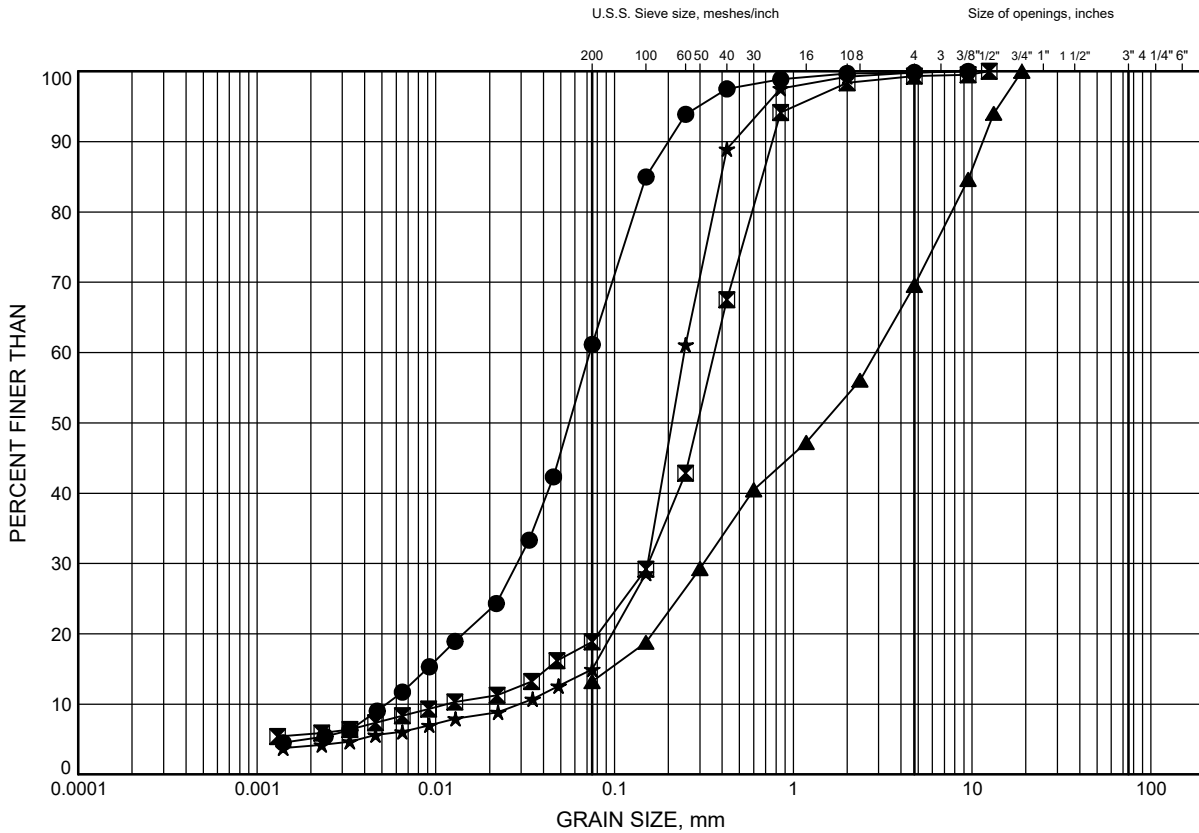


Prep'd AN
 Chkd. GS

Garage Expansion at Town of Orangeville OPC
GRAIN SIZE DISTRIBUTION

FIGURE C2

SAND to SILT and SAND



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BH-1	2.59	414.75
⊠	BH-2	1.83	415.81
▲	BH-3	3.35	414.29
★	BH-5	1.83	415.91

GRAIN SIZE DISTRIBUTION - THURBER TEL-36304.GPJ 6/19/23

Date June 2023
 Project 36304

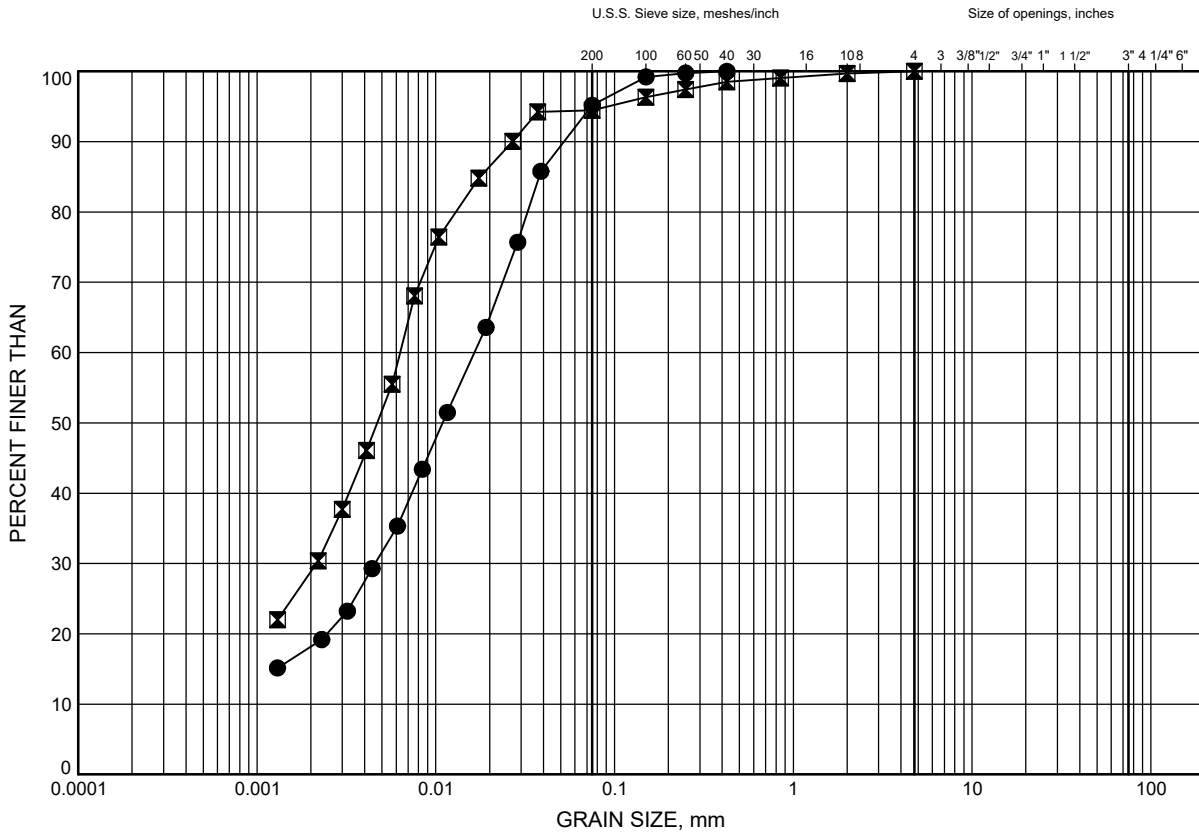


Prep'd AN
 Chkd. GS

Garage Expansion at Town of Orangeville OPC
GRAIN SIZE DISTRIBUTION

FIGURE C3

Silty CLAY to Clayey SILT



SILT and CLAY		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED		SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BH-1	3.35	413.99
⊠	BH-3	4.88	412.76

GRAIN SIZE DISTRIBUTION - THURBER TEL-36304.GPJ 6/19/23

Date June 2023
 Project 36304

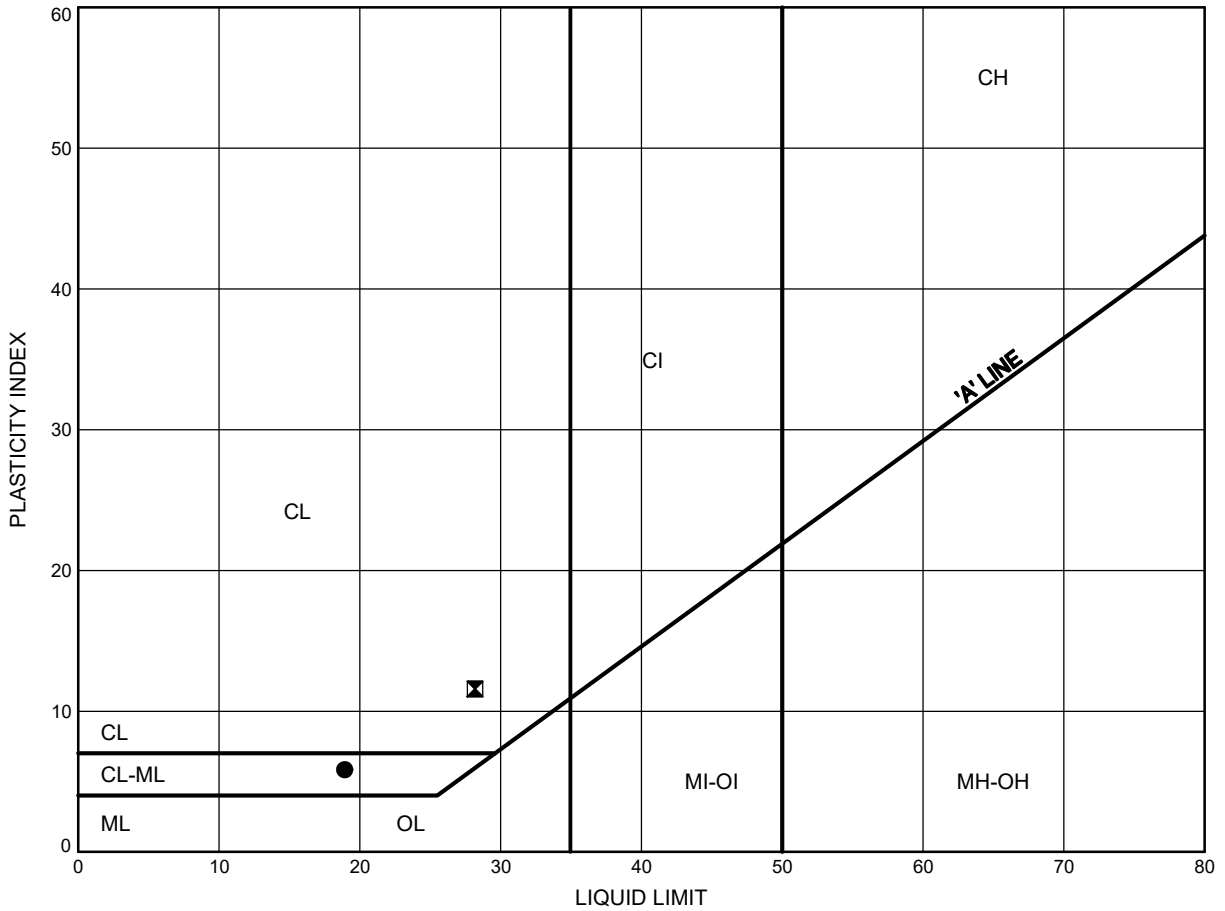


Prep'd AN
 Chkd. GS

Garage Expansion at Town of Orangeville OPC
ATTERBERG LIMITS TEST RESULTS

FIGURE C4

Silty CLAY to Clayey SILT



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BH-1	3.35	413.99
⊠	BH-3	4.88	412.76

Date June 2023
 Project 36304



Prep'd AN
 Chkd. GS



APPENDIX D SOIL CORROSIVITY LABORATORY CERTIFICATES OF ANALYSIS



FINAL REPORT

CA40088-FEB23 R1

36304, Orangeville

Prepared for

Thurber Engineering Ltd.

First Page

CLIENT DETAILS

LABORATORY DETAILS

Client	Thurber Engineering Ltd.	Project Specialist	Maarit Wolfe, Hon.B.Sc
Address	103, 2010 Winston Park Drive Oakville, ON L6H 5R7.	Laboratory	SGS Canada Inc.
Contact	Greg Stanhope	Address	185 Concession St., Lakefield ON, K0L 2H0
Telephone	905-829-8666	Telephone	705-652-2000
Facsimile		Facsimile	705-652-6365
Email	gstanhope@thurber.ca; kfurtbacher@thurber.ca	Email	Maarit.Wolfe@sgs.com
Project	36304, Orangeville	SGS Reference	CA40088-FEB23
Order Number		Received	02/09/2023
Samples	Soil (2)	Approved	02/17/2023
		Report Number	CA40088-FEB23 R1
		Date Reported	02/17/2023

COMMENTS

Temperature of Sample upon Receipt: 6 degrees C
 Cooling Agent Present: Yes
 Custody Seal Present: Yes

Chain of Custody Number: C1

Corrosivity Index is based on the American Water Works Corrosivity Scale according to AWWA C-105. An index greater than 10 indicates the soil matrix may be corrosive to cast iron alloys.

SIGNATORIES

Maarit Wolfe, Hon.B.Sc



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FINAL REPORT

CA40088-FEB23 R1

Client: Thurber Engineering Ltd.

Project: 36304, Orangeville

Project Manager: Greg Stanhope

Samplers: George Azzopardi

MATRIX: SOIL

Sample Number	5	6
Sample Name	BH-2 SS1 COR	BH-4 SS2 COR
Sample Matrix	Soil	Soil
Sample Date	07/02/2023	07/02/2023

Parameter	Units	RL	Result	Result
Corrosivity Index				
Corrosivity Index	none	1	3	14
Soil Redox Potential	mV	no	189	203
Sulphide (Na ₂ CO ₃)	%	0.04	< 0.04	< 0.04
pH	pH Units	0.05	9.93	9.26
Resistivity (calculated)	ohms.cm	-9999	3050	869

General Chemistry

Conductivity	uS/cm	2	328	1150
--------------	-------	---	-----	------

Metals and Inorganics

Moisture Content	%	0.1	3.6	6.8
Sulphate	µg/g	0.4	18	21

Other (ORP)

Chloride	µg/g	0.4	120	360
----------	------	-----	-----	-----

QC SUMMARY

Anions by IC

Method: EPA300/MA300-Ions1.3 | Internal ref.: ME-CA-IENVIIC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Chloride	DIO0229-FEB23	µg/g	0.4	<0.4	12	35	102	80	120	100	75	125
Sulphate	DIO0229-FEB23	µg/g	0.4	<0.4	4	35	100	80	120	85	75	125

Carbon/Sulphur

Method: ASTM E1915-07A | Internal ref.: ME-CA-IENVIARD-LAK-AN-020

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Sulphide (Na ₂ CO ₃)	ECS0041-FEB23	%	0.04	< 0.04	13	20	107	80	120			

Conductivity

Method: SM 2510 | Internal ref.: ME-CA-IENVIEWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Conductivity	EWL0209-FEB23	uS/cm	2	< 2	1	20	103	90	110	NA		

QC SUMMARY

pH

Method: SM 4500 | Internal ref.: ME-CA-ENVIEWL-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
pH	EWL0209-FEB23	pH Units	0.05	NA	0		100			NA		

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

- NSS** Insufficient sample for analysis.
- RL** Reporting Limit.
 - ↑ Reporting limit raised.
 - ↓ Reporting limit lowered.
- NA** The sample was not analysed for this analyte
- ND** Non Detect

Results relate only to the sample tested.

Data reported represent the sample as submitted to SGS. Solid samples expressed on a dry weight basis.

"Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the "Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act and Excess Soil Quality" published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated.

SGS Canada Inc. statement of conformity decision rule does not consider uncertainty when analytical results are compared to a specified standard or regulation.

This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/terms_and_conditions.htm.

The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Reproduction of this analytical report in full or in part is prohibited.

This report supersedes all previous versions.

-- End of Analytical Report --



APPENDIX E ENVIRONMENTAL LABORATORY CERTIFICATES OF ANALYSIS - SOIL



FINAL REPORT

CA40089-FEB23 R

36304, Orangeville

Prepared for

Thurber Engineering Ltd.

First Page

CLIENT DETAILS		LABORATORY DETAILS	
Client	Thurber Engineering Ltd.	Project Specialist	Brad Moore Hon. B.Sc
Address	103, 2010 Winston Park Drive Oakville, ON L6H 5R7.	Laboratory	SGS Canada Inc.
Contact	Greg Stanhope	Address	185 Concession St., Lakefield ON, K0L 2H0
Telephone	905-829-8666	Telephone	705-652-2143
Facsimile		Facsimile	705-652-6365
Email	gstanhope@thurber.ca; kfurtbacher@thurber.ca	Email	brad.moore@sgs.com
Project	36304, Orangeville	SGS Reference	CA40089-FEB23
Order Number		Received	02/09/2023
Samples	Soil (6)	Approved	02/16/2023
		Report Number	CA40089-FEB23 R
		Date Reported	02/16/2023

COMMENTS

CCME Method Compliance: Analyses were conducted using analytical procedures that comply with the Reference Method for the CWS for Petroleum Hydrocarbons in Soil and have been validated for use at the SGS laboratory, Lakefield, ON site.

Quality Compliance: Instrument performance / calibration quality criteria were met and extraction and analysis limits for holding times were met.

nC6 and nC10 response factors within 30% of response factor for toluene: YES

nC10, nC16 and nC34 response factors within 10% of the average response for the three compounds: YES

C50 response factors within 70% of nC10 + nC16 + nC34 average: YES

Linearity is within 15%: YES

F4G - gravimetric heavy hydrocarbons cannot be added to the C6 to C50 hydrocarbons.

The results for F4 and F4G are both reported and the greater of the two values is to be used in application to the CWS PHC.

Hydrocarbon results are expressed on a dry weight basis.

Benzo(b)fluoranthene results for comparison to the standard are reported as benzo(b+j)fluoranthene. Benzo(b)fluoranthene and benzo(j)fluoranthene co-elute and cannot be reported individually by the analytical method used.

Temperature of Sample upon Receipt: 6 degrees C

Cooling Agent Present: Yes

Custody Seal Present: Yes

Chain of Custody Number: n/a

SIGNATORIES

Brad Moore Hon. B.Sc



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FINAL REPORT

CA40089-FEB23 R

Client: Thurber Engineering Ltd.

Project: 36304, Orangeville

Project Manager: Greg Stanhope

Samplers: George Azzopardi

MATRIX: SOIL

Sample Number	9	10	12	13	14	15
Sample Name	BH-1 SS2	BH-2 SS1	BH-3 SS2	BH-4 SS1	BH-4 SS3	BH-5 SS1
Sample Matrix	Soil	Soil	Soil	Soil	Soil	Soil
Sample Date	07/02/2023	07/02/2023	07/02/2023	07/02/2023	07/02/2023	07/02/2023

L1 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

Parameter	Units	RL	L1	Result	Result	Result	Result	Result	Result
BTEX									
Benzene	µg/g	0.02	0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Ethylbenzene	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Toluene	µg/g	0.05	0.2	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Xylene (total)	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
m/p-xylene	µg/g	0.05		< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
o-xylene	µg/g	0.05		< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05

Hydrides

Antimony	µg/g	0.8	1.3	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8
Arsenic	µg/g	0.5	18	2.1	1.7	2.0	3.4	1.5	2.8
Selenium	µg/g	0.7	1.5	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7

Metals and Inorganics

Moisture Content	%	0.1		10.2	5.0	6.9	4.9	7.2	6.7
Barium	µg/g	0.1	220	27	10	20	16	11	18
Beryllium	µg/g	0.02	2.5	0.25	0.09	0.19	0.13	0.19	0.14
Boron	µg/g	1	36	2	2	2	3	2	3
Cadmium	µg/g	0.05	1.2	0.13	< 0.05	0.10	0.09	0.07	0.08
Chromium	µg/g	0.5	70	9.2	4.3	6.7	5.6	5.5	6.6
Cobalt	µg/g	0.01	21	3.9	1.9	2.9	4.3	2.6	2.8
Copper	µg/g	0.1	92	7.6	8.9	8.1	16	5.4	15
Lead	µg/g	0.1	120	6.4	3.5	5.5	7.8	3.9	6.9
Molybdenum	µg/g	0.1	2	0.3	0.2	0.2	0.3	0.2	0.3



FINAL REPORT

CA40089-FEB23 R

Client: Thurber Engineering Ltd.

Project: 36304, Orangeville

Project Manager: Greg Stanhope

Samplers: George Azzopardi

MATRIX: SOIL

Sample Number	9	10	12	13	14	15
Sample Name	BH-1 SS2	BH-2 SS1	BH-3 SS2	BH-4 SS1	BH-4 SS3	BH-5 SS1
Sample Matrix	Soil	Soil	Soil	Soil	Soil	Soil
Sample Date	07/02/2023	07/02/2023	07/02/2023	07/02/2023	07/02/2023	07/02/2023

L1 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

Parameter	Units	RL	L1	Result	Result	Result	Result	Result	Result
Metals and Inorganics (continued)									
Nickel	µg/g	0.5	82	7.4	4.0	5.5	5.3	4.9	5.7
Silver	µg/g	0.05	0.5	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Thallium	µg/g	0.02	1	0.05	0.03	0.05	0.06	0.03	0.05
Uranium	µg/g	0.002	2.5	0.35	0.25	0.30	0.30	0.26	0.34
Vanadium	µg/g	3	86	16	8	12	9	9	10
Zinc	µg/g	0.7	290	23	15	22	37	13	30
Water Soluble Boron	µg/g	0.5		< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5

Other (ORP)

Mercury	ug/g	0.05	0.27	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Sodium Adsorption Ratio	No unit	0.2	2.4	34.3	7.5	15.1	24.2	16.4	11.0
SAR Calcium	mg/L	0.2		13.1	5.1	12.8	9.1	7.0	7.5
SAR Magnesium	mg/L	0.3		1.7	1.6	3.5	4.3	1.3	2.8
SAR Sodium	mg/L	0.1		499	75.6	236	354	180	139
Conductivity	mS/cm	0.002	0.57	2.2	0.34	1.1	1.6	0.88	0.66
pH	pH Units	0.05		7.63	8.12	7.82	8.23	7.84	8.29
Chromium VI	µg/g	0.2	0.66	0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Free Cyanide	µg/g	0.05	0.051	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05



FINAL REPORT

CA40089-FEB23 R

Client: Thurber Engineering Ltd.

Project: 36304, Orangeville

Project Manager: Greg Stanhope

Samplers: George Azzopardi

MATRIX: SOIL

Sample Number	9	10	12	13	14	15
Sample Name	BH-1 SS2	BH-2 SS1	BH-3 SS2	BH-4 SS1	BH-4 SS3	BH-5 SS1
Sample Matrix	Soil	Soil	Soil	Soil	Soil	Soil
Sample Date	07/02/2023	07/02/2023	07/02/2023	07/02/2023	07/02/2023	07/02/2023

L1 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

Parameter	Units	RL	L1	Result	Result	Result	Result	Result	Result
PAHs									
Acenaphthene	µg/g	0.05	0.072	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	µg/g	0.05	0.093	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Anthracene	µg/g	0.05	0.16	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)anthracene	µg/g	0.05	0.36	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)pyrene	µg/g	0.05	0.3	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(b+j)fluoranthene	µg/g	0.05	0.47	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	µg/g	0.1	0.68	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	µg/g	0.05	0.48	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Chrysene	µg/g	0.05	2.8	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dibenzo(a,h)anthracene	µg/g	0.06	0.1	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Fluoranthene	µg/g	0.05	0.56	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	µg/g	0.05	0.12	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	µg/g	0.1	0.23	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
1-Methylnaphthalene	µg/g	0.05		< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
2-Methylnaphthalene	µg/g	0.05		< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Methylnaphthalene, 2-(1-)	µg/g	0.05	0.59	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Naphthalene	µg/g	0.05	0.09	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	µg/g	0.05	0.69	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Pyrene	µg/g	0.05	1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05



FINAL REPORT

CA40089-FEB23 R

Client: Thurber Engineering Ltd.

Project: 36304, Orangeville

Project Manager: Greg Stanhope

Samplers: George Azzopardi

MATRIX: SOIL

L1 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

Sample Number	9	10	12	13	14	15
Sample Name	BH-1 SS2	BH-2 SS1	BH-3 SS2	BH-4 SS1	BH-4 SS3	BH-5 SS1
Sample Matrix	Soil	Soil	Soil	Soil	Soil	Soil
Sample Date	07/02/2023	07/02/2023	07/02/2023	07/02/2023	07/02/2023	07/02/2023

Parameter	Units	RL	L1	Result	Result	Result	Result	Result	Result
PHCs									
F1 (C6-C10)	µg/g	10	25	< 10	< 10	< 10	< 10	< 10	< 10
F1-BTEX (C6-C10)	µg/g	10	25	< 10	< 10	< 10	< 10	< 10	< 10
F2 (C10-C16)	µg/g	10	10	< 10	< 10	< 10	< 10	< 10	< 10
F3 (C16-C34)	µg/g	50	240	< 50	< 50	< 50	< 50	< 50	< 50
F4 (C34-C50)	µg/g	50	120	< 50	< 50	< 50	88	< 50	< 50
Chromatogram returned to baseline at nC50	Yes / No	no		YES	YES	YES	YES	YES	YES

SVOC Surrogates

Surr 2-Fluorobiphenyl	Surr Rec %	no		99	90	97	92	92	85
Surr 4-Terphenyl-d14	Surr Rec %	no		88	86	86	87	79	84
Surr 2-Methylnaphthalene-D10	Surr Rec %	no		89	87	89	89	84	84
Surr Fluoranthene-D10	Surr Rec %	no		85	82	83	86	78	81

THMs (VOC)

Bromodichloromethane	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Bromoform	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dibromochloromethane	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05



FINAL REPORT

CA40089-FEB23 R

Client: Thurber Engineering Ltd.

Project: 36304, Orangeville

Project Manager: Greg Stanhope

Samplers: George Azzopardi

MATRIX: SOIL

Sample Number	9	10	12	13	14	15
Sample Name	BH-1 SS2	BH-2 SS1	BH-3 SS2	BH-4 SS1	BH-4 SS3	BH-5 SS1
Sample Matrix	Soil	Soil	Soil	Soil	Soil	Soil
Sample Date	07/02/2023	07/02/2023	07/02/2023	07/02/2023	07/02/2023	07/02/2023

L1 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

Parameter	Units	RL	L1	Result	Result	Result	Result	Result	Result
VOC Surrogates									
Surr 1,2-Dichloroethane-d4	Surr Rec %	no		102	102	103	102	104	103
Surr 4-Bromofluorobenzene	Surr Rec %	no		90	90	94	92	94	94
Surr 2-Bromo-1-Chloropropane	Surr Rec %	no		92	94	92	92	94	94

VOCs

Acetone	µg/g	0.5	0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Bromomethane	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Carbon tetrachloride	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Chlorobenzene	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Chloroform	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
1,2-Dichlorobenzene	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
1,3-Dichlorobenzene	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
1,4-Dichlorobenzene	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dichlorodifluoromethane	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
1,1-Dichloroethane	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
1,2-Dichloroethane	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
1,1-Dichloroethylene	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
trans-1,2-Dichloroethylene	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
cis-1,2-Dichloroethylene	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
1,2-Dichloropropane	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
cis-1,3-dichloropropene	µg/g	0.03		< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
trans-1,3-dichloropropene	µg/g	0.03		< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
1,3-dichloropropene (total)	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05



FINAL REPORT

CA40089-FEB23 R

Client: Thurber Engineering Ltd.

Project: 36304, Orangeville

Project Manager: Greg Stanhope

Samplers: George Azzopardi

MATRIX: SOIL

Sample Number	9	10	12	13	14	15
Sample Name	BH-1 SS2	BH-2 SS1	BH-3 SS2	BH-4 SS1	BH-4 SS3	BH-5 SS1
Sample Matrix	Soil	Soil	Soil	Soil	Soil	Soil
Sample Date	07/02/2023	07/02/2023	07/02/2023	07/02/2023	07/02/2023	07/02/2023

L1 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

Parameter	Units	RL	L1	Result	Result	Result	Result	Result	Result
VOCs (continued)									
Ethylenedibromide	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
n-Hexane	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Methyl ethyl ketone	µg/g	0.5	0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Methyl isobutyl ketone	µg/g	0.5	0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Methyl-t-butyl Ether	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Methylene Chloride	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Styrene	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Tetrachloroethylene	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
1,1,1,2-Tetrachloroethane	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
1,1,2,2-Tetrachloroethane	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
1,1,1-Trichloroethane	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
1,1,2-Trichloroethane	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Trichloroethylene	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Trichlorofluoromethane	µg/g	0.05	0.25	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Vinyl Chloride	µg/g	0.02	0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02

EXCEEDANCE SUMMARY

Parameter	Method	Units	Result	REG153 / SOIL / COARSE - TABLE 1 - Residential/Parklan d/Industrial - UNDEFINED L1
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BH-1 SS2

Conductivity	EPA 6010/SM 2510	mS/cm	2.2	0.57
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	No unit	34.3	2.4

BH-2 SS1

Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	No unit	7.5	2.4
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BH-3 SS2

Conductivity	EPA 6010/SM 2510	mS/cm	1.1	0.57
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	No unit	15.1	2.4

BH-4 SS1

Conductivity	EPA 6010/SM 2510	mS/cm	1.6	0.57
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	No unit	24.2	2.4

BH-4 SS3

Conductivity	EPA 6010/SM 2510	mS/cm	0.88	0.57
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	No unit	16.4	2.4

BH-5 SS1

Conductivity	EPA 6010/SM 2510	mS/cm	0.66	0.57
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	No unit	11.0	2.4



FINAL REPORT

CA40089-FEB23 R

QC SUMMARY

Conductivity

Method: EPA 6010/SM 2510 | Internal ref.: ME-CA-IENVIEWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Conductivity	EWL0197-FEB23	mS/cm	0.002	<0.002	0	10	100	90	110	NA		

Cyanide by SFA

Method: SM 4500 | Internal ref.: ME-CA-IENVISFA-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Free Cyanide	SKA5047-FEB23	µg/g	0.05	<0.05	ND	20	96	80	120	96	75	125

Hexavalent Chromium by SFA

Method: EPA218.6/EPA3060A | Internal ref.: ME-CA-IENVISKA-LAK-AN-012

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Chromium VI	SKA5045-FEB23	ug/g	0.2	<0.2	ND	20	90	80	120	86	75	125



FINAL REPORT

CA40089-FEB23 R

QC SUMMARY

Mercury by CVAAS

Method: EPA 7471A/EPA 245 | Internal ref.: ME-CA-IENVISPE-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Mercury	EMS0081-FEB23	ug/g	0.05	<0.05	ND	20	100	80	120	96	70	130

Metals in aqueous samples - ICP-OES

Method: MOE 4696e01/EPA 6010 | Internal ref.: ME-CA-IENVISPE-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
SAR Calcium	ESG0023-FEB23	mg/L	0.2	<0.09	4	20	102	80	120	105	70	130
SAR Magnesium	ESG0023-FEB23	mg/L	0.3	<0.02	2	20	102	80	120	106	70	130
SAR Sodium	ESG0023-FEB23	mg/L	0.1	<0.15	10	20	101	80	120	110	70	130

QC SUMMARY

Metals in Soil - Aqua-regia/ICP-MS

Method: EPA 3050/EPA 200.8 | Internal ref.: ME-CA-IENVISPE-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Silver	EMS0081-FEB23	ug/g	0.05	<0.05	ND	20	95	70	130	105	70	130
Arsenic	EMS0081-FEB23	ug/g	0.5	<0.5	2	20	90	70	130	97	70	130
Barium	EMS0081-FEB23	ug/g	0.1	<0.1	0	20	91	70	130	98	70	130
Beryllium	EMS0081-FEB23	ug/g	0.02	<0.02	1	20	92	70	130	88	70	130
Boron	EMS0081-FEB23	ug/g	1	<1	1	20	93	70	130	74	70	130
Cadmium	EMS0081-FEB23	ug/g	0.05	<0.05	1	20	91	70	130	103	70	130
Cobalt	EMS0081-FEB23	ug/g	0.01	<0.01	1	20	94	70	130	105	70	130
Chromium	EMS0081-FEB23	ug/g	0.5	<0.5	2	20	94	70	130	96	70	130
Copper	EMS0081-FEB23	ug/g	0.1	<0.1	1	20	93	70	130	107	70	130
Molybdenum	EMS0081-FEB23	ug/g	0.1	<0.1	6	20	91	70	130	103	70	130
Nickel	EMS0081-FEB23	ug/g	0.5	<0.5	1	20	97	70	130	104	70	130
Lead	EMS0081-FEB23	ug/g	0.1	<0.1	2	20	94	70	130	109	70	130
Antimony	EMS0081-FEB23	ug/g	0.8	<0.8	ND	20	91	70	130	99	70	130
Selenium	EMS0081-FEB23	ug/g	0.7	<0.7	ND	20	97	70	130	110	70	130
Thallium	EMS0081-FEB23	ug/g	0.02	<0.02	9	20	NV	70	130	102	70	130
Uranium	EMS0081-FEB23	ug/g	0.002	<0.002	1	20	93	70	130	NV	70	130
Vanadium	EMS0081-FEB23	ug/g	3	<3	2	20	94	70	130	96	70	130
Zinc	EMS0081-FEB23	ug/g	0.7	<0.7	0	20	94	70	130	99	70	130

QC SUMMARY

Petroleum Hydrocarbons (F1)

Method: CCME Tier 1 | Internal ref.: ME-CA-IENVIGC-LAK-AN-010

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
F1 (C6-C10)	GCM0170-FEB23	µg/g	10	<10	ND	30	99	80	120	112	60	140

Petroleum Hydrocarbons (F2-F4)

Method: CCME Tier 1 | Internal ref.: ME-CA-IENVIGC-LAK-AN-010

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
F2 (C10-C16)	GCM0152-FEB23	µg/g	10	<10	ND	30	112	80	120	116	60	140
F3 (C16-C34)	GCM0152-FEB23	µg/g	50	<50	ND	30	112	80	120	116	60	140
F4 (C34-C50)	GCM0152-FEB23	µg/g	50	<50	ND	30	112	80	120	116	60	140

QC SUMMARY

pH
 Method: SM 4500 | Internal ref.: ME-CA-ENVIEWL-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
pH	ARD0058-FEB23	pH Units	0.05		ND	20	100	80	120			

QC SUMMARY

Semi-Volatile Organics

Method: EPA 3541/8270D | Internal ref.: ME-CA-IENVIGC-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
1-Methylnaphthalene	GCM0168-FEB23	µg/g	0.05	< 0.05	ND	40	83	50	140	113	50	140
2-Methylnaphthalene	GCM0168-FEB23	µg/g	0.05	< 0.05	ND	40	81	50	140	111	50	140
Acenaphthene	GCM0168-FEB23	µg/g	0.05	< 0.05	ND	40	82	50	140	95	50	140
Acenaphthylene	GCM0168-FEB23	µg/g	0.05	< 0.05	ND	40	79	50	140	94	50	140
Anthracene	GCM0168-FEB23	µg/g	0.05	< 0.05	ND	40	77	50	140	94	50	140
Benzo(a)anthracene	GCM0168-FEB23	µg/g	0.05	< 0.05	ND	40	81	50	140	92	50	140
Benzo(a)pyrene	GCM0168-FEB23	µg/g	0.05	< 0.05	ND	40	79	50	140	86	50	140
Benzo(b+j)fluoranthene	GCM0168-FEB23	µg/g	0.05	< 0.05	ND	40	81	50	140	87	50	140
Benzo(ghi)perylene	GCM0168-FEB23	µg/g	0.1	< 0.1	ND	40	84	50	140	94	50	140
Benzo(k)fluoranthene	GCM0168-FEB23	µg/g	0.05	< 0.05	ND	40	79	50	140	86	50	140
Chrysene	GCM0168-FEB23	µg/g	0.05	< 0.05	ND	40	80	50	140	91	50	140
Dibenzo(a,h)anthracene	GCM0168-FEB23	µg/g	0.06	< 0.06	ND	40	74	50	140	90	50	140
Fluoranthene	GCM0168-FEB23	µg/g	0.05	< 0.05	5	40	77	50	140	99	50	140
Fluorene	GCM0168-FEB23	µg/g	0.05	< 0.05	ND	40	79	50	140	97	50	140
Indeno(1,2,3-cd)pyrene	GCM0168-FEB23	µg/g	0.1	< 0.1	ND	40	72	50	140	87	50	140
Naphthalene	GCM0168-FEB23	µg/g	0.05	< 0.05	ND	40	80	50	140	102	50	140
Phenanthrene	GCM0168-FEB23	µg/g	0.05	< 0.05	22	40	79	50	140	95	50	140
Pyrene	GCM0168-FEB23	µg/g	0.05	< 0.05	ND	40	78	50	140	98	50	140

QC SUMMARY

Volatile Organics

Method: EPA 5035A/5030B/8260C | Internal ref.: ME-CA-IENVIGC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
1,1,1,2-Tetrachloroethane	GCM0169-FEB23	µg/g	0.05	< 0.05	ND	50	92	60	130	99	50	140
1,1,1-Trichloroethane	GCM0169-FEB23	µg/g	0.05	< 0.05	ND	50	94	60	130	97	50	140
1,1,2,2-Tetrachloroethane	GCM0169-FEB23	µg/g	0.05	< 0.05	ND	50	91	60	130	98	50	140
1,1,2-Trichloroethane	GCM0169-FEB23	µg/g	0.05	< 0.05	ND	50	93	60	130	100	50	140
1,1-Dichloroethane	GCM0169-FEB23	µg/g	0.05	< 0.05	ND	50	94	60	130	98	50	140
1,1-Dichloroethylene	GCM0169-FEB23	µg/g	0.05	< 0.05	ND	50	94	60	130	95	50	140
1,2-Dichlorobenzene	GCM0169-FEB23	µg/g	0.05	< 0.05	ND	50	93	60	130	98	50	140
1,2-Dichloroethane	GCM0169-FEB23	µg/g	0.05	< 0.05	ND	50	97	60	130	102	50	140
1,2-Dichloropropane	GCM0169-FEB23	µg/g	0.05	< 0.05	ND	50	93	60	130	100	50	140
1,3-Dichlorobenzene	GCM0169-FEB23	µg/g	0.05	< 0.05	ND	50	93	60	130	97	50	140
1,4-Dichlorobenzene	GCM0169-FEB23	µg/g	0.05	< 0.05	ND	50	94	60	130	96	50	140
Acetone	GCM0169-FEB23	µg/g	0.5	< 0.5	ND	50	106	50	140	122	50	140
Benzene	GCM0169-FEB23	µg/g	0.02	< 0.02	ND	50	94	60	130	98	50	140
Bromodichloromethane	GCM0169-FEB23	µg/g	0.05	< 0.05	ND	50	94	60	130	101	50	140
Bromoform	GCM0169-FEB23	µg/g	0.05	< 0.05	ND	50	90	60	130	95	50	140
Bromomethane	GCM0169-FEB23	µg/g	0.05	< 0.05	ND	50	90	50	140	80	50	140
Carbon tetrachloride	GCM0169-FEB23	µg/g	0.05	< 0.05	ND	50	96	60	130	97	50	140
Chlorobenzene	GCM0169-FEB23	µg/g	0.05	< 0.05	ND	50	88	60	130	98	50	140
Chloroform	GCM0169-FEB23	µg/g	0.05	< 0.05	ND	50	95	60	130	99	50	140
cis-1,2-Dichloroethylene	GCM0169-FEB23	µg/g	0.05	< 0.05	ND	50	95	60	130	97	50	140

QC SUMMARY

Volatile Organics (continued)

Method: EPA 5035A/5030B/8260C | Internal ref.: ME-CA-IENVIGC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
cis-1,3-dichloropropene	GCM0169-FEB23	µg/g	0.03	< 0.03	ND	50	96	60	130	96	50	140
Dibromochloromethane	GCM0169-FEB23	µg/g	0.05	< 0.05	ND	50	95	60	130	100	50	140
Dichlorodifluoromethane	GCM0169-FEB23	µg/g	0.05	< 0.05	ND	50	75	50	140	50	50	140
Ethylbenzene	GCM0169-FEB23	µg/g	0.05	< 0.05	ND	50	93	60	130	100	50	140
Ethylenedibromide	GCM0169-FEB23	µg/g	0.05	< 0.05	ND	50	95	60	130	100	50	140
n-Hexane	GCM0169-FEB23	µg/g	0.05	< 0.05	ND	50	91	60	130	68	50	140
m/p-xylene	GCM0169-FEB23	µg/g	0.05	< 0.05	ND	50	92	60	130	99	50	140
Methyl ethyl ketone	GCM0169-FEB23	µg/g	0.5	< 0.5	ND	50	95	50	140	99	50	140
Methyl isobutyl ketone	GCM0169-FEB23	µg/g	0.5	< 0.5	ND	50	97	50	140	104	50	140
Methyl-t-butyl Ether	GCM0169-FEB23	µg/g	0.05	< 0.05	ND	50	98	60	130	102	50	140
Methylene Chloride	GCM0169-FEB23	µg/g	0.05	< 0.05	ND	50	94	60	130	98	50	140
o-xylene	GCM0169-FEB23	µg/g	0.05	< 0.05	ND	50	94	60	130	101	50	140
Styrene	GCM0169-FEB23	µg/g	0.05	< 0.05	ND	50	94	60	130	100	50	140
Tetrachloroethylene	GCM0169-FEB23	µg/g	0.05	< 0.05	ND	50	94	60	130	96	50	140
Toluene	GCM0169-FEB23	µg/g	0.05	< 0.05	ND	50	95	60	130	101	50	140
trans-1,2-Dichloroethylene	GCM0169-FEB23	µg/g	0.05	< 0.05	ND	50	93	60	130	96	50	140
trans-1,3-dichloropropene	GCM0169-FEB23	µg/g	0.03	< 0.03	ND	50	96	60	130	95	50	140
Trichloroethylene	GCM0169-FEB23	µg/g	0.05	< 0.05	ND	50	94	60	130	99	50	140
Trichlorofluoromethane	GCM0169-FEB23	µg/g	0.05	< 0.05	ND	50	90	50	140	89	50	140
Vinyl Chloride	GCM0169-FEB23	µg/g	0.02	< 0.02	ND	50	86	50	140	78	50	140

QC SUMMARY

Water Soluble Boron

Method: O.Reg. 15 3/04 | Internal ref.: ME-CA-IENV1 SPE-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Water Soluble Boron	ESG0024-FEB23	µg/g	0.5	<0.5	ND	20	100	80	120	110	70	130

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

- NSS** Insufficient sample for analysis.
- RL** Reporting Limit.
 - ↑ Reporting limit raised.
 - ↓ Reporting limit lowered.
- NA** The sample was not analysed for this analyte
- ND** Non Detect

Results relate only to the sample tested.

Data reported represent the sample as submitted to SGS. Solid samples expressed on a dry weight basis.

"Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the "Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act and Excess Soil Quality" published by the Ministry and dated March 9, 2004 as amended.

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This report supersedes all previous versions.

-- End of Analytical Report --

Received By: ED

Received Date (mm/dd/yy): 2-9-23

Received Time: 14:50

Received By (signature): *[Signature]*

Custody Seal Present:

Custody Seal Intact:

Laboratory Information Section - Lab use only

REPORT INFORMATION

Company: Thurber Engineering Ltd.

Contact: Greg Stanhope

Address: 103-2010 Winston Park Drive
Oakville, Ontario

Phone: 905-829-8666

Email: gstanhope@thurber.ca

Email: kfurtbacher@thurber.ca

INVOICE INFORMATION

(same as Report Information)

Company: _____

Contact: _____

Address: _____

Phone: _____

Email: accountingon@thurber.ca

PROJECT INFORMATION

Quotation #: _____ P.O. #: _____

Project #: 36304 Site Location/ID: Orangeville

TURNAROUND TIME (TAT) REQUIRED

TAT's are quoted in business days (exclude statutory holidays & weekends).
Samples received after 6pm or on weekends: TAT begins next business day

Regular TAT (5-7 days) 1 Day 2 Days 3 Days 4 Days

RUSH TAT (Additional Charges May Apply): 1 Day 2 Days 3 Days 4 Days

PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION

Specify Due Date: _____ Rush Confirmation ID: _____

REGULATIONS

Regulation 153/04:

Soil Texture: R/P/I IC/C A/O Medium Fine
 Table 1 Table 2 Table 3 Table 4

Other Regulations:

Reg 347/558 (3 Day min TAT) Sanitary Storm
 PWQO MMR Municipality:
 CCME Other: _____
 MISA O.Reg. 406 Table 1

RECORD OF SITE CONDITION (RSC) YES NO

NOTE: DRINKING (POTABLE) WATER SAMPLES FOR HUMAN CONSUMPTION MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

ANALYSIS REQUESTED

Field Filtered (Y/N) PAH ABN SVOC(alt)
 PCB Total Aroclor VOC F1-F4 VOC
 BTEX BTEX/F1 F2-F4 THM Pesticides OC OP TCLP M&I VOC PCB (B)P ABN Ignit. Water Pkg Gen. Ext. Sewer Use:
 Corrosivity Organic Content

COMMENTS:

SAMPLE IDENTIFICATION

	DATE SAMPLED	TIME SAMPLED	# OF BOTTLES	MATRIX
1	2/7/23	10:00	4	Soil
2	2/7/23	10:30	4	Soil
3	2/7/23	7:00	4	Soil
4	2/7/23	7:30	4	Soil
5	2/7/23	8:00	4	Soil
6	2/7/23	11:00	4	Soil
7	2/7/23	12:00	4	Soil
8	2/7/23	9:00	4	Soil
9				
10				
11				
12				

Observations/Comments/Special Instructions

Sampled By (NAME): George Azzopardi

Signature: *[Signature]*

Date: 02/09/23

(mm/dd/yy)

Pink Copy - Client

Relinquished by (NAME): Karel Furbacher

Signature: *[Signature]*

Date: 02/09/23

(mm/dd/yy)

Yellow & White Copy - SGS



FINAL REPORT

CA40289-FEB23 R1

36304, Orangeville

Prepared for

Thurber Engineering Ltd.

First Page

CLIENT DETAILS

LABORATORY DETAILS

Client	Thurber Engineering Ltd.	Project Specialist	Maarit Wolfe, Hon.B.Sc
Address	103, 2010 Winston Park Drive Oakville, ON L6H 5R7.	Laboratory	SGS Canada Inc.
Contact	Greg Stanhope	Address	185 Concession St., Lakefield ON, K0L 2H0
Telephone	905-829-8666	Telephone	705-652-2000
Facsimile		Facsimile	705-652-6365
Email	gstanhope@thurber.ca; kfurtbacher@thurber.ca	Email	Maarit.Wolfe@sgs.com
Project	36304, Orangeville	SGS Reference	CA40289-FEB23
Order Number		Received	02/09/2023
Samples	Leachate (1)	Approved	02/17/2023
		Report Number	CA40289-FEB23 R1
		Date Reported	02/21/2023

COMMENTS

Temperature of Sample upon Receipt: 6 degrees C
 Cooling Agent Present: Yes
 Custody Seal Present: Yes

 Chain of Custody Number: T1

SIGNATORIES

Maarit Wolfe, Hon.B.Sc



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FINAL REPORT

CA40289-FEB23 R1

Client: Thurber Engineering Ltd.

Project: 36304, Orangeville

Project Manager: Greg Stanhope

Samplers: George Azzopardi

MATRIX: LEACHATE

Sample Number 6
Sample Name TCLP
Sample Matrix Leachate
Sample Date 07/02/2023

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - Waste Management - -

Parameter	Units	RL	L1	Result
Acid rock Drainage				
Final pH	no unit	0.01		5.45
Metals and Inorganics				
Ignitability	yes/no			NO
Burn Rate	mm/S	1.6		< 1.6
Sample weight	g	0.001		100
Ext Fluid	#1 or #2	0.01		1
Ext Volume	mL	0.01		2000
Nitrite (as N)	as N mg/L	0.3		< 0.3
Nitrate (as N)	as N mg/L	0.6		< 0.6
Nitrate + Nitrite (as N)	as N mg/L	0.6	1000	< 0.6
Fluoride	mg/L	0.06	150	< 0.06
Cyanide (total)	mg/L	0.01	20	< 0.01
Arsenic	mg/L	0.002	2.5	0.002
Silver	mg/L	0.0005	5	< 0.0005
Barium	mg/L	0.00008	100	0.133
Boron	mg/L	0.02	500	0.03
Cadmium	mg/L	0.00003	0.5	0.00062
Chromium	mg/L	0.0008	5	< 0.0008
Lead	mg/L	0.00009	5	0.00060
Selenium	mg/L	0.0004	1	0.0018
Uranium	mg/L	0.00002	10	0.00048



FINAL REPORT

CA40289-FEB23 R1

Client: Thurber Engineering Ltd.

Project: 36304, Orangeville

Project Manager: Greg Stanhope

Samplers: George Azzopardi

MATRIX: LEACHATE

Sample Number 6
Sample Name TCLP
Sample Matrix Leachate
Sample Date 07/02/2023

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - Waste Management - -

Parameter	Units	RL	L1	Result
Other (ORP)				
Mercury	mg/L	0.00001	0.1	< 0.00001
PCBs				
Polychlorinated Biphenyls (PCBs) - Total	mg/L	0.001	0.3	< 0.001
SVOCs - PAHs				
Benzo(a)pyrene	mg/L	0.001	0.001	< 0.001
VOCs				
Methyl ethyl ketone	mg/L	0.8	200	< 0.8
Vinyl Chloride	mg/L	0.008	0.2	< 0.008
Dichloromethane	mg/L	0.02	5	< 0.02
Chloroform	mg/L	0.02	10	< 0.02
Trichloroethylene	mg/L	0.02	5	< 0.02
Tetrachloroethene	mg/L	0.02	3	< 0.02
Monochlorobenzene	mg/L	0.02	8	< 0.02
Carbon tetrachloride	mg/L	0.008	0.5	< 0.008
1,2-Dichlorobenzene	mg/L	0.02	20	< 0.02
1,4-Dichlorobenzene	mg/L	0.02	0.5	< 0.02
1,2-Dichloroethane	mg/L	0.02	0.5	< 0.02
1,1-Dichloroethylene	mg/L	0.02	1.4	< 0.02



FINAL REPORT

CA40289-FEB23 R1

Client: Thurber Engineering Ltd.

Project: 36304, Orangeville

Project Manager: Greg Stanhope

Samplers: George Azzopardi

MATRIX: LEACHATE

Sample Number 6
Sample Name TCLP
Sample Matrix Leachate
Sample Date 07/02/2023

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - Waste Management - -

Parameter	Units	RL	L1	Result
VOCs - BTEX				
Benzene	mg/L	0.02	0.5	< 0.02

EXCEEDANCE SUMMARY

No exceedances are present above the regulatory limit(s) indicated



FINAL REPORT

CA40289-FEB23 R1

QC SUMMARY

Cyanide by SFA

Method: SM 4500 | Internal ref.: ME-CA-IENVISFA-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Cyanide (total)	SKA0112-FEB23	mg/L	0.01	<0.01	ND	10	100	90	110	101	75	125

Fluoride by Specific Ion Electrode

Method: SM 4500 | Internal ref.: ME-CA-IENVIEWL-LAK-AN-014

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Fluoride	EWL0195-FEB23	mg/L	0.06	<0.06	3	10	94	90	110	100	75	125

Inorganics-General

Method: EPA 7471A/SM 3112B | Internal ref.: ME-CA-IENVISPE-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Mercury	EHG0016-FEB23	mg/L	0.00001	< 0.00001	ND	20	119	80	120	123	70	130



FINAL REPORT

CA40289-FEB23 R1

QC SUMMARY

Metals in aqueous samples - ICP-MS

Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-IENVISPE-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Silver	EMS0108-FEB23	mg/L	0.0005	<0.00005	ND	20	104	90	110	105	70	130
Arsenic	EMS0108-FEB23	mg/L	0.002	<0.0002	17	20	105	90	110	99	70	130
Barium	EMS0108-FEB23	mg/L	0.00008	<0.00002	0	20	100	90	110	121	70	130
Boron	EMS0108-FEB23	mg/L	0.02	<0.002	3	20	107	90	110	NV	70	130
Cadmium	EMS0108-FEB23	mg/L	0.00003	<0.000003	16	20	107	90	110	105	70	130
Chromium	EMS0108-FEB23	mg/L	0.0008	<0.00008	3	20	103	90	110	100	70	130
Lead	EMS0108-FEB23	mg/L	0.00009	<0.00001	9	20	103	90	110	103	70	130
Selenium	EMS0108-FEB23	mg/L	0.0004	<0.00004	ND	20	105	90	110	123	70	130
Uranium	EMS0108-FEB23	mg/L	0.00002	<0.000002	10	20	102	90	110	109	70	130

Nitrate by Ion Chromatography

Method: EPA300/MA300-Ions1.3 | Internal ref.: ME-CA-IENVIIC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Nitrate (as N)	DIO0272-FEB23	mg/L	0.6	<0.6	ND	20	102	90	110	103	75	125



FINAL REPORT

CA40289-FEB23 R1

QC SUMMARY

Nitrite by Ion Chromatography

Method: EPA300/MA300-Ions1.3 | Internal ref.: ME-CA-IENVIIC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Nitrite (as N)	DIO0272-FEB23	mg/L	0.3	<0.3	ND	20	94	90	110	97	75	125

Polychlorinated Biphenyls

Method: MOE E3400/EPA 8082A | Internal ref.: ME-CA-IENVIGC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Polychlorinated Biphenyls (PCBs) - Total	GCM0213-FEB23	mg/L	0.001	< 0.001	NSS	30	93	60	140	NSS	60	140

Semi-Volatile Organics

Method: EPA 3510C/8270D | Internal ref.: ME-CA-IENVIGC-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Benzo(a)pyrene	GCM0199-FEB23	mg/L	0.001	< 0.001	ND	30	93	50	140	NSS	50	140



FINAL REPORT

CA40289-FEB23 R1

QC SUMMARY

Total Nitrate/Nitrite by Ion Chromatography

Method: EPA300/MA300-Ions1.3 | Internal ref.: ME-CA-IENVIIC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Nitrate + Nitrite (as N)	DIO0272-FEB23	mg/L	0.6	<0.6	NA	20	NA	80	120	NA	75	125



FINAL REPORT

CA40289-FEB23 R1

QC SUMMARY

Volatile Organics

Method: EPA 5030B/8260C | Internal ref.: ME-CA-ENVIGC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
1,1-Dichloroethylene	GCM0176-FEB23	mg/L	0.02	<0.02	ND	30	94	60	130	98	50	140
1,2-Dichlorobenzene	GCM0176-FEB23	mg/L	0.02	<0.02	ND	30	96	60	130	102	50	140
1,2-Dichloroethane	GCM0176-FEB23	mg/L	0.02	<0.02	ND	30	98	60	130	101	50	140
1,4-Dichlorobenzene	GCM0176-FEB23	mg/L	0.02	<0.02	ND	30	94	60	130	100	50	140
Benzene	GCM0176-FEB23	mg/L	0.02	<0.02	ND	30	96	60	130	100	50	140
Carbon tetrachloride	GCM0176-FEB23	mg/L	0.008	<0.008	ND	30	96	60	130	100	50	140
Chloroform	GCM0176-FEB23	mg/L	0.02	<0.02	ND	30	96	60	130	100	50	140
Dichloromethane	GCM0176-FEB23	mg/L	0.02	<0.02	ND	30	96	60	130	100	50	140
Methyl ethyl ketone	GCM0176-FEB23	mg/L	0.8	<0.8	ND	30	107	50	140	104	50	140
Monochlorobenzene	GCM0176-FEB23	mg/L	0.02	<0.02	ND	30	94	60	130	100	50	140
Tetrachloroethene	GCM0176-FEB23	mg/L	0.02	<0.02	ND	30	92	60	130	98	50	140
Trichloroethylene	GCM0176-FEB23	mg/L	0.02	<0.02	ND	30	93	60	130	98	50	140
Vinyl Chloride	GCM0176-FEB23	mg/L	0.008	<0.008	ND	30	90	50	140	94	50	140

QC SUMMARY

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

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Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS Insufficient sample for analysis.
RL Reporting Limit.
 ↑ Reporting limit raised.
 ↓ Reporting limit lowered.
NA The sample was not analysed for this analyte
ND Non Detect

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This report supersedes all previous versions.

-- End of Analytical Report --



Request for Laboratory Services and CHAIN OF CUSTODY

Environment, Health & Safety - Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Fax: 705-652-6365 Web: www.sgs.com/environment

No: T1

Page 1 of 1

Laboratory Information Section - Lab use only

Received By: EO
 Received Date (mm/dd/yy): 2-9-23
 Received Time: 1450

Received By (signature): _____
 Custody Seal Present:
 Temperature Upon Receipt (°C): 6.3

LAB LIMS # CA40781-FEB23

REPORT INFORMATION

Company: Thurber Engineering Ltd.
 Contact: Greg Stanhope
 Address: 103-2010 Winston Park Drive
Oakville, Ontario
 Phone: 905-829-8666
 Email: gstanhope@thurber.ca
 Email: kfurbacher@thurber.ca

INVOICE INFORMATION

(same as Report Information)
 Company: _____
 Contact: _____
 Address: _____
 Phone: _____
 Email: accounting@thurber.ca

PROJECT INFORMATION

Quotation #: _____ P.O. #: _____
 Project #: 36304 Site Location/ID: Orangeville

TURNAROUND TIME (TAT) REQUIRED

TAT's are quoted in business days (exclude statutory holidays & weekends).
 Samples received after 6pm or on weekends: TAT begins next business day

Regular TAT (5-7days)
 1 Day 2 Days 3 Days 4 Days

RUSH TAT (Additional Charges May Apply): 1 Day 2 Days 3 Days 4 Days
PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION

Specify Due Date: _____ Rush Confirmation ID: _____

REGULATIONS

Regulation 153/04:
 Table 1: R/P/I
 Table 2: I/C/C
 Table 3: A/O
 Table: _____

Soil Texture: Coarse Medium Fine

Other Regulations:
 Reg 347/558 (3 Day min TAT)
 PWQO MMER Other:
 CCME MISA

Sewer By-Law:
 Sanitary Storm
 Municipality: _____

RECORD OF SITE CONDITION (RSC) YES NO

SAMPLE IDENTIFICATION		DATE SAMPLED	TIME SAMPLED	# OF BOTTLES	MATRIX
1	TCLP <input checked="" type="checkbox"/>	2/7/23	13:00	2	SOIL
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

Field Filtered (Y/N)

Metals & Inorganics

PAH ABN SVOC(alt)

PCB Total Arclor

HPC F1-F4 VOC

BTEX BTEX/F1 F2-F4

VOC BTEX THM

Pesticides OC OP

TCLP M&I VOC PCB

B(a)P ABN Igit.

Water Pkg Gen. Ext.

Sewer Use:

COMMENTS:

Observations/Comments/Special Instructions

Signed By (NAME): George Azzopardi Date: 02/09/23 (mm/dd/yy)

Relinquished by (NAME): Karel Furbacher Date: 02/09/23 (mm/dd/yy)

Signature: _____

Signature: _____

Pink Copy - Client
Yellow & White Copy - SGS



**APPENDIX F ENVIRONMENTAL LABORATORY CERTIFICATES OF ANALYSIS -
GROUNDWATER**



FINAL REPORT

CA40167-FEB23 R1

Prepared for

Thurber Engineering Ltd.

First Page

CLIENT DETAILS

Client: Thurber Engineering Ltd.
 Address: 103, 2010 Winston Park Drive
 Oakville, ON
 L6H 5R7.
 Contact: Greg Stanhope
 Telephone: 905-829-8666
 Facsimile:
 Email: gstanhope@thurber.ca; kfurbacher@thurber.ca
 Project:
 Order Number:
 Samples: Ground Water (1)

LABORATORY DETAILS

Project Specialist: Maarit Wolfe, Hon.B.Sc
 Laboratory: SGS Canada Inc.
 Address: 185 Concession St., Lakefield ON, K0L 2H0
 Telephone: 705-652-2000
 Facsimile: 705-652-6365
 Email: Maarit.Wolfe@sgs.com
 SGS Reference: CA40167-FEB23
 Received: 02/17/2023
 Approved: 02/28/2023
 Report Number: CA40167-FEB23 R1
 Date Reported: 02/28/2023

COMMENTS

RL - SGS Reporting Limit

Temperature of Sample upon Receipt: 4 degrees C

Cooling Agent Present: Yes

Custody Seal Present: Yes

Chain of Custody Number: 028960

Note: Elevated Ecoli reporting limit due to sample matrix.

SIGNATORIES

Maarit Wolfe, Hon.B.Sc



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QC Summary.....	7-13
Legend.....	14
Annexes.....	15



FINAL REPORT

CA40167-FEB23 R1

Client: Thurber Engineering Ltd.

Project:

Project Manager: Greg Stanhope

Samplers: Liam Scalena

MATRIX: WATER

Sample Number 8
Sample Name BH-3
Sample Matrix Ground Water
Sample Date 17/02/2023

L1 = SANSEW / WATER / - - Orangeville Sewer Use ByLaw - Sanitary Sewer Discharge - BL_75_96

L2 = SANSEW / WATER / - - Orangeville Sewer Use ByLaw - Storm Sewer Discharge - BL_75_96

Parameter	Units	RL	L1	L2	Result
-----------	-------	----	----	----	--------

General Chemistry

Carbonaceous Biochemical Oxygen Demand	mg/L	2	300		< 4 †
Total Suspended Solids	mg/L	2	350	15	5050
Total Kjeldahl Nitrogen	as N mg/L	0.5	100		< 0.5

Metals and Inorganics

Cyanide (total)	mg/L	0.01	2		< 0.01
Sulphate	mg/L	2	1500		200
Sulphide	mg/L	0.02	2		0.062
Aluminum (total)	mg/L	0.01	50		62.0
Antimony (total)	mg/L	0.009	5		< 0.009
Arsenic (total)	mg/L	0.002	1		0.029
Bismuth (total)	mg/L	0.0001	5		0.0009
Cadmium (total)	mg/L	0.00003	1	0.001	0.00080
Chromium (total)	mg/L	0.0008	5	0.2	0.121
Cobalt (total)	mg/L	0.00004	5		0.0579
Copper (total)	mg/L	0.002	3	0.01	0.150
Lead (total)	mg/L	0.0009	5	0.05	0.0775
Iron (total)	mg/L	0.07	50		103
Manganese (total)	mg/L	0.0001	5		4.01
Molybdenum (total)	mg/L	0.0004	5		0.0041
Nickel (total)	mg/L	0.001	3	0.05	0.118
Phosphorus (total)	mg/L	0.03	10		3.42



FINAL REPORT

CA40167-FEB23 R1

Client: Thurber Engineering Ltd.

Project:

Project Manager: Greg Stanhope

Samplers: Liam Scalena

MATRIX: WATER

Sample Number 8
Sample Name BH-3
Sample Matrix Ground Water
Sample Date 17/02/2023

L1 = SANSEW / WATER / - - Orangeville Sewer Use ByLaw - Sanitary Sewer Discharge - BL_75_96

L2 = SANSEW / WATER / - - Orangeville Sewer Use ByLaw - Storm Sewer Discharge - BL_75_96

Parameter	Units	RL	L1	L2	Result
-----------	-------	----	----	----	--------

Metals and Inorganics (continued)

Selenium (total)	mg/L	0.0004	5		0.0034
Silver (total)	mg/L	0.0005	5		< 0.0005
Tin (total)	mg/L	0.0006	5		0.0016
Titanium (total)	mg/L	0.0005	5		1.63
Vanadium (total)	mg/L	0.0001	5		0.123
Zinc (total)	mg/L	0.02	3	0.05	0.37

Microbiology

Fecal Coliform	cfu/100mL	0		200	< 20†
----------------	-----------	---	--	-----	-------

Oil and Grease

Oil & Grease (total)	mg/L	2			< 2
Oil & Grease (animal/vegetable)	mg/L	4	100		< 4
Oil & Grease (mineral/synthetic)	mg/L	4	15		< 4

Other (ORP)

pH	No unit	0.05	9.5	9	7.83
Chloride	mg/L	1	1500		2800
Mercury (total)	mg/L	0.00001	0.1	0.001	0.00012



FINAL REPORT

CA40167-FEB23 R1

Client: Thurber Engineering Ltd.

Project:

Project Manager: Greg Stanhope

Samplers: Liam Scalena

MATRIX: WATER

Sample Number 8

Sample Name BH-3

Sample Matrix Ground Water

Sample Date 17/02/2023

L1 = SANSEW / WATER / - - Orangeville Sewer Use ByLaw - Sanitary Sewer Discharge - BL_75_96

L2 = SANSEW / WATER / - - Orangeville Sewer Use ByLaw - Storm Sewer Discharge - BL_75_96

Parameter	Units	RL	L1	L2	Result
Phenols					
4AAP-Phenolics	mg/L	0.002	1		< 0.002

EXCEEDANCE SUMMARY

Parameter	Method	Units	Result	SANSEW / WATER	SANSEW / WATER
				L1	L2
				/ - - Orangeville Sewer Use ByLaw - Sanitary Sewer Discharge - BL_75_96	/ - - Orangeville Sewer Use ByLaw - Storm Sewer Discharge - BL_75_96

BH-3

Parameter	Method	Units	Result	L1	L2
Total Suspended Solids	SM 2540D	mg/L	5050	350	15
Aluminum	SM 3030/EPA 200.8	mg/L	62.0	50	
Copper	SM 3030/EPA 200.8	mg/L	0.150		0.01
Iron	SM 3030/EPA 200.8	mg/L	103	50	
Lead	SM 3030/EPA 200.8	mg/L	0.0775		0.05
Nickel	SM 3030/EPA 200.8	mg/L	0.118		0.05
Zinc	SM 3030/EPA 200.8	mg/L	0.37		0.05
Chloride	US EPA 325.2	mg/L	2800	1500	

QC SUMMARY

Anions by discrete analyzer

Method: US EPA 325.2 | Internal ref.: ME-CA-1ENVIEWL-LAK-AN-026

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Chloride	DIO5095-FEB23	mg/L	1	<1	ND	20	107	80	120	119	75	125
Sulphate	DIO5095-FEB23	mg/L	2	<2	ND	20	97	80	120	98	75	125

Biochemical Oxygen Demand

Method: SM 5210 | Internal ref.: ME-CA-1ENVIEWL-LAK-AN-007

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Carbonaceous Biochemical Oxygen Demand	BOD0031-FEB23	(CBOD5) mg/L	2	< 2	8	30	98	70	130	91	70	130



FINAL REPORT

CA40167-FEB23 R1

QC SUMMARY

Cyanide by SFA

Method: SM 4500 | Internal ref.: ME-CA-IENVISFA-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Cyanide (total)	SKA0179-FEB23	mg/L	0.01	<0.01	ND	10	92	90	110	90	75	125

Mercury by CVAAS

Method: EPA 7471A/SM 3112B | Internal ref.: ME-CA-IENVISPE-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Mercury (total)	EHG0026-FEB23	mg/L	0.00001	< 0.00001	17	20	103	80	120	117	70	130

QC SUMMARY

Metals in aqueous samples - ICP-MS

Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-ENVISPE-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Silver (total)	EMS0144-FEB23	mg/L	0.0005	<0.00005	ND	20	100	90	110	116	70	130
Aluminum (total)	EMS0144-FEB23	mg/L	0.01	<0.001	0	20	100	90	110	101	70	130
Arsenic (total)	EMS0144-FEB23	mg/L	0.002	<0.0002	12	20	98	90	110	111	70	130
Bismuth (total)	EMS0144-FEB23	mg/L	0.0001	<0.00001	9	20	97	90	110	106	70	130
Cadmium (total)	EMS0144-FEB23	mg/L	0.00003	<0.000003	10	20	100	90	110	96	70	130
Cobalt (total)	EMS0144-FEB23	mg/L	0.00004	<0.000004	12	20	98	90	110	107	70	130
Chromium (total)	EMS0144-FEB23	mg/L	0.0008	<0.00008	8	20	96	90	110	118	70	130
Copper (total)	EMS0144-FEB23	mg/L	0.002	<0.0002	7	20	98	90	110	109	70	130
Iron (total)	EMS0144-FEB23	mg/L	0.07	<0.007	14	20	101	90	110	100	70	130
Manganese (total)	EMS0144-FEB23	mg/L	0.0001	<0.00001	12	20	96	90	110	105	70	130
Molybdenum (total)	EMS0144-FEB23	mg/L	0.0004	<0.00004	5	20	95	90	110	91	70	130
Nickel (total)	EMS0144-FEB23	mg/L	0.001	<0.0001	11	20	99	90	110	105	70	130
Lead (total)	EMS0144-FEB23	mg/L	0.0009	<0.00001	7	20	100	90	110	101	70	130
Phosphorus (total)	EMS0144-FEB23	mg/L	0.03	<0.003	5	20	100	90	110	NV	70	130
Antimony (total)	EMS0144-FEB23	mg/L	0.009	<0.0009	ND	20	105	90	110	115	70	130
Selenium (total)	EMS0144-FEB23	mg/L	0.0004	<0.00004	20	20	109	90	110	NV	70	130
Tin (total)	EMS0144-FEB23	mg/L	0.0006	<0.00006	19	20	93	90	110	NV	70	130
Titanium (total)	EMS0144-FEB23	mg/L	0.0005	<0.00005	1	20	91	90	110	NV	70	130
Vanadium (total)	EMS0144-FEB23	mg/L	0.0001	<0.00001	9	20	99	90	110	105	70	130
Zinc (total)	EMS0144-FEB23	mg/L	0.02	<0.002	10	20	98	90	110	105	70	130



FINAL REPORT

CA40167-FEB23 R1

QC SUMMARY

Microbiology

Method: SM 9222D | Internal ref.: ME-CA-IENVIMIC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Fecal Coliform	BAC9288-FEB23	cfu/100mL	-	ACCEPTED	ACCEPTED							

Oil & Grease

Method: MOE E3401 | Internal ref.: ME-CA-IENVIGC-LAK-AN-019

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Oil & Grease (total)	GCM0284-FEB23	mg/L	2	<2	NSS	20	110	75	125			



FINAL REPORT

CA40167-FEB23 R1

QC SUMMARY

Oil & Grease-AV/MS

Method: MOE E3401/SM 5520F | Internal ref.: ME-CA-IENVIGC-LAK-AN-019

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Oil & Grease (animal/vegetable)	GCM0284-FEB23	mg/L	4	< 4	NSS	20	NA	70	130			
Oil & Grease (mineral/synthetic)	GCM0284-FEB23	mg/L	4	< 4	NSS	20	NA	70	130			

pH

Method: SM 4500 | Internal ref.: ME-CA-IENVIEWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
pH	EWL0410-FEB23	No unit	0.05	NA	1		99			NA		

Phenols by SFA

Method: SM 5530B-D | Internal ref.: ME-CA-IENVISFA-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
4AAP-Phenolics	SKA0178-FEB23	mg/L	0.002	<0.002	ND	10	99	80	120	107	75 125	

QC SUMMARY

Sulphide by SFA

Method: SM 4500 | Internal ref.: ME-CA-IENVISFA-LAK-AN-008

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Sulphide	SKA0192-FEB23	mg/L	0.02	<0.02	ND	20	108	80	120	NA	75	125

Suspended Solids

Method: SM 2540D | Internal ref.: ME-CA-IENVIEWL-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Total Suspended Solids	EWL0353-FEB23	mg/L	2	< 2	0	10	95	90	110	NA		

Total Nitrogen

Method: SM 4500-N C/4500-NO3- F | Internal ref.: ME-CA-IENVISFA-LAK-AN-002

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Total Kjeldahl Nitrogen	SKA0189-FEB23	as N mg/L	0.5	<0.5	3	10	100	90	110	117	75	125

QC SUMMARY

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS Insufficient sample for analysis.
RL Reporting Limit.
 ↑ Reporting limit raised.
 ↓ Reporting limit lowered.
NA The sample was not analysed for this analyte
ND Non Detect

Results relate only to the sample tested.

Data reported represent the sample as submitted to SGS. Solid samples expressed on a dry weight basis.

"Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the "Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act and Excess Soil Quality" published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated.

SGS Canada Inc. statement of conformity decision rule does not consider uncertainty when analytical results are compared to a specified standard or regulation.

This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/terms_and_conditions.htm.

The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Reproduction of this analytical report in full or in part is prohibited.

This report supersedes all previous versions.

-- End of Analytical Report --

Industries & Environment - Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Fax: 705-652-6365 Web: www.sgs.com/environment
- London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8060 Fax: 519-672-0361

Received By: Nicole Braganza Received By (signature): [Signature]
 Received Date: Feb 17 23 (mm/dd/yy) Cooling Agent Present: Yes No Type: Fee
 Received Time: 14:00 (hr: min) Custody Seal Intact: Yes No Temperature Upon Receipt (°C): 4.4

REPORT INFORMATION
 Company: Thurber Eng Ltd
 Contact: Gregory Zamhope
 Address: #103 2010 Winston Park Drive Oakville L6H 5K7
 Phone: 289 208 7586
 Fax: [Blank]
 Email: g.zamhope@thurber.ca

INVOICE INFORMATION
 (same as Report Information)
 Company: _____
 Contact: _____
 Address: _____
 Phone: _____
 Email: _____

REGULATIONS
 O.Reg 153/04 O.Reg 406/19
 Table 1 Res/Park Soil Texture:
 Table 2 Ind/Com Coarse
 Table 3 Agri/Other Medium/Fine
 Table _____ Appx. _____
 Soil Volume <350m3 >350m3

Other Regulations:
 Reg 347/558 (3 Day min TAT)
 PWQO MMR Other:
 CCME MISA
 ODWS Not Reportable *See note

RECORD OF SITE CONDITION (RSC) YES NO
SAMPLE IDENTIFICATION
 1 BH-3 02/17/23 9:30 14 BH GW N
 2
 3
 4
 5
 6
 7
 8
 9
 10
 11
 12

Sewer By-Law:	M & I	SVOC	PCB	PHC	VOC	Pest	Other (please specify)	SPLP TCLP	COMMENTS:	
										Field Filtered (Y/N)
<input checked="" type="checkbox"/> Sanitary <input checked="" type="checkbox"/> Storm <input type="checkbox"/> Municipality: <u>Orangeville</u>										

Observations/Comments/Special Instructions

Sampled By (NAME): Liam Scalera **Signature:** [Signature] **Date:** 02/17/23 (mm/dd/yy) **Pink Copy - Client**

Relinquished by (NAME): Liam Scalera **Signature:** [Signature] **Date:** 02/17/23 (mm/dd/yy) **Yellow & White Copy - SGS**

Revision # 1.6
Date of Issue: 02 May 2022

Note: Submission of samples to SGS is acknowledgement that you have been provided direction on sample collection/handling and transportation of samples. (2) Submission of samples to SGS is considered authorization for completion of work. Signatures may appear on this form or be retained on file in the contract, or in an alternative format (e.g. shipping documents). (3) Results may be sent by email to an unlimited number of addresses for no additional cost. Fax is available upon request. This document is issued by the Company under its General Conditions of Service accessible at http://www.sgs.com/terms_and_conditions.htm. (Printed copies are available upon request.) Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.

LAB LIMS #: CA-40167-FeB23

Quotation #: _____ P.O. #: _____
 Project #: _____ Site Location/ID: _____

TURNAROUND TIME (TAT) REQUIRED
 TAT's are quoted in business days (exclude statutory holidays & weekends).
 Samples received after 6pm or on weekends: TAT begins next business day
 Regular TAT (5-7days) 1 Day 2 Days 3 Days 4 Days
RUSH TAT (Additional Charges May Apply): 1 Day 2 Days 3 Days 4 Days
PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION

Specify Due Date: _____
 *NOTE: DRINKING (POTABLE) WATER SAMPLES FOR HUMAN CONSUMPTION MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY



FINAL REPORT

CA40181-FEB23 R1

Prepared for

Thurber Engineering Ltd.

First Page

CLIENT DETAILS

Client **Thurber Engineering Ltd.**

Address **103, 2010 Winston Park Drive
Oakville, ON
L6H 5R7.**

Contact **Greg Stanhope**

Telephone **905-829-8666**

Facsimile

Email **gstanhope@thurber.ca; kfurtbacher@thurber.ca**

Project

Order Number

Samples **Ground Water (2)**

LABORATORY DETAILS

Project Specialist **Brad Moore Hon. B.Sc**

Laboratory **SGS Canada Inc.**

Address **185 Concession St., Lakefield ON, K0L 2H0**

Telephone **705-652-2143**

Facsimile **705-652-6365**

Email **brad.moore@sgs.com**

SGS Reference **CA40181-FEB23**

Received **02/21/2023**

Approved **02/28/2023**

Report Number **CA40181-FEB23 R1**

Date Reported **06/28/2023**

COMMENTS

MAC - Maximum Acceptable Concentration
 AO/OG - Aesthetic Objective / Operational Guideline
 NR - Not reportable under applicable Provincial drinking water regulations as per client.

Temperature of Sample upon Receipt: 4 degrees C
 Cooling Agent Present: Yes
 Custody Seal Present: Yes

Chain of Custody Number: 028799

NO2 RL raised due to sample matrix

Revision 1 - Sample IDs updated from BH-3 and BH-3-F to BH-3 (PWQO) and BH-3-F (PWQO)

SIGNATORIES

Brad Moore Hon. B.Sc




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FINAL REPORT

CA40181-FEB23 R1

Client: Thurber Engineering Ltd.

Project:

Project Manager: Greg Stanhope

Samplers: Liam Scalena

MATRIX: WATER

Sample Number	7	8
Sample Name	BH-3 (PWQO)	BH-3-F (PWQO)
Sample Matrix	Ground Water	Ground Water
Sample Date	17/02/2023	17/02/2023

L1 = PWQO_L / WATER / - - Table 2 - General - July 1999 PIBS 3303E

Parameter	Units	RL	L1	Result	Result
General Chemistry					
Alkalinity	mg/L as CaCO3	2		721	472
Bicarbonate	mg/L as CaCO3	2		721	472
Carbonate	mg/L as CaCO3	2		< 2	< 2
OH	mg/L as CaCO3	2		< 2	< 2
Colour	TCU	3		7	11
Conductivity	uS/cm	2		7820	8820
Turbidity	NTU	0.10		3900	1.1
Ammonia+Ammonium (N)	as N mg/L	0.1		< 0.1	< 0.1
Total Reactive Phosphorous (o-phosphate as P)	mg/L	0.03		0.15	< 0.03
Total Organic Carbon	mg/L	1		4	4

Metals and Inorganics

Fluoride	mg/L	0.06		0.15	0.16
Bromide	mg/L	0.3		0.8	0.8
Nitrite (as N)	as N mg/L	0.03		< 0.3 †	< 0.3 †
Nitrate (as N)	as N mg/L	0.06		3.11	3.07
Sulphate	mg/L	2		170	190
Hardness	mg/L as CaCO3	0.05		1030	445
Aluminum (0.2µm)	mg/L	0.001	0.075	0.008	0.003
Aluminum (total)	mg/L	0.001		25.9	0.003
Arsenic (total)	mg/L	0.0002	0.005	0.0119	0.0005
Boron (total)	mg/L	0.002	0.2	0.048	0.037



FINAL REPORT

CA40181-FEB23 R1

Client: Thurber Engineering Ltd.

Project:

Project Manager: Greg Stanhope

Samplers: Liam Scalena

MATRIX: WATER

Sample Number	7	8
Sample Name	BH-3 (PWQO)	BH-3-F (PWQO)
Sample Matrix	Ground Water	Ground Water
Sample Date	17/02/2023	17/02/2023

L1 = PWQO_L / WATER / - - Table 2 - General - July 1999 PIBS 3303E

Parameter	Units	RL	L1	Result	Result
Metals and Inorganics (continued)					
Barium (total)	mg/L	0.00008		0.442	0.169
Beryllium (total)	mg/L	0.000007	1.1	0.00113	< 0.000007
Cobalt (total)	mg/L	0.000004	0.0009	0.0189	0.000455
Calcium (total)	mg/L	0.01		331	135
Cadmium (total)	mg/L	0.000003	0.0005	0.000272	0.000028
Copper (total)	mg/L	0.0002	0.005	0.0534	0.0032
Chromium (total)	mg/L	0.00008	0.1	0.0463	0.00135
Iron (total)	mg/L	0.007	0.3	43.2	0.094
Potassium (total)	mg/L	0.009		10.1	5.17
Magnesium (total)	mg/L	0.001		48.5	26.4
Manganese (total)	mg/L	0.00001		1.36	0.0898
Molybdenum (total)	mg/L	0.00004	0.04	0.00135	0.00067
Nickel (total)	mg/L	0.0001	0.025	0.0391	0.0033
Sodium (total)	mg/L	0.1		1560	1490
Phosphorus (total)	mg/L	0.003	0.01	1.30	0.010
Lead (total)	mg/L	0.00009	0.025	0.0330	< 0.00009
Silicon (total)	mg/L	0.02		55.5	3.35
Silver (total)	mg/L	0.00005	0.0001	0.00015	< 0.00005
Strontium (total)	mg/L	0.00008		0.882	0.647
Thallium (total)	mg/L	0.000005	0.0003	0.000411	< 0.000005
Tin (total)	mg/L	0.00006		0.00214	0.00074
Titanium (total)	mg/L	0.00005		0.869	0.00330



FINAL REPORT

CA40181-FEB23 R1

Client: Thurber Engineering Ltd.

Project:

Project Manager: Greg Stanhope

Samplers: Liam Scalena

MATRIX: WATER

Sample Number	7	8
Sample Name	BH-3 (PWQO)	BH-3-F (PWQO)
Sample Matrix	Ground Water	Ground Water
Sample Date	17/02/2023	17/02/2023

L1 = PWQO_L / WATER / - - Table 2 - General - July 1999 PIBS 3303E

Parameter	Units	RL	L1	Result	Result
Metals and Inorganics (continued)					
Antimony (total)	mg/L	0.0009	0.02	< 0.0009	< 0.0009
Selenium (total)	mg/L	0.00004	0.1	0.00085	0.00061
Uranium (total)	mg/L	0.000002	0.005	0.00402	0.00161
Vanadium (total)	mg/L	0.00001	0.006	0.0606	0.00094
Zinc (total)	mg/L	0.002	0.02	0.121	0.003
Other (ORP)					
pH	No unit	0.05	8.6	8.02	8.15
Chloride	mg/L	1		3000	3000
Chromium VI	µg/L	0.2	1	< 1.0†	0.7
Mercury (total)	mg/L	0.00001	0.0002	0.00006	0.00003
Mercury (dissolved)	mg/L	0.00001	0.0002	0.00006	0.00003

EXCEEDANCE SUMMARY

Parameter	Method	Units	Result	PWQO_L / WATER / - - Table 2 - General - July 1999 PIBS 3303E L1
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BH-3 (PWQO)

Arsenic	SM 3030/EPA 200.8	mg/L	0.0119	0.005
Cobalt	SM 3030/EPA 200.8	mg/L	0.0189	0.0009
Copper	SM 3030/EPA 200.8	mg/L	0.0534	0.005
Iron	SM 3030/EPA 200.8	mg/L	43.2	0.3
Lead	SM 3030/EPA 200.8	mg/L	0.0330	0.025
Nickel	SM 3030/EPA 200.8	mg/L	0.0391	0.025
Phosphorus	SM 3030/EPA 200.8	mg/L	1.30	0.01
Silver	SM 3030/EPA 200.8	mg/L	0.00015	0.0001
Thallium	SM 3030/EPA 200.8	mg/L	0.000411	0.0003
Vanadium	SM 3030/EPA 200.8	mg/L	0.0606	0.006
Zinc	SM 3030/EPA 200.8	mg/L	0.121	0.02

QC SUMMARY

Alkalinity

Method: SM 2320 | Internal ref.: ME-CA-1ENVIEWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Alkalinity	EWL0354-FEB23	mg/L as CaCO3	2	< 2	1	20	98	80	120	NA		
Alkalinity	EWL0364-FEB23	mg/L as CaCO3	2	< 2	3	20	106	80	120	NA		

Ammonia by SFA

Method: SM 4500 | Internal ref.: ME-CA-1ENVISFA-LAK-AN-007

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Ammonia+Ammonium (N)	SKA0191-FEB23	as N mg/L	0.1	<0.1	0	10	100	90	110	100	75 125	

QC SUMMARY

Anions by discrete analyzer

Method: US EPA 325.2 | Internal ref.: ME-CA-IENVIEWL-LAK-AN-026

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Chloride	DIO5094-FEB23	mg/L	1	<1	16	20	105	80	120	109	75	125
Sulphate	DIO5094-FEB23	mg/L	2	<2	ND	20	102	80	120	106	75	125

Anions by IC

Method: EPA300/MA300-Ions1.3 | Internal ref.: ME-CA-IENVIIC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Bromide	DIO0449-FEB23	mg/L	0.3	<0.3	ND	20	96	90	110	99	75	125
Nitrite (as N)	DIO0449-FEB23	mg/L	0.03	<0.03	14	20	99	90	110	102	75	125
Nitrate (as N)	DIO0449-FEB23	mg/L	0.06	<0.06	ND	20	101	90	110	103	75	125



FINAL REPORT

CA40181-FEB23 R1

QC SUMMARY

Carbon by SFA

Method: SM 5310 | Internal ref.: ME-CA-IENVISFA-LAK-AN-009

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Total Organic Carbon	SKA0196-FEB23	mg/L	1	<1	2	20	101	90	110	99	75	125

Carbonate/Bicarbonate

Method: SM 2320 | Internal ref.: ME-CA-IENVIEWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Carbonate	EWL0354-FEB23	mg/L as CaCO3	2	< 2	ND	10	NA	90	110	NA		
Bicarbonate	EWL0354-FEB23	mg/L as CaCO3	2	< 2	1	10	NA	90	110	NA		
OH	EWL0354-FEB23	mg/L as CaCO3	2	< 2	ND	10	NA	90	110	NA		
Carbonate	EWL0364-FEB23	mg/L as CaCO3	2	< 2	ND	10	NA	90	110	NA		
Bicarbonate	EWL0364-FEB23	mg/L as CaCO3	2	< 2	3	10	NA	90	110	NA		
OH	EWL0364-FEB23	mg/L as CaCO3	2	< 2	ND	10	NA	90	110	NA		

QC SUMMARY

Colour

Method: SM 2120 | Internal ref.: ME-CA-IENVIEWL-LAK-AN-002

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Colour	EWL0346-FEB23	TCU	3	< 3	ND	10	100	80	120	NA		

Conductivity

Method: SM 2510 | Internal ref.: ME-CA-IENVIEWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Conductivity	EWL0354-FEB23	uS/cm	2	< 2	1	20	103	90	110	NA		
Conductivity	EWL0364-FEB23	uS/cm	2	< 2	1	20	98	90	110	NA		

Fluoride by Specific Ion Electrode

Method: SM 4500 | Internal ref.: ME-CA-IENVIEWL-LAK-AN-014

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Fluoride	EWL0348-FEB23	mg/L	0.06	<0.06	ND	10	93	90	110	92	75 125	

QC SUMMARY

Hexavalent Chromium by SFA

Method: EPA218.6/EPA3060A | Internal ref.: ME-CA-IENVISKA-LAK-AN-012

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Chromium VI	SKA0209-FEB23	ug/L	0.2	<0.2	12	20	96	80	120	91	75	125
Chromium VI	SKA5077-FEB23	ug/L	0.2	<0.2	0	20	98	80	120	78	75	125

Mercury by CVAAS

Method: EPA 7471A/SM 3112B | Internal ref.: ME-CA-IENVISPE-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Mercury (total)	EHG0026-FEB23	mg/L	0.00001	< 0.00001	17	20	103	80	120	117	70	130



FINAL REPORT

CA40181-FEB23 R1

QC SUMMARY

Metals in aqueous samples - ICP-MS

Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-IENVISPE-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Silver (total)	EMS0177-FEB23	mg/L	0.00005	<0.00005	ND	20	108	90	110	110	70	130
Aluminum (total)	EMS0177-FEB23	mg/L	0.001	<0.001	1	20	94	90	110	118	70	130
Aluminum (0.2µm)	EMS0177-FEB23	mg/L	0.001	<0.001	1	20	94	90	110	118	70	130
Arsenic (total)	EMS0177-FEB23	mg/L	0.0002	<0.0002	2	20	96	90	110	98	70	130
Barium (total)	EMS0177-FEB23	mg/L	0.00008	<0.00002	6	20	96	90	110	103	70	130
Beryllium (total)	EMS0177-FEB23	mg/L	0.000007	<0.000007	6	20	94	90	110	99	70	130
Boron (total)	EMS0177-FEB23	mg/L	0.002	<0.002	0	20	97	90	110	96	70	130
Calcium (total)	EMS0177-FEB23	mg/L	0.01	<0.01	10	20	101	90	110	103	70	130
Cadmium (total)	EMS0177-FEB23	mg/L	0.000003	<0.000003	19	20	96	90	110	108	70	130
Cobalt (total)	EMS0177-FEB23	mg/L	0.000004	<0.000004	8	20	96	90	110	101	70	130
Chromium (total)	EMS0177-FEB23	mg/L	0.00008	<0.00008	11	20	95	90	110	110	70	130
Copper (total)	EMS0177-FEB23	mg/L	0.0002	<0.0002	19	20	105	90	110	119	70	130
Iron (total)	EMS0177-FEB23	mg/L	0.007	<0.007	4	20	103	90	110	125	70	130
Potassium (total)	EMS0177-FEB23	mg/L	0.009	<0.009	10	20	97	90	110	97	70	130
Magnesium (total)	EMS0177-FEB23	mg/L	0.001	<0.001	6	20	105	90	110	109	70	130
Manganese (total)	EMS0177-FEB23	mg/L	0.00001	<0.00001	4	20	97	90	110	102	70	130
Molybdenum (total)	EMS0177-FEB23	mg/L	0.00004	<0.00004	6	20	98	90	110	99	70	130
Sodium (total)	EMS0177-FEB23	mg/L	0.1	<0.01	9	20	102	90	110	110	70	130
Nickel (total)	EMS0177-FEB23	mg/L	0.0001	<0.0001	9	20	96	90	110	100	70	130
Lead (total)	EMS0177-FEB23	mg/L	0.00009	<0.00001	4	20	99	90	110	104	70	130



FINAL REPORT

CA40181-FEB23 R1

QC SUMMARY

Metals in aqueous samples - ICP-MS (continued)

Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-IENVISPE-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Phosphorus (total)	EMS0177-FEB23	mg/L	0.003	<0.003	5	20	99	90	110	NV	70	130
Antimony (total)	EMS0177-FEB23	mg/L	0.0009	<0.0009	ND	20	100	90	110	117	70	130
Selenium (total)	EMS0177-FEB23	mg/L	0.00004	<0.00004	1	20	101	90	110	121	70	130
Silicon (total)	EMS0177-FEB23	mg/L	0.02	<0.02	2	20	105	90	110	NV	70	130
Tin (total)	EMS0177-FEB23	mg/L	0.00006	<0.00006	15	20	95	90	110	NV	70	130
Strontium (total)	EMS0177-FEB23	mg/L	0.00008	<0.00002	2	20	96	90	110	100	70	130
Titanium (total)	EMS0177-FEB23	mg/L	0.00005	<0.00005	5	20	100	90	110	NV	70	130
Thallium (total)	EMS0177-FEB23	mg/L	0.000005	<0.000005	13	20	98	90	110	101	70	130
Uranium (total)	EMS0177-FEB23	mg/L	0.000002	<0.000002	3	20	95	90	110	110	70	130
Vanadium (total)	EMS0177-FEB23	mg/L	0.00001	<0.00001	9	20	96	90	110	105	70	130
Zinc (total)	EMS0177-FEB23	mg/L	0.002	<0.002	4	20	98	90	110	109	70	130

QC SUMMARY

pH

Method: SM 4500 | Internal ref.: ME-CA-IENVIEWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
pH	EWL0354-FEB23	No unit	0.05	NA	1		100			NA		
pH	EWL0364-FEB23	No unit	0.05	NA	0		101			NA		

Reactive Phosphorus by SFA

Method: SM 4500-P F | Internal ref.: ME-CA-IENVISFA-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Total Reactive Phosphorous (o-phosphate as P)	SKA0197-FEB23	mg/L	0.03	<0.03	ND	10	98	90	110	87	75	125

QC SUMMARY

Turbidity

Method: SM 2130 | Internal ref.: ME-CA-ENVIEWL-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Turbidity	EWL0359-FEB23	NTU	0.10	< 0.10	0	10	99	90	110	NA		

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

- NSS** Insufficient sample for analysis.
- RL** Reporting Limit.
 - ↑ Reporting limit raised.
 - ↓ Reporting limit lowered.
- NA** The sample was not analysed for this analyte
- ND** Non Detect

Results relate only to the sample tested.

Data reported represent the sample as submitted to SGS. Solid samples expressed on a dry weight basis.

"Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the "Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act and Excess Soil Quality" published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated.

SGS Canada Inc. statement of conformity decision rule does not consider uncertainty when analytical results are compared to a specified standard or regulation.

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This report supersedes all previous versions.

-- End of Analytical Report --



Request for Laboratory Services and CHAIN OF CUSTODY

Industries & Environment - Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Fax: 705-652-6365 Web: www.sgs.com/environment
 - London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8060 Fax: 519-672-0361

Received By: Michelle Bryant (mm/dd/yy) 17/21
 Received Date: Feb 17, 21 (hr.: min)
 Received Time: 00:00
 Laboratory Information Section - Lab use only
 LAB LIMS #: CA-40181-FeB23
 SR.

Received By (signature): [Signature]
 Custody Seal Present: Yes No Cooling Agent Present: Yes No Type: Fee
 Custody Seal Intact: Yes No Temperature Upon Receipt (°C): 4.4

Company: Trucker Dry Ltd
 Contact: Gregory Stanhope
 Address: #103-2010 Winston Park Blvd Oakville ON L6T 5R2
 Phone: 289 208 7886
 Fax: [Signature]
 Email: g.stanhope@trucker.ca

Quotation #: _____ P.O. #: _____
 Project #: _____ Site Location/ID: _____

TURNAROUND TIME (TAT) REQUIRED
 TAT's are quoted in business days (exclude statutory holidays & weekends).
 Samples received after 6pm or on weekends: TAT begins next business day
 Regular TAT (5-7 days) 1 Day 2 Days 3 Days 4 Days
RUSH TAT (Additional Charges May Apply): 1 Day 2 Days 3 Days 4 Days
PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION
 Specify Due Date: _____
 *NOTE: DRINKING (POTABLE) WATER SAMPLES FOR HUMAN CONSUMPTION MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

REGULATIONS
 O.Reg 153/04 O.Reg 406/19
 Table 1 Res/Park Soil Texture: _____
 Table 2 Ind/Com Coarse _____
 Table 3 Agri/Other Medium/Fine _____
 Table _____
 Soil Volume <350m3 >350m3

REPORT INFORMATION	INVOICE INFORMATION	REGULATIONS	ANALYSIS REQUESTED	COMMENTS:
Field Filtered (Y/N)	Metals & Inorganics incl: CrVI, CN, Hg, Pb, HgWS, EC, SAR-soil (Cl, Na-water)	Other Regulations: <input type="checkbox"/> Reg 347/558 (3 Day min TAT) <input checked="" type="checkbox"/> PWGO <input type="checkbox"/> MMER <input type="checkbox"/> CCME <input type="checkbox"/> Other: <input type="checkbox"/> MISA <input type="checkbox"/> ODWS Not Reportable *See note	M & I Full Metals Suite ICP Metals plus B (HWS-soil only) Hg, CrVI ICP Metals only Sp, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Mo, Ni, Se, Ag, Tl, V, Zn	Water Characterization Pkg General <input checked="" type="checkbox"/> Extended _____ Sewer Use: Pwao
Sewer By-Law: <input type="checkbox"/> Sanitary <input type="checkbox"/> Storm <input type="checkbox"/> Municipality:	(same as Report Information)	SWOC PAHs only all incl PAHs, ABNs, CPS	PCB Total <input type="checkbox"/> Aroclor <input type="checkbox"/>	Specific tests Metals <input type="checkbox"/> Ni&I <input type="checkbox"/> VOC <input type="checkbox"/> 1,4-dioxin <input type="checkbox"/> OCP <input type="checkbox"/> ABN <input type="checkbox"/>
DATE SAMPLED	TIME SAMPLED	# OF BOTTLES	MATRIX	Specify tests Pesticides Organochlorine or specify other
02/17/23	9:30	15	GW	BTEX only VOCs no BTEX F1-F4 only F1-F4 + BTEX
02/17/23	9:30	15	GW	PCBs Total <input type="checkbox"/> Aroclor <input type="checkbox"/>
				PHC
				VOC
				Pest
				Other (please specify)
				SPLP TCLP

Observations/Comments/Special Instructions
Compare the results of the general chemistry analysis in the storm drain to the PWGO samples.
 Signature: Liam Scallera
 Signature: Liam Scallera
 Date: 02.17.23
 Date: 02.17.23
 (mm/dd/yy) (mm/dd/yy)
 Client: _____
 Pink Copy - Client
 Yellow & White Copy - SGS
 Note: Submission of samples to SGS is acknowledgement that you have been provided direction on sample collection/handling and transportation of samples. (2) Submission of samples to SGS is considered authorization for completion of work. Signatures may appear on this form or be retained on file in the contract, or in an alternative format (e.g. shipping documents). (3) Results may be sent by email to an unlimited number of addresses for no additional cost. Fax is available upon request. This document is issued by the Company under its General Conditions of Service accessible at http://www.sgs.com/terms_and_conditions.htm. (Printed copies are available upon request.) Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.



SGS Engage --- Sample Crosstab

JobCA40181-FEB23				Client Sample ID:	BH-3 (PWQO)	BH-3-F (PWQO)
DescriptionGreg Stanhope				Lab Sample ID:	CA40181-FEB23-007	CA40181-FEB23-008
				Matrix:	Ground Water	Ground Water
				Location:	N/A	N/A
				Sample Date:	2/17/2023 9:30 AM	2/17/2023 9:30 AM
Analysis	Analyte	Unit	PWQO	Interim PWQO		
WATER-General Chemistry	Alkalinity	mg/L as CaCO3	-	-	721	472
WATER-General Chemistry	Ammonia+Ammonium (N)	as N mg/L	-	-	<0.1	<0.1
WATER-General Chemistry	Bicarbonate	mg/L as CaCO3	-	-	721	472
WATER-General Chemistry	Carbonate	mg/L as CaCO3	-	-	<2	<2
WATER-General Chemistry	Colour	TCU	-	-	7	11
WATER-General Chemistry	Conductivity	µS/cm	-	-	7820	8820
WATER-General Chemistry	Conductivity (calculated)	µS/cm	-	-	7820	8820
WATER-General Chemistry	Ion Ratio	no unit	-	-	0.93	0.75
WATER-General Chemistry	Langeliers Index 4° C	@ 4° C	-	-	1.32	0.87
WATER-General Chemistry	OH	mg/L as CaCO3	-	-	<2	<2
WATER-General Chemistry	Saturation pH 4°C	pHs @ 4°C	-	-	6.70	7.28
WATER-General Chemistry	Total Dissolved Solids (calculated)	mg/L	-	-	5530	5155
WATER-General Chemistry	Total Organic Carbon	mg/L	-	-	4	4
WATER-General Chemistry	Total Reactive Phosphorous (o-phosphate as P)	mg/L	-	-	0.15	<0.03
WATER-General Chemistry	Turbidity	NTU	-	-	3900	1.1
WATER-Metals and Inorganics	Aluminum (0.2µm)	mg/L	-	-	0.008	0.003
WATER-Metals and Inorganics	Aluminum (total)	mg/L	-	0.075	25.9	0.003
WATER-Metals and Inorganics	Anion Sum	meq/L	-	-	101.77	98.54
WATER-Metals and Inorganics	Anion-Cation Balance	% difference	-	-	-3.87	-14.17
WATER-Metals and Inorganics	Antimony (total)	mg/L	-	0.02	<0.0009	<0.0009
WATER-Metals and Inorganics	Arsenic (total)	mg/L	0.1	0.005	0.0119	0.0005
WATER-Metals and Inorganics	Barium (total)	mg/L	-	-	0.442	0.169
WATER-Metals and Inorganics	Beryllium (total)	mg/L	1.1	-	0.00113	<0.000007
WATER-Metals and Inorganics	Boron (total)	mg/L	-	0.2	0.048	0.037
WATER-Metals and Inorganics	Bromide	mg/L	-	-	0.8	0.8
WATER-Metals and Inorganics	Cadmium (total)	mg/L	0.0002	0.0005	0.000272	0.000028
WATER-Metals and Inorganics	Calcium (total)	mg/L	-	-	331	135
WATER-Metals and Inorganics	Cation sum	meq/L	-	-	94.18	74.08
WATER-Metals and Inorganics	Chromium (total)	mg/L	-	-	0.0463	0.00135
WATER-Metals and Inorganics	Cobalt (total)	mg/L	-	0.0009	0.0189	0.000455
WATER-Metals and Inorganics	Copper (total)	mg/L	-	0.005	0.0534	0.0032
WATER-Metals and Inorganics	Fluoride	mg/L	-	-	0.15	0.16
WATER-Metals and Inorganics	Hardness	mg/L as CaCO3	-	-	1030	445
WATER-Metals and Inorganics	Iron (total)	mg/L	0.3	-	43.2	0.094
WATER-Metals and Inorganics	Lead (total)	mg/L	-	0.025	0.0330	<0.00009
WATER-Metals and Inorganics	Magnesium (total)	mg/L	-	-	48.5	26.4
WATER-Metals and Inorganics	Manganese (total)	mg/L	-	-	1.36	0.0898
WATER-Metals and Inorganics	Molybdenum (total)	mg/L	-	0.04	0.00135	0.00067
WATER-Metals and Inorganics	Nickel (total)	mg/L	0.025	-	0.0391	0.0033
WATER-Metals and Inorganics	Nitrate (as N)	mg/L	-	-	3.11	3.07
WATER-Metals and Inorganics	Nitrite (as N)	mg/L	-	-	<0.3	<0.3
WATER-Metals and Inorganics	Phosphorus (total)	mg/L	-	0.01 - 0.03	1.3	0.010
WATER-Metals and Inorganics	Potassium (total)	mg/L	-	-	10.1	5.17
WATER-Metals and Inorganics	Selenium (total)	mg/L	0.1	-	0.00085	0.00061
WATER-Metals and Inorganics	Silicon (total)	mg/L	-	-	55.5	3.35
WATER-Metals and Inorganics	Silver (total)	mg/L	0.0001	-	0.00015	<0.00005
WATER-Metals and Inorganics	Sodium (total)	mg/L	-	-	1560	1490
WATER-Metals and Inorganics	Strontium (total)	mg/L	-	-	0.882	0.647
WATER-Metals and Inorganics	Sulphate	mg/L	-	-	170	190
WATER-Metals and Inorganics	Thallium (total)	mg/L	-	0.0003	0.000411	<0.000005
WATER-Metals and Inorganics	Tin (total)	mg/L	-	-	0.00214	0.00074
WATER-Metals and Inorganics	Titanium (total)	mg/L	-	-	0.869	0.00330
WATER-Metals and Inorganics	Uranium (total)	mg/L	-	0.03	0.00402	0.00161
WATER-Metals and Inorganics	Vanadium (total)	mg/L	-	0.005	0.0606	0.00094
WATER-Metals and Inorganics	Zinc (total)	mg/L	-	0.006	0.121	0.003
WATER-Other (ORP)	Chloride	mg/L	-	-	3000	3000
WATER-Other (ORP)	Chromium VI	µg/L	1	-	<1.0	0.7
WATER-Other (ORP)	Mercury (dissolved)	mg/L	0.0002	-	0.00006	0.00003
WATER-Other (ORP)	Mercury (total)	mg/L	-	-	0.00006	0.00003
WATER-Other (ORP)	pH	No unit	6.5 - 8.5	6.5 - 8.5	8.02	8.15

PWQO Exceedence Colour-Coded Legend	
	Exceeds PWQO
	Exceeds Interim PWQO
	Exceeds both PWQO and Interim PWQO

1 General

1.1 **SECTION INCLUDES**

.1 Design, labour, Products, equipment and services necessary for the miscellaneous and metal fabrication Work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 ANSI, H35.1M Alloy and Temper Designation Systems for Aluminum (Metric).

.2 ASTM A53, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.3 ASTM A123, Specification for Zinc (Hot Dip Galvanized) Coatings on Iron & Steel Products.

.4 ASTM A153, Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.5 ASTM A480/A480M-15, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.

.6 ASTM A307, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.

.7 ASTM A653/A653M, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.

.8 CISC/CPMA 1.73a, A Quick-Drying One-Coat Paint for Use on Structural Steel.

.9 CAN/CSA-G40.20/G40.21-M, General Requirements for Rolled or Welded Structural Quality Steel/ Structural Quality Steels.

.10 CAN/CSA S16.1-M, Limit States Design of Steel Structures.

.11 CSA S136.1-M, Commentary on CAN/CSA S136-M, Cold Formed Steel Structural Members.

.12 CSA W47.1, Certification of Companies for Fusion Welding of Steel Structures.

.13 CSA W48, Filler Metal and Allied Materials for Metal Arc Welding.

.14 CSA W59-M, Welded Steel Construction (Metal Arc Welding).

.15 CAN/CSA W117.2-M, Safety in Welding, Cutting and Allied Processes.

.16 CAN/CGSB 1.40-M, Primer, Structural Steel, Oil Alkyd Type.

- .17 CGSB 1-GP-181, Organic Zinc Rich Primer.
- .18 CGSB 85-GP-16M, Painting Galvanized Steel.
- .19 NAAMM, The National Association of Architectural Metal Manufacturers.
- .20 Steel Structures Painting Council (SSPC), Steel Structures Painting Manual, Vol. 2.

1.3 DESIGN REQUIREMENTS

- .1 Design details and connections, where not shown on Drawings, in accordance with CAN/CSA-S16.1 and CSA S136.1.

1.4 SUBMITTALS

- .1 Shop drawings:
 - .1 Submit shop drawings for fabrication and erection of miscellaneous and metal items in accordance with Section 01 33 00 indicating:
 - .1 Materials, core thicknesses, class of finish (AMP 555), connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.
 - .2 Ensure shop drawings are of one uniform size and based on field measurements.

1.5 QUALITY ASSURANCE

- .1 Retain a Professional Engineer, licensed in the Province of Ontario, with experience in Work of comparable complexity and scope, to perform the following services as part of the Work of this Section:
 - .1 Design metal fabrication items that are required to resist live, dead, lateral, wind, or seismic loads.
 - .2 Review, stamp, date, and sign shop drawings.
- .2 Workmanship: Fabricate Work of this Section to meet the required class of workmanship indicated below in accordance with AMP 555, Section 8.
 - .1 Class 2: for use on exposed to view (at a distance) fabricated items.
 - .2 Exposed surfaces retain mill marks and moderate irregularities not visible by naked eye at 10 metres. Ensure burrs and sharp edges are filed down or ground off.
 - .3 Exposed welds are ground with uniform sized cove.
 - .4 Minor distortions are permitted.
 - .5 Exposed joints have a maximum gap of 1.5 mm.
- .3 Execute welding by firms certified in accordance with CSA W47.1 Division 1 or 2.1. Ensure welding operators are licensed per CSA W47.1 for types of welding required by Work.

- .4 Perform stainless steel work in accordance with NAAMM, Code of Standard Practice for the Metal Industry, Workmanship, Class 1.
- 2 Products
- 2.1 **MATERIALS**
- .1 General:
 - .1 All materials under Work of this Section, including but not limited to, primers and paints are to have low VOC content limits.
 - .2 Unless detailed or specified herein, standard products will be acceptable if construction details, and installation meet intent of Drawings and Specifications.
 - .3 Include all materials, products, accessories, and supplementary parts necessary to complete assembly and installation of Work of this Section.
 - .4 Incorporate only metals that are free from defects which impair strength or durability, or which are visible. Install only new metals of best quality, and free from rust or waves and buckles, and that are clean, straight, and with sharp defined profiles.
 - .2 Structural shapes, plates, and similar items: CAN/CSA-G40.20/G40.21-M, Grade 350W. Hollow structural sections: CAN/CSA-G40.20/G40.21-M, Grade 350W, Class H.
 - .3 Galvanized sheet steel: ASTM A653/A653M Grade A, Z275 Commercial Quality zinc coating, size and shape as shown.
 - .4 Stainless steel sheet and plate: ASTM A480/A480M, Type 316L, finish to AISI No. 4. Size as shown.
 - .5 Protection Posts: ASTM A53/A53-M, Schedule 40 standard weight steel pipe in quantity and sizes shown.
 - .6 Welding materials: CSA W48 and CSA W59-M.
 - .7 Fasteners: Conforming to ASTM A307, Grade A, in areas not exposed to view, use unfinished bolts with hexagon heads and nuts. In areas exposed to view, use bolts, nuts, washers, rivets, lock washers, anchor bolts, machine screws and machine bolts Z275 zinc coated in accordance with ASTM A653/A653M. Supply bolts of lengths required to suit thickness of material being joined, but not projecting more than 6 mm beyond nut, without the use of washers.
 - .8 Primer paint: CAN/CGSB-1.40-M or CPMA 1.73a.

- .9 Galvanized primer paint: Inorganic zinc rich primer. For use on galvanized fabrications where touch up is to remain unpainted in finished work; Carbozinc 11WB by Carboline Company, Catha-Coat 305 by Devoe Coatings or Zinc Clad XI by Sherwin Williams.
- .10 Drilled inserts: Mega by ITW Construction Products or HSL by Hilti Inc. heavy-duty anchors, sizes as shown.

2.2 FABRICATION

- .1 Verify dimensions of existing Work before commencing fabrications and report any discrepancies to the Consultant.
- .2 Fit and assemble Work in shop where possible. Execute Work in accordance with details and reviewed shop drawings.
- .3 Use self-tapping shake-proof screws on items requiring assembly by screws or as indicated. Use screws for interior metal work. Use welded connections for exterior metal Work unless otherwise found acceptable by the Consultant.
- .4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush. Seal exterior steel fabrications against corrosion in accordance with CAN/CSA S16.1-M.
- .5 Execute shop welding to requirements specified.
- .6 Carefully make and fit details. Take special care with exposed finished Work to produce a neat and correct appearance to the Consultant's acceptance.
- .7 Assemble members without twists or open joints.
- .8 Correctly size holes for connecting Work of other trades where such can be determined prior to fabrication. Where possible, show holes on shop drawings. Place holes not to cause appreciable reduction in strength of member.
- .9 Draw mechanical joints to hairline tightness and seal countersunk screw and access holes for locking screws with metal filler where these occur on exposed surfaces.

2.3 FABRICATED ITEMS

- .1 Refer to Drawings for details of metal fabrication work and related items not specifically listed in this Section.
- .2 Where work is required to be built into work of other Sections supply such members to respective Sections.

- .3 Provide metal fabrication items indicated below and items not indicated to be supplied under other Sections. The following items includes miscellaneous and metal fabrication including but not limited to the items listed below.
- .4 Lintels: Fabricated from CAN/CSA-G40.20/G40.21-M, Grade 350W, size and location as shown, width to be not less than 25 mm less than width of wall and extend 200 mm beyond opening at each end. Unless otherwise shown, fabricate lintels in block walls of steel sections. Prime and paint all exposed surfaces, colour to be determined by Architect at a later date.
- .5 Masonry lateral support angles:
 - .1 Supply only, to Section 04 20 00 for installation, all horizontal lateral support anchors at top of non-load-bearing masonry walls.
 - .2 Refer to Structural Drawings for size and spacing of required support anchors. Provide drilled holes as required for anchorage.
 - .3 Galvanized for all exterior wall and unheated and high humidity locations.
- .6 Shelf Angles: Of size indicated on Drawings and as specified in structural steel specifications, with adjustable inserts for vertical adjustment and slotted holes for horizontal; galvanized.
- .7 Steel ladders:
 - .1 Fabricate complete with steel stiffeners, rungs, angle rails, bent plate straps or angle brackets as shown or as provided in shop drawings.
 - .2 Provide safety cages around ladders where indicated on Drawings and in accordance with Ministry of Labour requirements.
 - .3 Provide hot dipped galvanized exterior ladders. Prime and paint regular steel interior ladders, colour to be selected by Architect at a later date.
- .8 Bollards:
 - .1 Provide protection posts as indicated on drawings. Posts to be 150 mm diameter with a wall thickness of 8 mm (min.). Place posts into a 1500 mm foundation (where indicated), fill with 20 Mpa concrete and round top. Project pipes 1220 mm above finished grade. Finish prime coat.
 - .2 Material: Type galvanized steel.
 - .3 Finish: Primed and painted in colour to be selected by Architect (or as noted on drawings).
- .9 Brake shape trim elements:
 - .1 Provide brake shape trim elements around overhead doors and entrance tower openings as indicated on drawings.
 - .2 Material: Type 316L Stainless steel.
 - .3 Finish: Primed and painted in colour to be selected by Architect.

- .10 Miscellaneous steel brackets, supports and angles:
 - .1 Supply and install or supply for installation by trades responsible, all loose steel brackets, supports and angles where indicated, except where such brackets, supports and angles are specified under work of other Sections. Drill for countersunk screws, expansion anchors and anchor bolts.
 - .2 Unless otherwise specified, prime paint for interior installation, galvanized finish for exterior installation.

2.4 ANCHORS AND FASTENING

- .1 Use weld studs of size not larger than 10 mm for attaching miscellaneous materials and equipment to building steel. If weight of item requires larger fasteners use clips or brackets and secure by welding or through bolting.
- .2 Use self-drilling expansion type concrete anchors for attaching to masonry and concrete.
- .3 Do not secure items to steel deck.
- .4 Use steel beam clamps of two bolt design to transmit load to beam web. Do not use C and I clamps.

2.5 WELDING

- .1 Perform welding by electric arc process.
- .2 Execute welding to avoid damage or distortion to Work. Execute welding in accordance with following standards:
 - .1 CSA W48 - for Electrodes. If rods are used, only coated rods are allowed.
 - .2 CSA W59-M and CSA W59S1-M for design of connections and workmanship.
 - .3 CAN/CSA W117.2-M - for safety.
- .3 Thoroughly clean welded joints and expose steel for a sufficient distance to perform welding operations. Finish welds smooth. Supply continuous and ground welds which will be exposed to view and finish paint.
- .4 Test welds for conformance and remove Work not meeting specified standards and replace to Consultant's acceptance.

2.6 SHOP PAINTING

- .1 Clean steel to SSPC SP6 and remove loose mill scale, weld flux and splatter.
- .2 Shop prime steel with one coat of primer paint to dry film thickness of 0.07 mm. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7 deg C. Paint items under cover and leave under cover until primer is dry. Follow paint manufacturer's recommendations regarding application methods, equipment, temperature, and humidity conditions.

- .3 Shop prime galvanized steel in accordance with CGSB 85-GP-16M.
- .4 Clean but do not paint surfaces being welded in field.
- .5 Do not paint surfaces embedded in concrete, but clean as if they were to be primed.
- .6 Do not prime steel to be fireproofed or to receive intumescent paint coating.
- .7 Do not prime machine finished surfaces but apply an effective anti-rust compound.
- .8 Take precautions to avoid damage to adjacent surfaces.

2.7 HOT DIP GALVANIZING

- .1 After fabrication, hot dip galvanize specific miscellaneous steel items as indicated. After galvanizing, plug relief vents air tight with appropriate aluminum plugs as suitable and required for intended metal fabricated item. Straighten shapes and assemblies true to line and plane after galvanizing. Repair damaged galvanized surfaces with zinc rich primer in accordance with manufacturer's printed directions.
- .2 Hot-dip galvanize members in accordance with requirements of the following ASTM, with minimum coating weights or thicknesses as follows:
 - .1 Rolled, pressed and forged steel shapes, plates, bars and strips: ASTM A123; average weight of zinc coating per square/metre of actual surface, for 4.8 mm and less thickness members 600 g/m² for 6 mm and heavier members 640 g/m².
 - .2 Iron and steel hardware: ASTM A153; minimum weight of zinc coating, in ounces per square foot of surface, in accordance with ASTM A153, Table 1 for the various classes of materials used in the Work.

3 Execution

3.1 EXAMINATION

- .1 Examine previously installed Work, upon which this Section depends, verify dimensions and condition of existing Work, and coordinate repairs, alterations, and rectification if necessary. Commencement of Work of this Section is deemed to signify acceptance of existing, prior conditions.
- .2 Obtain Consultant's written approval prior to field cutting or altering of structural members.

3.2 **ERECTION**

- .1 Install metal fabrications in accordance with reviewed shop drawings and manufacturer's written instructions.
- .2 Fit joints and intersecting members accurately. Make Work in true planes with adequate fastenings. Build and erect Work plumb, true, square, straight, level and accurate to sizes detailed, free from distortion or defects detrimental to appearance or performance.
- .3 Perform drilling of concrete and steel as required to fasten Work of this Section.

3.3 **TOUCH UPS**

- .1 Paint bolt heads, washers, nuts, field welds and previously unpainted items. Touch up shop primer damaged during transit and installation, with primer to match shop primer.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Labour, Products, equipment and services necessary for rough carpentry Work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 ASTM A153, Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.2 ASTM A325, Specification for Bolts Quenched/Tempered Steel Nominal Thread Diameter M16 - M36 For Structural Steel Joints.

.3 ASTM A653, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.4 ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials.

.5 ASTM F1667, Driven Fasteners: Nails, Spikes and Staples.

.6 CAN/CSA O80 Series M, Wood Preservation.

.7 CSA O121-M, Douglas Fir Plywood.

.8 CAN/CSA O141, Softwood Lumber.

.9 CSA O151-M, Canadian Softwood Plywood.

.10 NLGA, Standard Grading Rules for Canadian Lumber, National Lumber Grades Authority.

1.3 **QUALITY ASSURANCE**

.1 Lumber identification: Grade stamp of an agency certified by the Canadian Lumber Standards Accreditation Board.

.2 Plywood identification: Grade mark in accordance with applicable CSA standards.

.3 Lumber quality: Carefully select individual pieces so that knots and obvious defects will not interfere with placing bolts, proper nailing or making proper connections.

.4 Moisture Content of wood at time of construction shall be 19% maximum.

- .5 Each piece of fire retardant treated lumber shall be shop marked with the pressure treatment brand and ULC monogram respectively, in accordance with CAN/CSA O80-M.
- .6 Dimensions of lumber shall conform to dressed sizes specified in CAN/CSA-0141 unless actual dimensions are otherwise indicated or specified.
- .7 Dimensional references to lumber on Drawings and in Specifications are to nominal sizes unless actual dimensions are indicated. Such actual dimensions shall be dry size.
- .8 Lumber defects: Discard wood with defects which will render a piece unable to serve its intended function. Lumber will be rejected by Consultant for excessive warp, twist, bow, crook, mildew, fungus, or mould, as well as for improper cutting and fitting, whether or not it has been installed.

1.4 ENVIRONMENTAL REQUIREMENTS

- .1 When it is required that wood maintain dimensional stability and tolerances to ensure accurate installation of later work, store and install it only in dry areas, and where no further installation of moist materials is contemplated.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- .1 Store materials in a dry area. Cover materials with tarpaulins or polyethylene sheets to prevent moisture absorption and impairment of structural and aesthetic properties. Vent to allow air movement. Tie covering to keep in place.

2 Products

2.1 MATERIALS

- .1 General: All materials under Work of this Section, including but not limited to, adhesives are to have low VOC content limits.
- .2 Lumber: Softwood, G4S, moisture content 19% or less at time of installation, in accordance with the following:
 - .1 Lumber shall be of same species and grade, equally seasoned and shall be processed and stamped at same mill.
 - .2 CSA O141 and NLGA Standard Grading Rules for Canadian Lumber.
 - .3 Board quality: Construction or better.
 - .4 Dimension quality:
 - .1 Structural joists, planks, and framing: No. 1 Select Structural.
 - .2 Light framing: Construction..

- .3 Plywood: CSA O121-M, G1S, T & G, standard construction, laminated with waterproof adhesive, exterior grade, Thickness as indicated on drawings.
 - .4 Sheathing: Douglas Fir, CSA 0121-M or CSA O151-M; Select-Tight Face, exterior grade, T & G.
 - .5 Roof lumber: NLGA, Construction grade light framing, Jack Pine, S4S, pressure treated to CAN/CSA-O80 series using copper based waterborne preservative treatment, impregnated to a net retention of 4 kg/ m³ of preservative unless otherwise specified by preservative manufacturer.
 - .6 Surface applied wood preservative: Green coloured copper naphthenate or 5% pentachlorophenol solution, water repellent preservative or same copper based preservative as used for shop impregnation, in accordance with CAN/CSA O80.
 - .7 Fire retardant treatment of lumber and plywood (interior and protected locations): 'Dricon FRT' fire retardant treatment by Biewer Lumber or approved alternative, conforming to ASTM E84, to provide a flame spread rating of 25 or less.
 - .8 Rough hardware: Conforming to ASTM F1667; Nails, bolts, screws, anchors, expansion shields, and other fastenings required to frame and fix rough carpentry as follows:
 - .1 Nails, spikes and staples: Spiral type.
 - .2 Bolts: ASTM A325; 12.7 mm diameter minimum with nuts and washers unless noted otherwise.
 - .3 Screws: Countersunk head, full thread type.
 - .4 Proprietary fasteners: Toggle bolts, expansion shields, lag bolts, screws, inorganic fibre plugs, recommended for purpose by manufacturer.
 - .5 Galvanize rough hardware used in fire treated wood and hardware exposed to the atmosphere.
 - .9 Fasteners for use in pressure treated wood: Provide hot dipped galvanized fasteners complying to ASTM A153 and connectors in accordance with ASTM A653, Class G185 for non-structural members. Provide type 304 or 316 stainless steel fasteners and connectors for use in Structural, pressure treated wood.
- 3 Execution
- 3.1 **EXAMINATION**
- .1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of Work means acceptance of existing conditions.

3.2 GENERAL

- .1 Lay out work carefully and to accommodate work of others. Cut and fit accurately: erect in position indicated by Drawings.
- .2 Install rough carpentry to allow for expansion and contraction of the materials.
- .3 Cut work into lengths as long as practicable and with square ends. Align, level, square, plumb, and secure work permanently in place. Brace work temporarily as required. Join work only over solid backing.
- .4 Bore holes true to line and to same size as bolts. Drive bolts into place for snug fit, and use plates or washers for bolthead and nut bearings. Turn up bolts and lag screws tightly when installed, and again just before concealed by other work or at completion of Work.
- .5 Provide anchors, bolts, and inserts required for attachment of the work of this Section, to those performing the work of other Sections and who are responsible for their installation.
- .6 Do not attach work by wood plugs or blocking in concrete or masonry. Use lead shields, expansion shields, or similar methods only as approved by Consultant.

3.3 MISCELLANEOUS WOODWORK

- .1 Fit and install wood furring, strapping, grounds and blocking. Adequately size, correctly place and conceal members for finishes, fitments and for Work under other Sections. Do not assume that Drawings show required work exactly or completely. Anchor wood members securely in place.
- .2 Install rough bucks, nailing strips and linings to rough openings as required for backing for frames and other Work.
- .3 Except where steel supports are specifically shown, provide wood blocking and supports in metal stud partitions for fastening of items such as casework and other wall mounted accessories. Have respective trades approve the location of such wood blocking.
- .4 Bolt wood blocking or nailing strips to steel framing.
- .5 Align and plumb faces of furring and blocking to tolerance of 1:600.
- .6 Use fire retardant lumber for blocking/framing in ceiling\ spaces, partitions and bulkheads.

3.4 ROOF WOODWORK

- .1 Install continuous wood nailers around roof perimeters, curbs and roof openings larger than 150 x 150 mm, and at edges of insulation as detailed. Install cut cant strips and continuous nailers on copings and curbs as detailed.
- .2 Install wood backing, dressed, tapered and recessed slightly below top surface of roof insulation and roof hopper.

3.5 BACKBOARDS

- .1 Install plywood backboards, primed and painted white on both sides, with fire retardant paint.
- .2 Use minimum 19 mm thick plywood on 19 x 38 mm furring around perimeter and at maximum 300 mm intermediate spacing.

3.6 FASTENERS

- .1 Frame, anchor, fasten, tie and brace members for required strength and rigidity.
- .2 Use hot dipped galvanized fasteners for exterior Work and Work below grade.
- .3 Countersink bolts and bolt heads as required for clearance of other Work.
- .4 Size fasteners to penetrate base member by half of fastener length minimum. Minimize splitting of wood members by staggering nails in direction of grain.
- .5 For plywood use spiral, annular or resin coated nails and staples.

3.7 SURFACE-APPLIED WOOD PRESERVATIVE

- .1 Treat raw surfaces, drilled holes and cut ends of pressure treated wood with 2 coats of wood preservative immediately after cutting.
- .2 Apply preservative by dipping, by brush or by pouring into plugged holes to completely saturate surface.

END OF SECTION

- 1 General
- 1.1 **SECTION INCLUDES**
 - .1 Labour, Products equipment and services necessary for the finish carpentry Work in accordance with the Contract Documents.
- 1.2 **REFERENCES**
 - .1 ANSI A208.1, Particleboard.
 - .2 ANSI A208.2, Medium Density Fibreboard for Interior Use.
 - .3 ANSI/NEMA LD 3, High-Pressure Decorative Laminates.
 - .4 ASTM F1667, Driven Fasteners: Nails, Spikes and Staples.
 - .5 Architectural Woodwork Manufacturers Association of Canada (AWMAC).
 - .6 Architectural Woodwork Standards (AWS) - Quality Standards for Architectural Woodwork.
 - .7 CSA O115-M, Hardwood and Decorative Plywood.
 - .8 CAN/CSA O141, Softwood Lumber.
 - .9 CSA O151-M, Canadian Softwood Plywood.
 - .10 National Hardwood Lumber Association (NHLA) Rules for the Measurement and Inspection of Hardwood and Cypress.
 - .11 National Lumber Grades Authority (NLGA) Standard Grading Rules for Canadian Lumber.
- 1.3 **SUBMITTALS**
 - .1 Shop drawings: Submit shop drawings of finish carpentry Work in accordance with Section 01 33 00 indicating materials, thicknesses, sizes, finishes, wood species, grades, profiles, connection attachments, shop jointing, field jointing, reinforcing, anchorage, fastener types and sizes, location of exposed fastenings, mechanical and electrical service routes, service outlets, cutout locations, and sizes. Include erection drawings, plans, elevations, sections, and details as applicable.
 - .2 Samples: Submit samples of the following in accordance with the requirements of Section 01 33 00:
 - .1 Two representative pieces of each type of wood to receive a stained or natural finish.

- .2 Two representative pieces of each type of wood finished as specified.
- .3 Two of each colour, pattern, gloss, and texture of plastic laminate, in manufacturer's standard tag size.
- .4 Two samples of laminated plastic joints, edging, cutouts and postformed profiles.
- .5 Two of each solid surface, in 100 x 75 x 10 mm samples.
- .6 Two samples of melamine surfaced board, edging and postformed profiles.
- .7 One of each item of finish carpentry hardware.

1.4 **QUALITY ASSURANCE**

- .1 Execute Work of this Section by member of AWMAC, with 5 years' experience in finish carpentry Work of comparable complexity and scope. Submit proof of experience upon Consultant's request.
- .2 Fabricate finish carpentry Work in accordance with AWS Quality Standards, Premium Quality materials and installation unless otherwise indicated. Perform Work in accordance with the definition of Good Workmanship as defined in the AWS Quality Standards.
- .3 Remove and replace finish carpentry Work which does not conform to the AWS Quality standards or as amended by these Specifications.
- .4 Mock-up:
 - .1 Shop fabricate one mock-up of a base cabinet, wall cabinet, and counter top for each type of surfacing specified, complete with hardware and shop applied finishes, installed in location acceptable to Consultant.
 - .2 Arrange for Consultant's review and acceptance, allow 48 hours after acceptance before proceeding with Work.
 - .3 When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of Work if accepted by Consultant. Remove and dispose of mock-ups which do not form part of Work.

1.5 **DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store, and handle finish carpentry in accordance with the AWS Quality Standards. Control the temperature and humidity in accordance with the AWS recommendations, before, during, and after finish carpentry delivery, and also during storage and installation.
- .2 Cover finished plastic laminated work with heavy kraft paper or put in cartons during shipment. Protect installed surfaces by approved means. Do not remove until immediately before final inspection.

1.6 **EXTENDED WARRANTY**

- .1 Submit a extended warranty for plastic laminate work of this Section in accordance with General Conditions, except that warranty period is extended to 2 years from date of Substantial Performance of the Work.
 - .1 Warrant against defects in material and workmanship including but not limited to opening of joints, cracking, shrinkage, warpage, and delamination of plastic laminate.
 - .2 Coverage: Complete replacement including affected adjacent Work.

2 Products

2.1 **MATERIALS**

- .1 General: All materials under Work of this Section, including but not limited to, adhesives and mastics, are to have low VOC content limits.
SEE ARCHITECTURAL DRAWINGS for Millwork Material Finish Schedule.
- .2 Concealed framing lumber and plywood:
 - .1 Eastern Spruce, Balsam Fir, or Jack Pine, to CAN/CSA O141, NLGA, and AWS Custom Grade, S4S, average moisture content 7% +/- 2% at installation.
 - .2 Softwood plywood: CSA O151-M; 19 mm unless indicated otherwise, (G2S). Provide exterior grade at stainless steel counters or counters with plumbing fixtures.
- .3 Hardwood lumber: Maple, unless otherwise indicated, to NHLA and AWS Premium Grade, S4S, average moisture content 7% +/- 2% at installation.
- .4 Softwood plywood: CSA O151-M; 19 mm unless indicated otherwise, (G2S).
- .5 Medium Density Fibreboard (MDF): ANSI A208.2; omnidirectional, light coloured with uniform density throughout 'Superior MDF' by G-P Flakboard Ltd. or 'Panfibre Excel MDF' by Uniboard Canada Inc., meeting the following minimum criteria:
 - .1 Density: 740 kg/m³.
 - .2 Internal bond: 0.8 N/mm².
 - .3 Modulus of rupture: 30 N/mm².
 - .4 Modulus of elasticity: 3400 N/mm².
 - .5 Face screw holding: 1450 N.
 - .6 Core screw holding: 1300 N.
 - .7 Moisture content: 4-7%
- .6 Thermofoil coating, provide thermofoil coating from a reputable manufacturer c/w heat shields adjacent to all ranges, and dishwashers. Colour shall be "White"
- .7 Draw bolts and splines: Type as recommended by fabricator.

- .6 Nails and staples: Conforming to ASTM F1667; Size and type to suit application, galvanized for exterior work, interior humid areas and for treated lumber; plain finish elsewhere.
- .7 Bolts, nuts, washers, blind fasteners, lags and screws: Size and type to suit application. Stapling is not acceptable.
- .8 Adhesive and bituminous mastic: Selected by the millwork fabricator with low VOC content.
- .9 Miscellaneous metals: In accordance with Section 05 50 00.
- .19 Fire retarded coating: Provide clear fire retardent coating to decorative wood panels as indicated. Two component, VOC free coating providing Class A Flame Spread rating to ASTM E84. 'Safecoat Clear Fire Retardant Coating' as manufactured by Quantum Group of Companies or approved alternative.
- .10 Finishing: In accordance with Section 09 91 00.

2.2 **HARDWARE**

- .1 The following hardware is the minimum quality standard for the work of this Section. Alternatives may be considered provided they are approved by Consultant prior to ordering of products.
If not otherwise noted on ARCHITECTURAL DRAWINGS.
- .2 Drawer slides: Full extension, 8400 Series by Knape & Vogt.
- .3 Pilasters: Clear anodized aluminum recessed shelf standards with 12 mm divisions, Model 233 by Knape & Vogt.
- .4 Clips: Bright zinc plated, adjustable height shelf supports, Model 256 by Knape & Vogt.
- .5 Cabinet hinges: Heavy duty, concealed 170 degree, clip, self closing, Model UC71650180 by Blum.
- .6 Drawer and cabinet pulls: 10 mm dia. x 106 mm wide, stainless steel with matt finish, 115.61.601 by Hafele.
- .7 Magnetic catches: Model 918 by Knape & Vogt.
- .8 Locks: Cam locks/deadbolt locks complete with lock core by Hafele, type to suit application and installation.

- .9 Closet rail: 27 mm diameter wardrobe rail stainless steel finish >Model 660 Round Tubing' and tubing flange >Model 734' by Knappe & Vogt.

2.3 **FABRICATION**

- .1 Be responsible for methods of construction and for ensuring that materials are rigidly and securely attached and will not be loosened by the work of other sections.
- .2 Coordinate locations of concealed supports and blocking with other parts of Work. Provide cutouts for outlet boxes and other fixtures.
- .3 Fabricate work in a manner which will permit expansion and contraction of the materials without visible open joints. Conceal joints and connections in wherever possible.
- .4 Set nails and countersink screws, apply wood filler to indentations, sand smooth and leave ready to receive finish.
- .5 Mitre exposed corners, no end grain shall be visible in completed installation.
- .6 Finish millwork in accordance with Section 09 91 00. Finished millwork shall be free from bruises, blemishes, mineral marks, knots, shakes and other defects and shall be selected for uniformity of colour, grain and texture.
- .7 Shelving to cabinetwork to be adjustable unless otherwise noted.
- .8 Recess shelf standards, unless noted otherwise. Stagger recessed shelf standards on opposite sides of divider.
- .9 Do not exceed maximum 760 mm unsupported span for 19 mm thick shelving. House fixed shelving into gables and divisions.
- .10 Shop assemble finish carpentry to accommodate delivery and handling and to ensure passage through building openings.
- .11 Shop install cabinet hardware for doors, shelves and drawers. Recess shelf standards unless noted otherwise.
- .12 Fabricate base from paint grade wood 100 mm high x 16 mm thick, finished in accordance with Section 09 91 00.
- .13 Fabricate sills, screens, frames and moldings to profiles shown.

3 Execution

3.1 **EXAMINATION**

- .1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of Work means acceptance of existing conditions.

3.2 **INSTALLATION**

- .1 Install Work in accordance with AWS Quality Standards and tolerances for Architectural Woodwork. Set and secure finish carpentry in place, rigid, plumb, square, and level.
- .2 Scribe and cut as required, fit to abutting walls, and surfaces, fit properly into recesses and to accommodate columns, fixtures, outlets, or other projecting, intersecting or penetrating objects leaving a 0.8 mm gap maximum.
- .3 Coordinate cutouts for plumbing fixtures, inserts, appliances, outlet boxes, and other fixtures, in finish carpentry. Round internal corners of cut-outs and seal exposed cores.
- .4 Form joints to conceal shrinkage.
- .5 Install draw bolts and splines in laminated plastic counter top joints at maximum spacing 450 mm o.c., and 75 mm from edge. Make joints flush, hairline butt joints.
- .6 Install finishing hardware accurately and securely in accordance with manufacturer's directions, adjust and clean.
- .7 Install prefinished millwork at locations shown on drawings. Position accurately, level, plumb straight.
- .8 Apply bituminous coating over wood framing members in contact with masonry or cementitious construction.
- .9 Melamine panels: Assemble melamine millwork using dowelled/wafered-and-glue construction. Installed melamine panels shall not show any exposed fasteners on finished/exposed surfaces..
- .10 Mouldings: Install in locations indicated on Drawings in accordance with manufacturer's recommendations. Fill holes with wood putty and sand for finishing material.
- .11 Install solid surfacing in accordance with manufacturer's instructions.

- .12 Install wood panelling in locations indicated on drawings and ensuring that it is securely fastened in true vertical and horizontal manner.
- .13 Install window sills level, plumb and even in locations as indicated and ensure that sills are securely fastened.
- .14 Fastening:
 - .1 Coordinate wall securement, anchorage, and blocking for finish carpentry items.
 - .2 Position items of finished carpentry work accurately, level, plumb, true and fasten or anchor securely.
 - .3 Design and select fasteners to suit size and nature of components being joined. Use proprietary devices as recommended by manufacturer.
 - .4 Provide heavy duty fixture attachments for wall mounted cabinets.
 - .5 Set finishing nails to receive filler. Where screws are used to secure members, countersink screw in round cleanly cut hole and plug with wood plug to match material being secured.
- .15 Remove and replace damaged, marked, or stained finish carpentry.

END OF SECTION

- 1 General
- 1.1 **SECTION INCLUDES**
 - .1 Labour, Products equipment and services necessary for spray applied waterproofing Work in accordance with the Contract Documents.
- 1.2 **REFERENCES**
 - .1 ASTM C836, Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course.
 - .2 ASTM E96, Standard Test Methods for Water Vapor Transmission of Materials.
- 1.3 **SUBMITTALS**
 - .1 Product data:
 - .1 Submit manufacturer's Product data in accordance with Section 01 33 00 indicating:
 - .1 Materials list of items to be provided under this Section.
 - .2 Manufacturer's specifications and other data needed to ensure compliance with the specified requirements including but not limited to installation details and physical properties.
 - .3 Manufacturer's current recommended installation procedures.
 - .2 Shop drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 indicating:
 - .1 Adjacent construction and typical details, dimensions, thickness, crack and joint treatment, method of attachment, protection and penetration details.
 - .2 Location of each membrane penetration.
 - .3 Certificates:
 - .1 Submit certifications for items required at least 4 weeks prior to installation of Work of this Section.
 - .2 Submit manufacturer's certification that waterproofing system materials and accessories supplied are compatible, meet Specification requirements and that installer is licensed/approved by membrane manufacturer.
 - .3 Submit manufacturer's certification that waterproofing components are approved for use as complete waterproofing system.
 - .4 Submit Contractor's certification that waterproofing installers and quality control supervisors meet Specification requirements. Submit names of successful membrane installations in which certified personnel have performed tasks of comparable complexity and scope within preceding 5 years.
 - .5 Submit inspection reports and certification by manufacturer confirming that installations are in accordance with manufacturer's requirements.

1.4 **QUALITY ASSURANCE**

- .1 Perform Work of this Section by company, approved by Product manufacturer and having 5 years recent experience in Work of comparable complexity and scope.
- .2 Applicator qualifications:
 - .1 Applicator shall have at written approval from the manufacturer as recommended for the installation of spray-applied waterproofing.
 - .2 Applicator shall designate a single individual as project foreman who shall be on site at all times during installation.
- .3 Mock-up:
 - .1 Construct one 1 m² mock-up of waterproofing system in a location acceptable to the Consultant. Show stages of application and crack and joint preparation and treatment.
 - .2 Obtain Consultant's acceptance. Accepted mock-up may become part of the Work. Mark mock-up to Consultant's acceptance and match remainder of work to accepted mock-up. Remove unacceptable mock-up.
- .4 Pre-installation meeting: Arrange with Consultant and manufacturer's representative to inspect substrates and review drawings and specifications affecting work of this Section, verify all conditions, review installation procedures, and coordinate scheduling with interfacing portions of the Work minimum 48 hours in advance of installation.

1.5 **DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver materials to job site in manufacturer's unopened containers with all labels intact and legible at time of use.
- .2 Maintain the products in accord with manufacturer's recommendations with proper precautions to ensure fitness of material when installed.
- .3 Comply with pertinent provisions of Section 01 60 00.

1.6 **SITE CONDITIONS**

- .1 Maintain air and substrate temperature at waterproofing installation area above 40EF for 24 h before, during and 4 hrs after installation.
- .2 Do not apply waterproofing in wet weather.

1.7 **EXTENDED WARRANTY**

- .1 Submit a extended written warranty for fluid applied waterproofing in accordance with the General Conditions, except that warranty period is extended to 5 years from date of Substantial Performance of the Work.
 - .1 Warrant Work against defects including adhesive failure, cohesive failure, waterproofing failure, and water leakage.

.2 Coverage: Complete replacement including effected adjacent Work.

2 Products

2.1 **MATERIALS**

- .1 All materials under Work of this Section, including but not limited to, sealants and primers are to have low VOC content limits.
- .2 Spray applied waterproofing: ASTM E96, Type 1, 100% rubber copolymer liquid applied membrane which is non-toxic and non-carcinogenic. Rub-R-Wall by Advanced Coatings or approved alternative.
- .3 Concrete repair, mastic, backer rod, sealants, primers, elastomeric sheet, protection boards and other accessory materials: As recommended by manufacturer.

3 Execution

3.1 **EXAMINATION**

- .1 Verify condition of previously installed Work upon which this Section depends. Verify conformance with manufacturer's requirements. Report defects to Consultant. Commencement of Work means acceptance of existing conditions.

3.2 **SUBSTRATE PREPARATION AND PROTECTION**

- .1 Allow concrete substrates to cure 24 to 48 hours prior to surface preparation.
- .2 Verify substrate surfaces are solid, free from surface water, frozen matter, dust, oil, grease, scaling or laitance, projections and foreign matter detrimental to the adhesion of the hot rubberized asphalt.
- .3 Clean all surfaces to receive membrane system in accord with manufacturer's instructions; vacuum clean or blow clean with oil-free compressed air all surfaces to receive waterproofing membrane and accessories. Protect adjacent surfaces not being waterproofed.
- .4 Rout, clean, prepare and detail surface cracks form tie holes, honeycombed areas, and other voids and holes which may impair performance of waterproofing membrane in accord with manufacturer's instructions; install backer rod where required.
- .5 Clean metal surfaces to bright metal by wire brushing or mechanical etching; scuff-sand lead flashing and plastic surfaces..

- .6 Install detail cants, detail coats, joint and crack treatments, and liquid flashings in accord with manufacturer's instructions.
- .7 Allow detail applications to cure in accord with manufacturer's instructions prior to general application of membrane.
- .8 Prime surfaces in accordance with manufacturer's instructions.
- .9 Supply and install temporary protection to adjacent surfaces to prevent damage resulting from Work of this Section.

3.3 APPLICATION

- .1 Apply waterproofing in accordance with manufacturer's instructions.
- .2 Grid surfaces to assure proper coverage rates and verify membrane wet-film mil thickness with gauges as work progresses.
- .3 Apply membrane in uniform passes by spray to wet film thickness of 60 - 70 mils on vertical surfaces unless more stringent requirements are indicated in submitted data.
- .4 Spray the top of the footing 75 mm away from the wall, do not spray the entire top surface of the footing.
- .5 Continue membrane up wall to a minimum of 150 mm above final grade line or previously determined elevation.
- .6 Ensure complete coverage to substrate, around flashings and protrusions and at changes in direction of surface. Re-spray thin spots and voids to obtain proper thickness. Work material into any fluted rib forming indentations.
- .7 Feather terminating edge when entire area cannot be completed in one day; clean area 150 mm wide along terminating edge of membrane with Xylene solvent on clean white rags prior to start-up on next working day; overlap existing work by 150 mm with new work.
- .8 Allow minimum 15 minute cure time before application of protection board, insulation, drainage board. Ensure proper initial placement, without overlap of protection boards.

3.4 FIELD QUALITY CONTROL

- .1 Do not cover or permit to be covered any portion of the membranes until they have had full cure of 48 hours and been inspected by the Consultant or by an inspection agency appointed by the Consultant.

3.5 PROTECTION AND CLEAN-UP

- .1 Promptly remove overspray of membrane system material from adjacent surfaces with cleaner approved by membrane manufacturer. Leave work area in broom clean condition.
- .2 Prohibit traffic over completed work and protect against work overhead until protection course is installed.

END OF SECTION

- 1 General
- 1.1 **SECTION INCLUDES**
 - .1 Labour, Products, equipment and services necessary for the thermal insulation Work in accordance with the Contract Documents.
- 1.2 **REFERENCES**
 - .1 CAN/ULC-S702, Mineral Fibre Thermal Insulation for Buildings.
 - .2 CAN/ULC-S704, Thermal Insulation, Polyurethane and Polyisocyanurate, Boards, Faced.
- 1.3 **SUBMITTALS**
 - .1 Product data: Submit manufacturer's Product data in accordance with Section 01 33 00 indicating characteristics, performance criteria, and limitations. Indicate installation requirements and techniques, storage, and handling criteria and installation procedure acceptable to manufacturer.
 - .2 Certification: Submit installer's certification verifying compliance with specification requirements.
- 1.4 **QUALITY ASSURANCE**
 - .1 Qualifications: Execute Work of this Section by company specializing in thermal insulation Work with minimum of three years, recent, documented experience, on Work of comparable complexity and scope.
- 2 Products
- 2.1 **MATERIALS**
 - .1 All materials under Work of this Section, including but not limited to, adhesives are to have low VOC content limits.
 - .2 Batt Insulation: CAN/ULC-S702, Type 1, friction fit. 'ComfortBatt' by Roxul, or approved alternative.
 - .3 Semi-rigid insulation: Semi-rigid mineral wool conforming to CAN/ULC-S702, Type 1, minimum density 70 kg/m³, thickness as indicated. 'CavityRock MD' by Roxul.
 - .4 Cavity wall insulation: Mineral wool fibre insulation conforming to CAN/ULC-S702, Type 1, minimum density 100 kg/m³, thickness as indicated. 'CavityRock DD' by Roxul.

- .5 Polyisocyanurate Board Insulation: CAN/ULC S704; Type 2, Class C, Rigid polyisocyanurate foam core board to meet specified requirements, faced both sides with glass fibre reinforced polymer facers or foil faces. 'Energy Shield' by Atlas Roofing Corporation or approved alternative.
- .6 Acoustic Insulation: In accordance with Section 09 21 16.
- .7 Insulation retainers: In accordance with Section 04 20 00.
- .8 Spray Foam Insulation: CAN/ULC S770-09; Walltite XL01 by BASF.

3 Execution

3.1 **EXAMINATION**

- .1 Verify condition of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of Work means acceptance of existing conditions.
- .2 Ensure substrate surfaces are dry, clean, suitable to receive adhesive and free from other deleterious substances.

3.2 **INSTALLATION**

- .1 Install thermal insulation in longest panel sizes possible in accordance with manufacturer's instructions.
- .2 Butt insulation with moderate contact and, cut and fit them tightly around other construction elements. Offset single layer vertical joints and both vertical and horizontal joints in multiple layer applications.,
- .3 Make thermal insulation continuous, maintain thermal protection continuity and secure to prevent displacement. Ensure that insulation is tight to substrate without air gaps.
- .4 Cut and fit thermal insulation tightly around electrical boxes, plumbing and heating pipes and ducts, exterior doors and windows, and other protrusions.
- .5 Leave 75 mm separation between thermal insulation and heat emitting devices such as recessed light fixtures.
- .6 Cut and trim thermal insulation neatly to fit spaces; do not excessively compress insulation to fit. Install only thermal insulation boards which are free from chipped or broken edges.
- .7 Pack miscellaneous cavities with insulation to maintain continuity of thermal barrier.
- .8 Arrange for Consultant to review thermal insulation before it is enclosed.

- .9 Ensure compatibility and continuity of the vapour barrier at smoke seal and firestop location.

3.3 **SECUREMENT**

- .1 Batt insulation: Install batt insulation in partitions, between studs, and as indicated on Contract Drawings and in accordance with the manufacturer's instructions. Fill stud cavities to full height of partitions and carefully cut and fit batt insulation around services and protrusions.
- .2 Cavity wall insulation:
 - .1 Provide insulation tight to the inner wythe starting at the base of the wall in parallel courses with tight butt joints. Stagger end joints in adjacent course.
 - .2 Provide finish work level, plumb and true.
 - .3 Provide securement for cavity wall insulation with wedge type retainers in accordance with manufacturer's written instructions.
- .3 Rigid insulation: Apply adhesive to thermal insulation foam boards in accordance with manufacturer's recommendations. Omit adhesive bonding of foam board insulation over expansion and control joints.
- .4 Perimeter foundation insulation:
 - .1 Exterior application: unless otherwise indicated, extend boards from finish grade down to top of footing. Install on exterior face of perimeter foundation wall with clips and adhesive. Protect entire face of insulation exposed to backfill with protection board. Terminate protection board 100 mm below finish grade level.
- .5 Underslab insulation:
 - .1 Install insulation boards in locations shown in accordance with manufacturer's instructions.
 - .2 Protect insulation board from damage by placing 200 mm layer of 19 mm crusher-run limestone over insulation board.
 - .3 In drainage trenches, place insulation board to size and location as shown in Contract Drawings, with joints butted tight.

END OF SECTION

- 1 General
- 1.1 **SECTION INCLUDES**
 - .1 Labour, Products, equipment and services necessary for vapour retarders Work in accordance with the Contract Documents.
- 1.2 **REFERENCES**
 - .1 ASTM E1643, Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
 - .2 ASTM E1745, Standard Specification for Water Vapour Retarders used in contact with Soil or Granular Fill under Concrete Slabs.
 - .3 CAN/CGSB 19.21-M, Sealing and Bedding Compound, Acoustical.
 - .4 CAN/CGSB-51.34-M, Vapour Barrier, Polyethylene Sheet, for Use in Building Construction.
- 1.3 **SUBMITTALS**
 - .1 Product data:
 - .1 Submit duplicate copies of manufacturer's Product data in accordance with Section 01 33 00 indicating:
 - .1 Performance criteria, compliance with appropriate reference standard, characteristics, and limitations.
 - .2 Product transportation, storage, handling and installation requirements.
 - .2 Samples: Submit following samples in accordance with Section 01 33 00:
 - .1 Two 300 x 300 mm samples of vapour retarders.
 - .2 Two samples, 300 mm long, of fastening bar.
 - .3 Duplicate samples of pipe and conduit boot.
- 1.4 **QUALITY ASSURANCE**
 - .1 Mock-up:
 - .1 Construct one 10 m² mock-up of each type vapour retarder in location acceptable to Consultant indicating as a minimum one lap joint, one inside corner, one window interface, and one electrical box.
 - .2 Arrange for Consultant's review and acceptance.
 - .3 Mock-up may remain as part of Work if accepted by Consultant. Remove and dispose of mock-ups which do not form part of Work.

1.5 **SITE CONDITIONS**

- .1 Do not install the Work of this Section outside of environmental ranges as recommended by manufacturer without Consultant's and Product manufacturer's written acceptance.
- .2 Supply and install temporary protection and facilities to maintain Product manufacturer's, and above specification, environmental requirements before, during, and after installation.

2 Products

2.1 **MATERIALS**

- .1 All materials under Work of this Section, including but not limited to, primers and sealants are to have low VOC content limits.
- .2 Membrane vapour retarder: 1.0 mm thick, single-ply, self-adhering, self-sealing, rubberised asphalt, bonded to a cross-laminated high density polyethylene film.
 - .1 'CCW 705' by Carlisle Coatings & Waterproofing.
 - .2 'Blueskin SA' by Henry Company Canada Inc.
 - .3 'Soprasedal Stick 1100 T' by Soprema.
 - .4 'Exo-Air 110' by Tremco.
 - .5 'Air-Shield' by W. R. Meadows.
- .3 Primer:
 - .1 'CCW-AWP Primer' by Carlisle Coatings & Waterproofing.
 - .2 'Aquatac' by Henry Company Canada Inc.
 - .3 'Elastocol Stick H20' by Soprema.
 - .4 'ExoAir WB Primer' by Tremco
 - .5 'Mel-Prime Water Base' by W.R. Meadows.
- .4 Mastic:
 - .1 'CCW 704 Mastic' by Carlisle Coatings & Waterproofing.
 - .2 'Polybitume 570-05' by Henry Company Canada Inc.
 - .3 'Sopramastic' by Soprema.
 - .4 'Acoustical Sealant' by Tremco
 - .5 'Sealtight Pointing Mastic' by W.R. Meadows.
- .5 Fastening bar: Continuous 25 mm wide x 3 mm thick aluminum bar, predrilled for mechanical attachment.
- .6 Fasteners: As specified herein or manufacturer's recommended fastener for attaching to Substrate.
- .7 Sheet vapour retarder 'Super Six' Polyethylene film to CAN/CGSB-51.34, 0.15 mm (6 mil) thick.

- .8 Joint sealing tape: Air resistant pressure sensitive adhesive tape, type recommended by sheet vapour retarder manufacturer, 50 mm wide for lap joints and perimeter seals, 25 mm wide elsewhere.
- .9 Sealant: CAN/CGSB 19.21; One-part, non-sag, non-bleeding, non-drying, non-hardening, sealant shall remain tacky for permanent bonding to all surfaces; 'Tremco Acoustical Sealant' by Tremco Ltd. or approved alternative.
- .10 Vapour retarder (under slab): ASTM E1745, Class A, 0.38 mm (15 mil) thick; 'Stego Wrap Vapor Barrier' by Stego Industries or 'Perminator' by W.R. Meadows.
 - .1 Joint sealing tape: High density polyethylene tape with pressure sensitive adhesive with minimum width 100 mm. Type recommended by sheet vapour retarder manufacturer.
 - .2 Pipe and conduit boots: Construct pipe and conduit boots from vapour retarder material and pressure sensitive tape as recommended by manufacturer.

3 Execution

3.1 EXAMINATION AND COORDINATION

- .1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of Work means acceptance of existing conditions..
- .2 Verify that existing substrates to receive vapour retarder are clean, dry, sound, smooth, and continuous.
- .3 Coordinate installation of vapour retarders with work of other Sections to achieve a vapour tight building envelope.

3.2 SHEET VAPOUR RETARDER INSTALLATION

- .1 Ensure substrates and services are installed and inspected prior to installation of retarder.
- .2 Install sheet vapour retarder on the warm side of roof assembly, prior to installation of roof insulation to form a continuous vapour retarder.
- .3 Use sheets of largest practical size to minimize joints.
- .4 Inspect for continuity. Repair punctures and tears with sealing tape before work is concealed.

- .5 At exterior surface openings, cut vapour retarder to form openings and ensure material is lapped and sealed to frame.
- .6 Ensure continuity of vapour retarder is maintained at junctures with other materials.
- .7 At perimeter seals, seal perimeter of sheet vapour retarder as follows:
 - .1 Apply continuous bead of sealant to substrate at perimeter of sheets.
 - .2 Lap sheet over sealant and press into sealant bead.
 - .3 Install fasteners through lapped sheets at sealant bead into substrate.
 - .4 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.
- .8 Seal lap joints of sheet vapour retarder as follows:
 - .1 Attach first sheet to substrate.
 - .2 Apply continuous bead of sealant over solid backing at joint.
 - .3 Lap adjoining sheet minimum 150 mm and press into sealant bead.
 - .4 Install fasteners through lapped sheets at sealant bead into substrate.
 - .5 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.
- .9 Seal electrical switch and outlet device boxes that penetrate vapour retarder as follows:
 - .1 Wrap boxes with film sheet providing minimum 300 mm perimeter lap flange.
 - .2 Apply sealant to seal edges of flange to main vapour retarder and seal wiring penetrations through box cover.

3.3 MASTIC AND PRIMER

- .1 Fill substrate voids, gaps, depressions, cracks, and joints with mastic until continuous, smooth, substrate for vapour retarder is achieved.
- .2 Prime substrate surfaces to receive vapour retarder in accordance with manufacturer's instructions, at recommended application rate, allow to dry. Vary coverage to suit surface porosity.
- .3 Prime surfaces. Re-prime surfaces if not covered with vapour retarder within 4 hours.

3.4 UNDER SLAB VAPOUR RETARDER INSTALLATION

- .1 Install sheet vapour retarder under the floor slab prior to installation of floor slab, to form a continuous vapour retarder in accordance with ASTM E1643 and manufacturer's written instructions.
- .2 Lap vapour barrier over footings and seal to foundation walls.
- .3 Overlap joints 150 mm and seal with manufacturer approved sealing tape.
- .4 Seal all penetrations (including conduits and pipes) with manufacturer's pipe boot.

- .5 Use sheets of largest practical size to minimize joints.
- .6 Inspect for continuity. Repair punctures and tears with sealing tape before work is concealed.
- .7 Ensure continuity of vapour retarder is maintained at junctures with other materials.

3.5 MEMBRANE VAPOUR RETARDER INSTALLATION

- .1 Install mastic where required to ensure integrity of vapour retarder installation at protrusions and other complex details.
- .2 Install vapour retarder in accordance with manufacturer's instructions in locations indicated.
- .3 Lap vapour retarder ends and edges 50 mm minimum. Roll vapour retarder and laps for continuous adhesion over entire substrate area; use manufacturer's recommended roller.
- .4 Extend vapour retarder as required to connect to roof parapets, windows, doors frames, aluminum work and other components of Work comprising vapour retarder system.
- .5 Cut and fit vapour retarder as required for passage of protrusions, ensuring continuous adherence to substrate.
- .6 At end of days' Work, trowel mastic water cut-off along uppermost edge of incomplete vapour retarder assembly, to prevent loss of adhesion and damage to vapour retarder.

3.6 FASTENING BARS

- .1 Supply and install continuous mechanical fastening bar to clamp vapour retarder both sides of unfilled gaps, cracks, and joints.

3.7 FIELD QUALITY CONTROL

- .1 Inspect vapour retarder continuity immediately prior to installation of subsequent construction. Repair punctures, rips and tears to ensure continuity of vapour retarder.
- .2 Where punctures and tears are extensive, replace entire damaged section.
- .3 Do not cover or permit to be covered any portion of vapour retarder until it has been inspected by Consultant.

END OF SECTION

1 General

1.1 SECTION INCLUDES

- .1 Surface preparation.
- .2 Application of an underslab vapour retarder.

1.2 RELATED SECTIONS

- .1 Section 03 30 00 - Concrete.
- .2 Section 07 10 00 – Dampproofing and Waterproofing.
- .3 Section 09 65 00 - Resilient Flooring.

1.3 REFERENCES

- .1 ASTM D1709 - 09 Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.
- .2 ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
- .3 ASTM E154 - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs.
- .4 ASTM E1643 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
- .5 ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
- .6 ASTM F1249-01 Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.

1.4 SUBMITTALS

- .1 Comply with Section 01 33 00 - Submittal Procedures.
- .2 Submit manufacturer's product data and application instructions.

1.5 QUALITY ASSURANCE

- .1 Use an experienced installer and adequate number of skilled personnel who are thoroughly trained and experienced in the application of the vapour retarder.
- .2 Obtain vapour retarder materials from a single manufacturer regularly engaged in manufacturing the product.
- .3 Provide products which comply with all state and local regulations controlling use of volatile organic compounds (VOCs).

1.6 PRECONSTRUCTION MEETING

- .1 Pre-Construction Meeting: Convene one week prior to installation of underslab vapour retarder. Attendees to be as follows: - Architect, Engineer, General Contractor, Vapour Retarder Installer, and Vapour Retarder Manufacturer to discuss the application in detail.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- .2 Store materials in a clean, dry area in accordance with manufacturer's instructions.
- .3 Protect materials during handling and application to prevent damage or contamination.
- .4 Ensure membrane is stamped with manufacturer's name, product name, and membrane thickness at intervals of no more than 220cm (85").

1.8 ENVIRONMENTAL REQUIREMENTS

- .1 Product not intended for uses subject to abuse or permanent exposure to the elements.
- .2 Do not apply on frozen ground..

2 Products

2.1 MANUFACTURER

- .1 W. R. MEADOWS OF CANADA, 70 Hannant Court, Milton, Ontario, Canada L9T 5C1. (800) 563-3618. Fax (905) 878-4125. Web Site: www.wrmeadows.com.

2.2 MATERIALS

- .1 Plastic Vapour Retarder
 - .1 PERMINATOR 15 mil by W. R. MEADOWS.

2.3 ACCESSORIES

- .1 Seam Tape
 - .1 High Density Polyethylene Tape with pressure sensitive adhesive. Minimum width 4" (100 mm).
 - .1 Perminator Tape by W.R. Meadows.
- .2 Pipe Collars
 - .1 Construct pipe collars from vapour retarder material and pressure sensitive tape per manufacturer's instructions.

3 Execution

3.1 SURFACE PREPARATION

- .1 Prepare surfaces in accordance with manufacturer's instructions.
- .2 Level, tamp, or roll earth or granular material beneath the slab base.

3.2 EXAMINATION

- .1 Examine surfaces to receive membrane. Notify architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.3 APPLICATION

- .1 Install the vapour retarder membrane in accordance with manufacturer's instructions and ASTM E 1643-98.
- .2 Unroll vapour retarder with the longest dimension parallel with the direction of the pour.
- .3 Lap vapour retarder over footings and seal to foundation walls.
- .4 Overlap joints 152mm (6") and seal with manufacturer's tape.
- .5 Seal all penetrations (including pipes) with manufacturer's pipe boot.
- .6 No penetration of the vapour retarder is allowed except for reinforcing steel and permanent utilities.
- .7 Repair damaged areas by cutting patches of vapour barrier, overlapping damaged area 152mm (6") and taping all four sides with tape.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Labour, Products equipment and services necessary for spray applied air/vapour barrier Work in accordance with the Contract Documents.

1.2 **SUBMITTALS**

.1 Product data:

.1 Submit manufacturer's Product data in accordance with Section 01 33 00 indicating:

.1 Materials list of items to be provided under this Section.

.2 Manufacturer's specifications and other data needed to ensure compliance with the specified requirements including but not limited to installation details and physical properties.

.3 Manufacturer's current recommended installation procedures.

.2 Shop drawings: Submit shop drawings in accordance with Section 01 33 00 indicating locations and extent of air/vapour barrier system including details for terminations flashings, penetrations, window and door openings and treatment of substrate joints and cracks.

.3 Certificates:

.1 Submit manufacturer's certification that air/vapour barrier system materials and accessories supplied are compatible, meet Specification requirements and that installer is licensed/approved by membrane manufacturer.

.2 Submit manufacturer's certification that air/vapour barrier components are approved for use as complete air/vapour barrier system.

.3 Submit inspection reports and certification by manufacturer confirming that installations are in accordance with manufacturer's requirements.

1.3 **QUALITY ASSURANCE**

.1 Qualifications: Perform Work of this Section by a company that has a minimum of five years proven experience in installations of a similar size and nature and that is approved by manufacturer.

.2 Mock-up:

.1 Construct one 10 m² mock-up of spray applied air/vapour barrier in location acceptable to Consultant.

.2 Demonstrate verify details, tie-ins and to demonstrate the required quality of materials and installation.

.3 Arrange for Consultant's review and acceptance, allow 48 hours after acceptance before proceeding with Work.

.4 Mock-up may remain as part of Work if accepted by Consultant. Remove and dispose of mock-ups which do not form part of Work.

.5 Upon acceptance, mock-up shall serve as a minimum standard of quality for the balance of the work of this Section.

- .3 Pre-installation meetings:
 - .1 Minimum 48 hours in advance of installation, arrange a meeting with manufacturer's representative, Consultant and all Subtrades affected by the work of this Section. Agenda should include but not be limited to the following:
 - .2 Review of submittals
 - .3 Review of surface preparation, minimum curing period and installation procedures
 - .4 Review of special details and flashings.
 - .5 Sequence of construction, responsibilities and schedule for subsequent operations.
 - .6 Review of inspection, testing, protection and repair procedures.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver materials to job site in manufacturer's unopened containers with all labels intact and legible at time of use..
- .2 Maintain the products in accord with manufacturer's recommendations with proper precautions to ensure fitness of material when installed.
- .3 Comply with pertinent provisions of Section 01 60 00.

1.5 SITE CONDITIONS

- .1 Maintain air and substrate temperature at air/vapour barrier installation area above -4 degrees Celsius (25 degrees Fahrenheit) for 24 h before, during and 24 hrs after installation.
- .2 Do not apply air/vapour barrier in wet weather.

2 Products

2.1 MATERIALS

- .1 All materials under Work of this Section, including but not limited to, sealants and primers are to have low VOC content limits.
- .2 Spray applied air/vapour barrier: One component, water-based coating, 100% silicone elastomeric air and weather-barrier. No primer required. 'Defendair 200' by Dow Corning or 'Air-shield LMP' by WR Meadows.
- .3 Joint Treatment:
 - .1 Joint Tape: Self-adhered fiberglass mesh tape as recommended by weather barrier manufacturer.
 - .2 Joint Compound: Fluid-applied, vapour permeable, elastomeric flashing material; trowel applied.

- .4 Flashing: Vapour permeable fluid-applied elastomeric flashing.
- .5 Sealant: Elastomeric; non-vapor permeable sealant; compatible with weather barrier

3 Execution

3.1 EXAMINATION

- .1 Verify condition of previously installed Work upon which this Section depends. Verify conformance with manufacturer's requirements. Report defects to Consultant. Commencement of Work means acceptance of existing conditions.
- .2 New concrete should be cured for a minimum of 14 days and must be dry before membrane installation.
- .3 Verify that existing substrates to receive air/vapour barrier are clean, dry, sound, smooth, continuous, sound and free of voids, spalled areas, loose aggregate, and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Use repair materials and methods that are acceptable to membrane manufacture.
- .4 Coordinate sealing of interruptions in, and protrusions through air/vapour barrier. Verify that other Work items projecting through air/vapour barrier are in place and are securely installed.

3.2 SUBSTRATE PREPARATION AND PROTECTION

- .1 Verify substrate surfaces are solid, free from surface water, frozen matter, dust, oil, grease, scaling or laitance, projections and foreign matter detrimental to the adhesion of the hot rubberized asphalt.
- .2 Clean all deck surfaces to receive membrane system in accord with manufacturer's instructions; vacuum clean or blow clean with oil-free compressed air all surfaces to receive air/vapour barrier membrane and accessories. Protect adjacent surfaces not being waterproofed.
- .3 Rout, clean, prepare and detail surface cracks form tie holes, honeycombed areas, and other voids and holes which may impair performance of air/vapour barrier membrane in accord with manufacturer's instructions; install backer rod where required.
- .4 Clean metal surfaces to bright metal by wire brushing or mechanical etching; scuff-sand lead flashing and plastic surfaces.
- .5 Install detail cants, detail coats, joint and crack treatments, and liquid flashings in accord with manufacturer's instructions.
- .6 Allow detail applications to cure in accord with manufacturer's instructions prior to general application of membrane.

- .7 Joints between panels of exterior grade gypsum, plywood and other panel type substrates shall be sealed prior to the application of membrane.
- .8 Prime surfaces in accord with manufacturer's instructions. Apply primer to all areas to receive transition membrane.
- .9 Supply and install temporary protection to adjacent surfaces to prevent damage resulting from Work of this Section.

3.3 APPLICATION

- .1 Apply air/vapour barrier in accordance with reviewed shop drawings and manufacturer's written instructions in locations indicated.
- .2 Grid surfaces to assure proper coverage rates and verify membrane wet-film mil thickness with gauges as work progresses.
- .3 Apply membrane in uniform passes by spray to recommended wet film thickness unless more stringent requirements are indicated in submitted data.
- .4 Extend air/vapour barrier as required to connect to other components of Work comprising air/vapour barrier system.
- .5 Ensure complete coverage to substrate, around flashings and protrusions and at changes in direction of surface. Re-spray thin spots and voids to obtain proper thickness. Work material into any fluted rib forming indentations.
- .6 Seal around masonry reinforcing or ties and all penetrations with termination mastic.

3.4 FIELD QUALITY CONTROL

- .1 Do not cover or permit to be covered any portion of the membranes until they have had full cure of 48 hours and been inspected by the Consultant or by an inspection agency appointed by the Consultant.

3.5 PROTECTION AND CLEAN-UP

- .1 Promptly remove overspray of membrane system material from adjacent surfaces with cleaner approved by membrane manufacturer. Leave work area in broom clean condition.
- .2 Prohibit traffic over completed work and protect against work overhead until protection course is installed.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Design, labour, Products, equipment and services necessary for metal siding and soffit Work in accordance with the Contract Documents.

1.2 REFERENCES

- .1 ANSI B18.6.4, Screws, Tapping and Metallic Drive, Inch Series, Thread Forming and Cutting.
- .2 ASTM A653/A653M, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.
- .3 ASTM C920, Specification for Elastomeric Joint Sealants.
- .4 CAN/CGSB-1.40-M, Primer, Structural Steel, Oil Alkyd Type.
- .5 CAN/CSA-G40.20/G40.21M, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels.
- .6 CSA S136, Cold Formed Steel Structural Members.
- .7 CSA S136.1, Commentary on CAN/CSA S136-M, Cold Formed Steel Structural Members.

1.3 DESIGN REQUIREMENTS

- .1 Design metal siding and soffit system in accordance with CSA S136, S136.1, and to withstand live, dead, lateral, wind, seismic, handling, transportation, and erection loads.
- .2 Design metal siding and soffit system in accordance with following Climatic Design Data for Peterborough contained in Ontario Building Code.
 - .1 Design Temperature: January 1%, July 2 ½%.
 - .2 Wind (Hourly Wind Pressures): 1 in 50 year occurrence.
 - .3 Earthquake: Seismic Data as listed.
- .3 Design metal siding and soffit system to limit deflection under design loads, to L/240.
- .4 Design metal siding and soffit system to prevent restriction of thermal induced movement which would induce deformation such as warping, buckling, and failure of joint seals and fasteners. Design metal siding and soffit system to prevent vibration when subject to the effects of wind.
- .5 Design miscellaneous, additional structural framing members and sag rods, required to complete metal siding and soffit system, where not indicated on Contract Drawings.

1.4 SUBMITTALS

- .1 Product data:
 - .1 Submit copies of manufacturer's Product data in accordance with Section 01300 indicating:
 - .1 Performance criteria, compliance with appropriate reference standard, characteristics, limitations.
 - .2 Product transportation, storage, handling and installation requirements.
 - .2 Shop drawings: Submit shop drawings indicating dimensions, profiles, Products, wall elevations, details, arrangements of sheets and joints, thicknesses, dimensions, locations of supports and fasteners and special shapes in accordance with Section 01300.
 - .3 Samples: Submit samples 600 x 600 mm samples of siding and soffit system showing fully assembled components including but not limited to face sheets, sub-girts, and concealed sealant. Sample to be fabricated using exact colour and gauges specified in accordance with Section 01300.
 - .4 Reports: Submit written field inspection and test report results after each inspection.

1.5 QUALITY ASSURANCE

- .1 Retain a licensed Professional Engineer, registered in Province of Ontario, to perform following services for metal siding and soffit Work:
 - .1 Design of metal siding and soffit Work.
 - .2 Review, stamp, and sign shop drawings.
 - .3 Conduct shop and field inspections and prepare and submit inspection reports.
- .2 Mock-up:
 - .1 Fabricate, deliver, and erect one full scale 1200 mm wide x 1800 mm high mock-up panel of metal siding and soffit construction, in location acceptable to Consultant.
 - .2 Demonstrate finish, colours, and quality of workmanship.
 - .3 Mock-up may form part of final Work, if acceptable to Consultant. Remove and dispose of mock-ups which do not form part of Work.
- .3 Pre-installation meeting: Arrange with manufacturer's representative, Contractor, and Consultant to inspect substrates, and to review installation procedures 48 hours in advance of installation.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Stockpile panels tilted to provide water run-off, free from ground contact on firm, level, non-staining supports extending full width of sheet and spaced not more than 450 mm apart. Cover components with opaque polyethylene sheet. Vent to allow air movement.

1.7 EXTENDED WARRANTY

- .1 Submit warranty for metal siding and soffit Work in accordance with General Conditions, except that warranty period is extended to 3 years.
 - .1 Against warping, twisting, joint, finish failure and water penetration.
 - .2 Coverage: Complete replacement including affected adjacent parts.

2 Products

2.1 MATERIALS

- .1 Metal siding and soffit: ASTM A653/A653M, Z275 galvanized steel, 0.76 mm minimum base metal thickness.
Diamond Rib profile by VicWest Steel, 24 Ga, exposed fasteners.
Finish: WeatherX by Vicwest Steel. Types as follows:
 - .1 Type 1: Regent Grey '56082'
- .2 Structural shapes, plates, sag rods, and similar items: CAN/CSA-G40.20-G40.21-M, Grade 300W.
- .3 Hollow structural sections: CAN/CSA-G40.20/G40.21-M Grade 350W, Class H.
- .4 Z girts and C channels: CAN/CSA S136-M; Minimum 1.2 mm thick, Z275 galvanized. Depth as indicated on Contract Drawings.
- .5 Fascia, trim, closures, and flashings: Material, finish, colour, and fasteners to match siding and soffit material, 0.76 mm minimum base metal thickness minimum.
- .6 Screw fasteners: ANSI B18.6.4, stainless steel Type 304. Exposed locations: With coloured nylon heads to match metal siding and soffit.
- .7 Primer paint: CAN/CGSB-1.40-M.
- .8 Isolation coating: Black bituminous coating, acid and alkali resistant material. '410-02' by Bakor Inc. or approved alternative.
- .9 Joint backing: Product as recommended by and soffit sealant manufacturer.
- .10 Siding and soffit sealant: ASTM C920, Type S, Grade NS; One-part, ultra-low modulus, moisture curing silicone sealant, 790 Silicone by Dow Corning or Spectrem 1 by Tremco Ltd. Colour: As selected by Consultant.
- .11 Thermal Separation: Continuous 3 mm thick x 38 mm wide self adhering cork.

3 Execution

3.1 **EXAMINATION**

- .1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of Work means acceptance of existing conditions.

3.2 **STRUCTURAL FRAMING**

- .1 Supply and install miscellaneous, additional structural framing members, required to complete metal siding and soffit system, where not indicated on Contract Drawings.

3.3 **GIRTS AND CHANNELS**

- .1 Notch Z girts and C channels as required to allow drainage of cavity.
- .2 Install Z girts, fastened into structural framing beneath. Orient Z girts to drain water from cavity.
- .3 Install C channels to frame openings such as doors, windows, and louvre openings, and orient channel webs to form heads, jambs and sills of openings.

3.4 **FASCIA, TRIM, CLOSURES, AND FLASHINGS**

- .1 Install fascia and trim including inside and outside corners, flashing, edgings, cap strips, drips, under-sill trim, fillers, closure strips, starter strips, and window or door trim, carefully formed and profiled.

3.5 **METAL SIDING AND SOFFIT**

- .1 Install metal siding vertically and soffit in accordance with reviewed shop drawings and manufacturer's written instructions.
- .2 Install metal siding and soffit in one piece, full height, except as indicated otherwise.
- .3 Maintain joints in exterior siding and soffit, plumb, true to line, tight fitting, hairline joints.
- .4 Attach metal siding and soffit system components to prevent warping, buckling, and deformation induced by restriction of thermal induced movement.
- .5 Install corner pieces, closures, flashings, etc, where shown and where required. Provide formed steel closures around opening.
- .6 Bed flashings, closures, and corner pieces in sealant to provide a weathertight installation.

3.6 JOINT BACKING AND SEALANT

- .1 Prepare substrate surface and mask as recommended by sealant manufacturer.
- .2 Install joint backing and sealant at siding and soffit system joints and perimeter for weathertight installation. Tool sealant to concave profile.

3.7 TOUCH UP

- .1 Touch up marred surfaces with air dry formulation to match pre-finished siding and soffit if approved by Consultant, otherwise remove and replace damaged metal siding and soffit.
- .2 Clean and touch up marred galvanized surfaces after installation, with zinc rich primer.

END OF SECTION

SECTION 075500
MODIFIED BITUMINOUS MEMBRANE ROOFING

1 GENERAL

1.1 SECTION INCLUDES

1.1.1 Hot Applied 2-Ply Asphalt Roofing (StressPly). (2.9) (3.5)

1.1.2 Accessories. (2.19)

1.2 SCOPE OF WORK

1.2.1 Check deck for damage and report to owner's representative. Replace damaged decking as authorized. If surface corrosion is present treat with Rust-Go.

1.2.2 Install 0.5" densdeck prime mechanically fasten at a rate of one fastener per 2 sq. ft.

1.2.3 Install two plies type 4 organic felts in full moppings of type III asphalt at a rate of no less than 25 pounds per square.

1.2.4 Install 2 layers of 2.5" Atlas AC FOAMII Polyisocyanurate insulation (FM approved) (4' x 4' boards) in FM approved adhesive as per manufacturers installation recommendations.

1.2.5 Install 0.5" high density, asphalt coated fiberboard insulation (FM approved) (4' x 2' or 4'x4' boards) in full moppings of hot type III asphalt. Step all boards into place immediately after placement to ensure full adhesion. Tightly brace all seams to allow no gaps in insulation. All joints must be staggered and offset between layers of insulation.

1.2.6 Install a wood fibre cant in hot asphalt.

1.2.7 Envelope insulation with excess vapour retarder and hot asphalt at all perimeters and projections.

1.2.8 Install 1 ply stressbase 80 in hot asphalt (type III at EVT) at a rate of not less than 25 lbs per square per ply. Ensure full adhesion of each ply and good bleed out at all seams.

1.2.9 Install 1-ply of Stressply Max SBS modified membrane in hot asphalt (type III at EVT) at a rate of not less than 30 lbs per square per ply. Ensure full adhesion of each ply and good bleed out at all seams. Membrane is to extend to the top of the cant.

1.2.10 Install new membrane base flashings surrounding and within area with one ply of Versiply 40 perimeter and projection base flashing followed by one ply Stressply Max perimeter and projection flashing in hot asphalt. Ensure Versiply 40 extends 6-8" onto the field of the roof. Ensure Stressply Max extends a minimum of 8" – 9" onto the field of the roof. Cant strips to be used at all horizontal to vertical transitions. Flashings to extend 8" above cant, and 8" onto field. Flashings at perimeter to extend above and over top of raised edge or 8" above cant and finished with termination bar. Terminate top of flashings with termination bar and cover top seam of membrane with Garlaflex.

1.2.11 Butter all vertical seams Garlaflex/Garmesh/Garlaflex.

1.2.12 Install water cutoffs at tie-ins to existing roofs and nightly temporary cutoffs. Utilizing Flashing Bond, fill all flutes that run from an old roof section into a new roof section to prevent water traveling. Tie-in will require an overlap of 12" using 2 plies of No.15 felt and 24" using one ply of high performance modified bitumen.

- 1.2.13 All drains in this section to sit in an 4' x 4' sump. Use 2.0" Polyisocyanurate insulation followed by 0.5" fibreboard in the sump. Shave ISO insulation around sump to create a small taper.
- 1.2.14 Install new Garland Superdrains with u-flow drain inserts and spun aluminum cones.
- 1.2.15 Install new spun aluminum stack flashings and insulate.
- 1.2.16 Install new tall cones and insulate.
- 1.2.17 Where pitch pockets are required, solder all seams.
- 1.2.18 Topcoat with hot asphalt (type III at EVT) at a rate of not less than 60 lbs per square and immediately embed new pea gravel at a rate of not less than 500 lb. Per square to cover over all asphalt. All outside corners to have a double pour installed extending 10' in each direction.
- 1.2.19 Install new 24 gauge series 8000 pre-painted metal counter flashings on roof curbs, sleepers, caps, and perimeter. Metal to cover all exposed membrane down to the roof surface. Perimeter metal details will require a continuous starter strip secured 18" O.C.. Metal is to have s-locks and is to be secured by use of screws in the s-locks. There are not to be any fasteners through the metal into the cant. Do not fasten metal through face of flashing.
- 1.2.20 Install new wood blocking or paver stone on 2" extruded polystyrene insulation pad under any equipment sitting on roof membrane.
- 1.2.21 Install walk-treads at bottom of all downspouts from higher roofs draining onto lower roofs and at all access doors onto roof and at all roof top units where filters will be changed.
- 1.2.22 Fill all pitch pockets with Gar-Rock and Seal Tite and caulk all open metal seams.
- 1.2.23 Paint Gas-Lines with Rust-Go yellow.
- 1.2.24 Clean entire project of debris and remove all equipment.
- 1.2.25 Issue membrane manufacturer's 30 year No Dollar Limit, leak free, materials, workmanship, and labour warranty, non-prorated with no charge annual follow-up inspections.
- 1.2.26

1.3 RELATED SECTIONS

- 1.3.1 Section _____ - Roof Deck Substrate Preparation.
- 1.3.2 Section 05300 - Metal Roof Deck.
- 1.3.3 Section 06100 - Rough Carpentry.
- 1.3.4 Section 06114 - Wood Blocking and Curbing: Wood nailers and cant strips.
- 1.3.5 Section 07220 - Insulation Board: Insulation and fastening.
- 1.3.6 Section 07620 - Sheet Metal Flashing and Trim: Weather protection for base flashings.
- 1.3.7 Section 07710 - Manufactured Roof Specialties: Counter flashing gravel stops, and fascia.
- 1.3.8 Section 07724 - Roof Hatches: Frame and integral curb; Counter flashing.

- 1.3.9 Section 08620 - Unit Skylights: Skylight frame and integral curb and counter flashing.
- 1.3.10 Section 08630 - Metal-Framed Skylights: Skylight frame and integral curb and counter flashing.
- 1.3.11 Section 08950 - Translucent Wall and Roof Assemblies: Counter flashing
- 1.3.12 Section 08960 - Sloped Glazing Assemblies: Counter flashing.
- 1.3.13 Section 15120 - Piping Specialties: Roof Drains, Sumps.

1.4 REFERENCES

- 1.4.1 ASTM D 41 - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
- 1.4.2 ASTM D 312 - Standard Specification for Asphalt used in Roofing.
- 1.4.3 ASTM D 451 - Standard Test Method for Sieve Analysis of Granular Mineral Surfacing for Asphalt Roofing Products.
- 1.4.4 ASTM D 1970 - Specification for Sheet Materials, Self-Adhering Polymer Modified Bituminous, Used as Steep Roofing Underlayment for Ice Dam Protection.
- 1.4.5 ASTM D 1079 Standard Terminology Relating to Roofing, Waterproofing and Bituminous Materials.
- 1.4.6 ASTM D 1227 Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.
- 1.4.7 ASTM D 1863 Standard Specification for Mineral Aggregate Used as a Protective Coating for Roofing.
- 1.4.8 ASTM D 2178 Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing.
- 1.4.9 ASTM D 2824 Standard Specification for Aluminum-Pigmented Asphalt Roof Coating.
- 1.4.10 ASTM D 4586 Standard Specification for Asphalt Roof Cement, Asbestos-Free.
- 1.4.11 ASTM D 4601 Standard Specification for Asphalt Coated Glass Fiber Base Sheet Used in Roofing.
- 1.4.12 ASTM D 5147 Standard Test Method for Sampling and Testing Modified Bituminous Sheet Materials.
- 1.4.13 ASTM D 6162 Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements.
- 1.4.14 ASTM D 6163 Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements.
- 1.4.15 ASTM D 6164 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements.
- 1.4.16 ASTM D 6754 - Standard Specification for Ketone Ethylene Ester (KEE) Sheet Roofing.
- 1.4.17 ASTM D 6757 - Standard Specification for Underlayment Felt Containing Inorganic Fibers

Used in Steep-Slope Roofing.

- 1.4.18 ASTM E 108 - Standard Test Methods for Fire Test of Roof Coverings
- 1.4.19 Factory Mutual Research (FM): Roof Assembly Classifications.
- 1.4.20 National Roofing Contractors Association (NRCA): Roofing and Waterproofing Manual.
- 1.4.21 Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) - Architectural Sheet Metal Manual.
- 1.4.22 Underwriters Laboratories, Inc. (UL): Fire Hazard Classifications.
- 1.4.23 Warnock Hersey (WH): Fire Hazard Classifications.
- 1.4.24 ANSI-SPRI ES-1 Wind Design Standard for Edge Systems used with Low Slope Roofing Systems.
- 1.4.25 ASCE 7, Minimum Design Loads for Buildings and Other Structures
- 1.4.26 UL - Fire Resistance Directory.
- 1.4.27 FM Approvals - Roof Coverings and/or RoofNav assembly database.
- 1.4.28 FBC - Florida Building Code.
- 1.4.29 Miami-Dade Building Code Compliance - N.O.A. (Notice of Acceptance).
- 1.4.30 California Title 24 Energy Efficient Standards.

1.5 DESIGN / PERFORMANCE REQUIREMENTS

- 1.5.1 Perform work in accordance with all federal, provincial and municipal codes.
- 1.5.2 Exterior Fire Test Exposure: Roof system shall achieve a UL, FM or WH Class rating for roof slopes indicated on the Drawings as follows:
 - 1.5.2.1 Factory Mutual Class A Rating.
 - 1.5.2.2 Underwriters Laboratory Class A Rating.
 - 1.5.2.3 Warnock Hersey Class A Rating.
- 1.5.3 Design Requirements:
 - 1.5.3.1 Uniform Wind Uplift Load Capacity
 - 1.5.3.1.1 Installed roof system shall withstand negative (uplift) design wind loading pressures complying with the following criteria.
 - 1.5.3.1.1.1 Design Code: ASCE 7, Method 2 for Components and Cladding.
 - 1.5.3.1.1.2 Importance Category:
 - 1.5.3.1.1.2.1 III.
 - 1.5.3.1.1.3 Importance Factor of:
 - 1.5.3.1.1.3.1 1.15
 - 1.5.3.1.1.4 Wind Speed: 78 mph
 - 1.5.3.1.1.5 Ultimate Pullout Value: 320 pounds per each of the fastener
 - 1.5.3.1.1.6 Exposure Category:
 - 1.5.3.1.1.6.1 C.
 - 1.5.3.1.1.7 Design Roof Height: 22 feet.
 - 1.5.3.1.1.8 Minimum Building Width: 60 feet.
 - 1.5.3.1.1.9 Roof Pitch: 0.13 : 12.
 - 1.5.3.1.1.10 Roof Area Design Uplift Pressure:
 - 1.5.3.1.1.10.1 Zone 1 - Field of roof 31.5 psf

- 1.5.3.1.1.10.1 Zone 1' - Field of roof 20.3 psf
- 1.5.3.1.1.10.2 Zone 2 - Eaves, ridges, hips and rakes 39.9 psf
- 1.5.3.1.1.10.3 Zone 3 - Corners 52.5 psf
- 1.5.3.2 Snow Load: ___ psf.
- 1.5.3.3 Live Load: 20 psf, or not to exceed original building design.
- 1.5.3.4 Dead Load:
 - 1.5.3.4.1 Installation of new roofing materials shall not exceed the dead load capacity of the existing roof structure.

1.6 SUBMITTALS

- 1.6.1 Submit under provisions of Section 01300.
- 1.6.2 Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1.6.2.1 Preparation instructions and recommendations.
 - 1.6.2.2 Storage and handling requirements and recommendations.
 - 1.6.2.3 Installation instructions.
- 1.6.3 Design Pressure Calculations: Submit design pressure calculations for the roof area in accordance with ASCE 7 and local Building Code requirements. Include a roof system attachment analysis report, certifying the system's compliance with applicable wind load requirements before Work begins.
- 1.6.4 Recycled or Bio-Based Materials: Provide third party certification through UL Environment of roof System membranes containing recycled or bio based materials.
- 1.6.5 Verification Samples: For each modified bituminous membrane ply product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.
- 1.6.6 Manufacturer's Certificates: Provide to certify products meet or exceed specified requirements.
- 1.6.7 Test Reports: Submit test reports, prepared by an independent testing agency, for all modified bituminous sheet roofing, indicating compliance with ASTM D5147. Testing must be performed at 77 deg. F. Tests at 0 deg. F will not be considered.
- 1.6.8 Test Reports: Submit test reports, prepared by an independent testing agency, for all modified bituminous sheet roofing, indicating compliance with ASTM D5147.
- 1.6.9 Manufacturer's Fire Compliance Certificate: Certify that the roof system furnished is approved by Factory Mutual (FM), Underwriters Laboratories (UL), Warnock Hersey (WH) or approved third party testing facility in accordance with ASTM E108, Class A for external fire and meets local or nationally recognized building codes.
- 1.6.10 Closeout Submittals: Provide manufacturer's maintenance instructions that include recommendations for periodic inspection and maintenance of all completed roofing work. Provide product warranty executed by the manufacturer. Assist Owner in preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire and extended coverage insurance on roofing and associated work.

1.7 QUALITY ASSURANCE

- 1.7.1 Perform Work in accordance with NRCA Roofing and Waterproofing Manual.
- 1.7.2 Manufacturer Qualifications: Company specializing in manufacturing products specified with documented ISO 9001 certification and minimum of twelve years of documented experience and must not have been in Chapter 11 bankruptcy during the last 30 years.

- 1.7.3 Installer Qualifications: Company specializing in performing Work of this section with minimum five years documented experience and a certified Pre-Approved Garland Contractor.
 - 1.7.4 Installer's Field Supervision: Maintain a full-time Supervisor/Foreman on job site during all phases of roofing work while roofing work is in progress.
 - 1.7.5 Product Certification: Provide manufacturer's certification that materials are manufactured in North America and conform to requirements specified herein, are chemically and physically compatible with each other, and are suitable for inclusion within the total roof system specified herein.
 - 1.7.6 Source Limitations: Obtain all components of roof system from a single manufacturer. Secondary products that are required shall be recommended and approved in writing by the roofing system Manufacturer. Upon request of the Architect or Owner, submit Manufacturer's written approval of secondary components in list form, signed by an authorized agent of the Manufacturer.
- 1.8 PRE-INSTALLATION MEETINGS
- 1.8.1 Convene minimum two weeks prior to commencing Work of this section.
 - 1.8.2 Review installation procedures and coordination required with related Work.
 - 1.8.3 Inspect and make notes of job conditions prior to installation:
 - 1.8.3.1 Record minutes of the conference and provide copies to all parties present.
 - 1.8.3.2 Identify all outstanding issues in writing designating the responsible party for follow-up action and the timetable for completion.
 - 1.8.3.3 Installation of roofing system shall not begin until all outstanding issues are resolved to the satisfaction of the Architect.
- 1.9 DELIVERY, STORAGE, AND HANDLING
- 1.9.1 Deliver and store products in manufacturer's unopened packaging with labels intact until ready for installation.
 - 1.9.2 Store all roofing materials in a dry place, on pallets or raised platforms, out of direct exposure to the elements until time of application. Store materials at least 4 inches above ground level and covered with "breathable" tarpaulins.
 - 1.9.3 Stored in accordance with the instructions of the manufacturer prior to their application or installation. Store roll goods on end on a clean flat surface except store KEE-Stone FB 60 rolls flat on a clean flat surface. No wet or damaged materials will be used in the application.
 - 1.9.4 Store at room temperature wherever possible, until immediately prior to installing the roll. During winter, store materials in a heated location with a 50 degree F (10 degree C) minimum temperature, removed only as needed for immediate use. Keep materials away from open flame or welding sparks.
 - 1.9.5 Avoid stockpiling of materials on roofs without first obtaining acceptance from the Architect/Engineer.
 - 1.9.6 Adhesive storage shall be between the range of above 50 degree F (10 degree C) and below 80 degree F (27 degree C). Area of storage shall be constructed for flammable storage.
- 1.10 COORDINATION

1.10.1 Coordinate Work with installing associated metal flashings as work of this section proceeds.

1.11 PROJECT CONDITIONS

1.11.1 Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.12 WARRANTY

1.12.1 Upon completion of the work, provide the Manufacturer's written and signed NDL Warranty, warranting that, if a leak develops in the roof during the term of this warranty, due either to defective material or defective workmanship by the installing contractor, the manufacturer shall provide the Owner, at the Manufacturer's expense, with the labor and material necessary to return the defective area to a watertight condition.

1.12.1.1 Warranty Period:

1.12.1.1.1 30 years from date of acceptance.

2 PRODUCTS

2.1 MANUFACTURERS

2.1.1 Acceptable Manufacturer: Garland Canada Inc. C/O Soren Vaerum: Cell: 705-321=0127 vaerum@garlandcanada.com

2.1.2 The Products specified are intended and the Standard of Quality for the products required for this project. If other products are proposed the bidder must disclose in the bid the manufacturer and the products that they intend to use on the Project. If no manufacturer and products are listed, the bid may be accepted only with the use of products specified.

2.1.2.1 Bidder will not be allowed to change materials after the bid opening date.

2.1.2.2 If alternate products are included in the bid, the products must be equal to or exceed the products specified. Supporting technical data shall be submitted to the Architect/ Owner for approval prior to acceptance.

2.1.2.3 In making a request for substitution, the Bidder/Roofing Contractor represents that it has:

2.1.2.3.1 Personally investigated the proposed product or method, and determined that it is equal or superior in all respects to that specified.

2.1.2.3.2 Will provide the same guarantee for substitution as for the product and method specified.

2.1.2.3.3 Will coordinate installation of accepted substitution in work, making such changes as may be required for work to be completed in all respects.

2.1.2.3.4 Will waive all claims for additional cost related to substitution, which consequently become apparent.

2.1.2.3.5 Cost data is complete and includes all related cost under his/her contract or other contracts, which may be affected by the substitution.

2.1.2.3.6 Will reimburse the Owner for all redesign cost by the Architect for accommodation of the substitution.

2.1.2.4 Architect/ Owner reserves the right to be the final authority on the acceptance or rejection of any or all bids, proposed alternate roofing systems or materials that has met ALL specified requirement criteria.

2.1.2.5 Failure to submit substitution package, or any portion thereof requested, will result in immediate disqualification and consideration for that particular contractors request for manufacturer substitution.

2.2 HOT APPLIED 2-PLY ASPHALT ROOFING - STRESSPLY, OPTIMAX, OR VERSIPLY

- 2.2.1 Base (Ply) Sheet: One ply bonded to the prepared substrate with Interply Adhesive:
 - 2.2.1.1 StressBase 80:
 - 2.2.2 Modified Cap (Ply) Sheet: One ply bonded to the prepared substrate with Interply Adhesive.
 - 2.2.2.1 StressPly Max:
 - 2.2.3 Interply Adhesive: (1 and 2)
 - 2.2.3.1 Generic Type III Asphalt:
 - 2.2.4 Flashing Base Ply: One ply bonded to the prepared substrate with Interply Adhesive: except torch sheet.
 - 2.2.4.1 VersiPly 40:
 - 2.2.5 Flashing Cap (Ply) Sheet: One ply bonded to the prepared substrate with Interply Adhesive: except torch sheet.
 - 2.2.5.1 StressPly Max:
 - 2.2.6 Surfacing:
 - 2.2.6.1 Aggregate/Flood Coat
 - 2.2.6.1.1 Generic Type III Asphalt:
 - 2.2.6.2 Surface Coatings
 - 2.2.6.2.1 Silver-Shield:
- 2.3 ACCESSORIES:
- 2.3.1 Roof Insulation: Provide G-P Gypsum DenDeck Prime, G-P Gypsum DenDeck DuraGuard, USG Securock for proper adhesion of the self-adhered base sheet in accordance with Section 07220.
 - 2.3.2 Vapor Retarder: HPR Glasfelts, inorganic asphalt impregnated felts conforming to ASTM D 2178, Type IV. Install two fiberglass ply sheets in 25 lbs. (11.3kg) per square of bitumen, shingled uniformly to achieve two plies over the entire prepared substrate. Shingle in direction of slope of roof to shed water on each area of roof.
 - 2.3.2.1 Tensile Strength, ASTM D 2178
 - 2.3.2.1.1 MD 44 lbf/in (7.7 kN/m) XD 44 lbf/in (7.7 kN/m)
 - 2.3.3 Nails and Fasteners: Non-ferrous metal or galvanized steel, except that hard copper nails shall be used with copper; aluminum or stainless steel nails shall be used with aluminum; and stainless steel nails shall be used with stainless steel, Fasteners shall be self-clinching type of penetrating type as recommended by the deck manufacturer. Fasten nails and fasteners flush-driven through flat metal discs not less than 1 inch (25 mm) diameter. Omit metal discs when one-piece composite nails or fasteners with heads not less than 1 inch (25 mm) diameter are used.
 - 2.3.4 Urethane Sealant Hybrid - Tuff-Stuff MS: One part, non-sag sealant as approved and furnished by the membrane manufacturer for moving joints.
 - 2.3.4.1 Tensile Strength, ASTM D 412: 250 psi
 - 2.3.4.2 Elongation, ASTM D 412: 450%
 - 2.3.4.3 Hardness, Shore A ASTM C 920: 35
 - 2.3.4.4 Adhesion-in-Peel, ASTM C 92: 30 pli
 - 2.3.5 Non-Shrink Grout GarRock: All weather fast setting chemical action concrete material to fill pitch pans.
 - 2.3.5.1 Flexural Strength, ASTM C 78: (modified) 7 days 1100psi
 - 2.3.5.2 High Strength, ASTM C 109: (modified) 24 days 8400lbs (3810kg)
 - 2.3.6 Pitch Pocket Sealer - Seal-Tite: Two part, 100% solids, self-leveling, polyurethane sealant

for filling pitch pans as recommended and furnished by the membrane manufacturer.

- 2.3.6.1 Durometer, ASTM D 2240: 40-50 Shore
- 2.3.6.2 Elongation, ASTM D 412: 250%
- 2.3.6.3 Tensile Strength, ASTM D 412: 200 @ 100 mil

3 EXECUTION

3.1 EXAMINATION

- 3.1.1 Do not begin installation until substrates have been properly prepared.
- 3.1.2 Inspect and approve the deck condition, slopes and fastener backing if applicable, parapet walls, expansion joints, roof drains, stack vents, vent outlets, nailers and surfaces and elements.
- 3.1.3 Verify that work penetrating the roof deck, or which may otherwise affect the roofing, has been properly completed.
- 3.1.4 If substrate preparation and other conditions are the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- 3.2.1 General: Clean surfaces thoroughly prior to installation.
 - 3.2.1.1 Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
 - 3.2.1.2 Fill substrate surface voids that are greater than 1/4 inch wide with an acceptable fill material.
 - 3.2.1.3 Roof surface to receive roofing system shall be smooth, clean, free from loose gravel, dirt and debris, dry and structurally sound.
 - 3.2.1.4 Wherever necessary, all surfaces to receive roofing materials shall be power broom and vacuumed to remove debris and loose matter prior to starting work.
 - 3.2.1.5 Do not apply roofing during inclement weather. Do not apply roofing membrane to damp, frozen, dirty, or dusty surfaces.
 - 3.2.1.6 Fasteners and plates for fastening components mechanically to the substrate shall provide a minimum pull-out capacity of 300 lbs. (136 k) per fastener. Base or ply sheets attached with cap nails require a minimum pullout capacity of 40 lb. per nail.
 - 3.2.1.7 Prime decks where required, in accordance with requirements and recommendations of the primer and deck manufacturer.
- 3.2.2 Metal Deck: Metal deck shall be installed as specified in Section
 - 3.2.2.1 Fastening of the deck should comply with the anticipated live and dead loads pertaining to the building as well as applicable Code.
 - 3.2.2.2 Steel decks shall be minimum 22-gauge factory galvanized or zinc alloy coated for protection against corrosion.
 - 3.2.2.3 Suitable insulation shall be mechanically attached as recommended by the insulation manufacturer.
 - 3.2.2.4 Decks shall comply with the gauge and span requirements in the current Factory Mutual FM Approval Guide and be installed in accordance with Loss Prevention Data Sheet 1-28 or specific FM approval.
 - 3.2.2.5 When re-roofing over steel decks, surface corrosion shall be removed, and repairs to severely corroded areas made. Loose or inadequately secured decking shall be fastened, and irreparable or otherwise defective decking shall be replaced.

3.3 INSTALLATION - GENERAL

- 3.3.1 Install modified bitumen membranes and flashings in accordance with manufacturer's instructions and with the recommendations provided by the National Roofing Contractors Association's Roofing & Waterproofing Manual, the Asphalt Roofing Manufacturers Association, and applicable codes.
- 3.3.2 General: Avoid installation of modified bitumen membranes at temperatures lower than 40-45 degrees F. When work at such temperatures unavoidable use the following precautions:
 - 3.3.2.1 Take extra care during cold weather installation and when ambient temperatures are affected by wind or humidity, to ensure adequate bonding is achieved between the surfaces to be joined. Use extra care at material seam welds and where adhesion of the applied product to the appropriately prepared substrate as the substrate can be affected by such temperature constraints as well.
 - 3.3.2.2 Unrolling of cold materials, under low ambient conditions must be avoided to prevent the likelihood of unnecessary stress cracking. Rolls must be at least 40 degrees F at the time of application. If the membrane roll becomes stiff or difficult to install, it must be replaced with roll from a heated storage area.
- 3.3.3 Commence installation of the roofing system at the lowest point of the roof (or roof area), working up the slope toward the highest point. Lap sheets shingle fashion so as to constantly shed water
- 3.3.4 All slopes greater than 2:12 require back-nailing to prevent slippage of the ply sheets. Use ring or spiral-shank 1 inch cap nails, or screws and plates at a rate of 1 fastener per ply (including the membrane) at each insulation stop. Place insulation stops at 16 ft o.c. for slopes less than 3:12 and 4 feet o.c. for slopes greater than 3:12. On non-insulated systems, nail each ply directly into the deck at the rate specified above. When slope exceeds 2:12, install all plies parallel to the slope (strapping) to facilitate backnailing. Install 4 additional fasteners at the upper edge of the membrane when strapping the plies.

3.4 INSTALLATION HOT APPLIED ROOF SYSTEM

- 3.4.1 Base/Felt Ply(s): Install base sheet or felt plies in twenty five (25) lbs (11.3kg) per square of bitumen shingled uniformly to achieve one or more plies over the entire prepared substrate. Shingle in direction of slope of roof to shed water on each area of roof. Do not step on base rolls until asphalt has cooled, fish mouths should be cut and patched.
 - 3.4.1.1 Lap ply sheet ends 8 inches (203 mm). Stagger end laps 2 inches (304mm) minimum.
 - 3.4.1.2 Install base flashing ply to all perimeter and projection details after membrane application.
 - 3.4.1.3 Extend plies 2 inches beyond top edges of cants at wall and projection bases.
 - 3.4.1.4 Install base flashing ply to all perimeter and projection details.
 - 3.4.1.5 Allow the one ply of base sheet to cure at least 30 minutes before installing the modified membrane. However, the modified membrane must be installed the same day as the base plies.
- 3.4.2 Modified Cap Ply(s): Solidly bond the modified membrane to the base layers with specified material at the rate of 25 to thirty 30 lbs. (11-13kg) per 100 square feet.
 - 3.4.2.1 Roll must push a puddle of hot material in front of it with material slightly visible at all side laps. Use care to eliminate air entrapment under the membrane. Exercise care during application to eliminate air entrapment under the membrane.
 - 3.4.2.2 Apply pressure to all seams to ensure that the laps are solidly bonded to substrate.
 - 3.4.2.3 Install subsequent rolls of modified membrane as above with a minimum of 4 inch (101 mm) side laps and 8 inch (203 mm) end laps. Stagger end laps. Apply membrane in the same direction as the previous layers but stagger the laps so they do not coincide with the laps of the base layers.

- 3.4.2.4 Apply hot material no more than 5 feet (1.5 m) ahead of each roll being embedded.
- 3.4.2.5 Extend membrane 2 inches (50 mm) beyond top edge of all cants in full moppings of the specified hot material.
- 3.4.3 Fibrous Cant Strips: Provide non-combustible perlite or glass fiber cant strips at all wall/curb detail treatments where angle changes are greater than 45 degrees. Cant may be set in approved cold adhesives, hot asphalt or mechanically attached with approved plates and fasteners.
- 3.4.4 Wood Blocking, Nailers and Cant Strips: Provide wood blocking, nailers and cant strips as specified in Section 06114.
 - 3.4.4.1 Provide nailers at all roof perimeters and penetrations for fastening membrane flashings and sheet metal components.
 - 3.4.4.2 Wood nailers should match the height of any insulation, providing a smooth and even transition between flashing and insulation areas.
 - 3.4.4.3 Nailer lengths should be spaced with a minimum 1/8 inch gap for expansion and contraction between each length or change of direction.
 - 3.4.4.4 Nailers and flashings should be fastened in accordance with Factory Mutual "Loss Prevention Data Sheet 1- 49, Perimeter Flashing" and be designed to be capable of resisting a minimum force of 200 lbs/lineal foot in any direction.
- 3.4.5 Metal Work: Provide metal flashings, counter flashings, parapet coping caps and thru-wall flashings as specified in Section 07620 or Section 07710. Install in accordance with the SMACNA "Architectural Sheet Metal Manual" or the NRCA Roofing Waterproofing manual.
- 3.4.6 Termination Bar: Provide a metal termination bar or approved top edge securement at the terminus of all flashing sheets at walls and curbs. Fasten the bar a minimum of 8 inches (203 mm) o/c to achieve constant compression. Provide suitable, sealant at the top edge if required.
- 3.4.7 Flashing Base Ply: Install flashing sheets by the same application method used for the base ply.
 - 3.4.7.1 Seal curb, wall and parapet flashings with an application of mastic and mesh on a daily basis. Do not permit conditions to exist that will allow moisture to enter behind, around or under the roof or flashing membrane.
 - 3.4.7.2 Prepare all walls, penetrations, expansion joints and surfaces to be flashed with required primer at the rate of 100 square feet per gallon. Allow primer to dry tack free.
 - 3.4.7.3 Adhere to the underlying base flashing ply with specified hot material unless otherwise noted in these specifications. Nail off at a minimum of 8 inches (203 mm) o.c. from the finished roof at all vertical surfaces.
 - 3.4.7.4 Solidly adhere the entire sheet of flashing membrane to the substrate.
 - 3.4.7.5 Seal all vertical laps of flashing membrane with a three-course application of trowel-grade mastic and mesh.
 - 3.4.7.6 Coordinate counter flashing, cap flashings, expansion joints, and similar work with modified bitumen roofing work as specified.
 - 3.4.7.7 Coordinate roof accessories, miscellaneous sheet metal accessory items, including piping vents and other devices with the roofing system work.
- 3.4.8 Flood Coat/Aggregate:
 - 3.4.8.1 Install after cap sheets and modified flashing, tests, repairs and corrective actions have been completed and approved.
 - 3.4.8.2 Apply flood coat materials in the quantities recommended by the manufacturer.
 - 3.4.8.3 Uniformly embed aggregate in the flood coat of cold adhesive at a rate recommended by the manufacturer.
 - 3.4.8.4 Aggregate must be dry and placed in a manner required to form a compact,

embedded overlay. To aid in embedment, lightly roll aggregate.

- 3.4.9 Flashing Cap Ply: Install flashing cap sheets by the same application method used for the cap ply.
 - 3.4.9.1 Seal curb, wall and parapet flashings with an application of mastic and mesh on a daily basis. Do not permit conditions to exist that will allow moisture to enter behind, around or under the roof or flashing membrane.
 - 3.4.9.2 Prepare all walls, penetrations, expansion joints and where shown on the Drawings to be flashed with required primer at the rate of 100 square feet per gallon. Allow primer to dry tack free.
 - 3.4.9.3 Adhere to the underlying base flashing ply with specified flashing ply adhesive unless otherwise specified. Nail off at a minimum of 8 inches (203 mm) o.c. from the finished roof at all vertical surfaces.
 - 3.4.9.4 Coordinate counter flashing, cap flashings, expansion joints and similar work with modified bitumen roofing work as specified.
 - 3.4.9.5 Coordinate roof accessories, miscellaneous sheet metal accessory items with the roofing system work.
 - 3.4.9.6 All stripping shall be installed prior to flashing cap sheet installation.
 - 3.4.9.7 Heat and scrape granules when welding or adhering at cut areas and seams to granular surfaces at all flashings.
 - 3.4.9.8 Secure the top edge of the flashing sheet using a termination bar only when the wall surface above is waterproofed, or nailed 4 inches on center and covered with an acceptable counter flashing.
- 3.4.10 Surface Coatings: Apply roof coatings in strict conformance with the manufacturer's recommended procedures.
- 3.4.11 Roof Walkways: Provide walkways in areas indicated on the Drawings.

3.5 CLEANING

- 3.5.1 Clean-up and remove daily from the site all wrappings, empty containers, paper, loose particles and other debris resulting from these operations.
- 3.5.2 Remove asphalt markings from finished surfaces.
- 3.5.3 Repair or replace defaced or disfigured finishes caused by Work of this section.

3.6 PROTECTION

- 3.6.1 Provide traffic ways, erect barriers, fences, guards, rails, enclosures, chutes and the like to protect personnel, roofs and structures, vehicles and utilities.
- 3.6.2 Protect exposed surfaces of finished walls with tarps to prevent damage.
- 3.6.3 Plywood for traffic ways required for material movement over existing roofs shall be not less than 5/8 inch (16 mm) thick.
- 3.6.4 In addition to the plywood listed above, an underlayment of minimum 1/2 inch (13 mm) recover board is required on new roofing.
- 3.6.5 Special permission shall be obtained from the Manufacturer before any traffic shall be permitted over new roofing.

3.7 FIELD QUALITY CONTROL

- 3.7.1 Inspection: Provide manufacturer's field observations daily. Provide a final inspection upon completion of the Work.

- 3.7.1.1 Warranty shall be issued upon manufacturer's acceptance of the installation.
- 3.7.1.2 Field observations shall be performed by a Representative employed full-time by the manufacturer and whose primary job description is to assist, inspect and approve membrane installations for the manufacturer.
- 3.7.1.3 Provide observation reports from the Representative indicating procedures followed, weather conditions and any discrepancies found during inspection.
- 3.7.1.4 Provide a final report from the Representative, certifying that the roofing system has been satisfactorily installed according to the project specifications, approved details and good general roofing practice.

3.8 SCHEDULES

3.8.1 Base (Ply) Sheet:

- 3.8.1.1 StressBase 80: 80 mil SBS (Styrene-Butadiene-Styrene) rubber modified roofing base sheet reinforced with a fiberglass scrim, performance requirements according to ASTM D 5147.
 - 3.8.1.1.1 Tensile Strength, ASTM D 5147
 - 3.8.1.1.1.1 2 in/min. @ 0 +/- 3.6 deg. F MD 100 lbf/in XD 100 lbf/in
 - 3.8.1.1.1.2 50mm/min. @ -17.78 +/- 2 deg. C MD 17.5 kN/m XD 17.5 kN/m
 - 3.8.1.1.2 Tear Strength, ASTM D 5147
 - 3.8.1.1.2.1 2 in/min. @ 73.4 +/- 3.6 deg. F MD 110 lbf XD 100 lbf
 - 3.8.1.1.2.2 50mm/min. @ 23 +/- 2 deg. C MD 489 N XD 444 N
 - 3.8.1.1.3 Elongation at Maximum Tensile, ASTM D 5147
 - 3.8.1.1.3.1 2 in/min. @ 0 +/- 3.6 deg. F MD 4 % XD 4 %
 - 3.8.1.1.3.2 50mm/min @ -17.78 +/- 2 deg. C MD 4 % XD 4 %
 - 3.8.1.1.4 Low Temperature Flexibility, ASTM D 5147, Passes -40 deg. F (-40 deg. C)

3.8.2 Thermoplastic/Modified Cap (Ply) Sheet:

- 3.8.2.1 StressPly Max: 145 mil SBS and SIS (Styrene-Butadiene-Styrene and Styrene-Isoprene-Styrene) rubber modified membrane incorporating post-consumer recycled rubber and reinforced with a fiberglass and polyester composite scrim. ASTM D 6162, Type III Grade G
 - 3.8.2.1.1 Tensile Strength, ASTM D 5147
 - 3.8.2.1.1.1 2 in/min. @ 73.4 +/- 3.6 deg. F MD 1,000 lbf/in XD 1,000 lbf/in
 - 3.8.2.1.1.2 50 mm/min. @ 23 +/- 2 deg. C MD 175 kN/m XD 175 kN/m
 - 3.8.2.1.2 Tear Strength, ASTM D 5147
 - 3.8.2.1.2.1 2 in/min. @ 73.4 +/- 3.6 deg. F MD 1,600 lbf XD 1,500 lbf
 - 3.8.2.1.2.2 50 mm/min. @ 23 +/- 2 deg. C MD 7,117.1 N XD 6,672.3 N
 - 3.8.2.1.3 Elongation at Maximum Tensile, ASTM D 5147
 - 3.8.2.1.3.1 2 in/min. @ 73.4 +/- 3.6 deg. F MD 16.0% XD 16.0%
 - 3.8.2.1.3.2 50 mm/min. @ 23 +/- 2 deg. C MD 16.0% XD 16.0%
 - 3.8.2.1.4 Low Temperature Flexibility, ASTM D 5147, Passes -40 deg. F (-40 deg. C)

3.8.3 Interply Adhesive:

- 3.8.3.1 Generic Type III Asphalt: Hot Bitumen, ASTM D 312, Type III steep asphalt having the following characteristics:
 - 3.8.3.1.1 Softening Point 185 deg. F - 205 deg. F
 - 3.8.3.1.2 Flash Point 500 deg. F
 - 3.8.3.1.3 Penetration @ 77 deg. F 15-35 units
 - 3.8.3.1.4 Ductility @ 77 deg. F 2.5 cm

3.8.4 Flashing Base Ply:

- 3.8.4.1 VersiPly 40: 40 mil SBS (Styrene-Butadiene-Styrene) rubber modified roofing base sheet with dual fiberglass reinforced scrim.
 - 3.8.4.1.1 Tensile Strength, ASTM D 5147

- 3.8.4.1.1.1 2 in/min. @ 73.4 +/- 3.6 deg. F MD 215 lbf/in XD 215 lbf/in
- 3.8.4.1.1.2 50 mm/min. @ 23 +/- 2 deg. C MD 37.5 kN/m XD 37.5 kN/m
- 3.8.4.1.2 Tear Strength, ASTM D 5147
 - 3.8.4.1.2.1 2 in/min. @ 73.4 +/- 3.6 deg. F MD 275 lbf XD 275 lbf
 - 3.8.4.1.2.2 50 mm/min. @ 23 +/- 2 deg. C MD 1223 N XD 1223 N
- 3.8.4.1.3 Elongation at Maximum Tensile, ASTM D 5147
 - 3.8.4.1.3.1 2 in/min. @ 73.4 +/- 3.6 deg. F MD 4.5% XD 4.5%
 - 3.8.4.1.3.2 50 mm/min. @ 23 +/- 2 deg. C MD 4.5% XD 4.5%
- 3.8.4.1.4 Low Temperature Flexibility, ASTM D 5147
 - 3.8.4.1.4.1 Passes -30 deg. F (-34 deg. C). Meets or Exceeds ASTM D 4601 Type II Performance Criteria.

3.8.5 Flashing Ply Adhesive:

- 3.8.5.1 Generic Type III Asphalt: Hot Bitumen, ASTM D 312, Type III steep asphalt having the following characteristics:
 - 3.8.5.1.1 Softening Point 185 deg. F - 205 deg. F
 - 3.8.5.1.2 Flash Point 500 deg. F
 - 3.8.5.1.3 Penetration @ 77 deg. F 15-35 units
 - 3.8.5.1.4 Ductility @ 77 deg. F 2.5 cm

3.8.6 Surfacing:

- 3.8.6.1 Flood Coat/Aggregate:
 - 3.8.6.1.1 Generic Type III Asphalt: Hot Bitumen, ASTM D 312, Type III steep asphalt having the following characteristics:
 - 3.8.6.1.1.1 Softening Point 185 deg. F - 205 deg. F
 - 3.8.6.1.1.2 Flash Point 500 deg. F
 - 3.8.6.1.1.3 Penetration @ 77 deg. F 15-35 units
 - 3.8.6.1.1.4 Ductility @ 77 deg. F 2.5 cm
 - 3.8.6.1.1.5 Roofing Aggregate: ASTM D 1863
 - 3.8.6.1.1.5.1 Pea gravel.
- 3.8.6.2 Flashing Cap (Ply) Sheet:
 - 3.8.6.2.1 StressPly Max: 145 mil SBS and SIS (Styrene-Butadiene-Styrene and Styrene-Isoprene-Styrene) rubber modified membrane incorporating post-consumer recycled rubber and reinforced with a fiberglass and polyester composite scrim. ASTM D 6162, Type III Grade G
 - 3.8.6.2.1.1 Tensile Strength, ASTM D 5147
 - 3.8.6.2.1.1.1 2 in/min. @ 73.4 +/- 3.6 deg. F MD 1,000 lbf/in XD 1,000 lbf/in
 - 3.8.6.2.1.1.2 50 mm/min. @ 23 +/- 2 deg. C MD 175 kN/m XD 175 kN/m
 - 3.8.6.2.1.2 Tear Strength, ASTM D 5147
 - 3.8.6.2.1.2.1 2 in/min. @ 73.4 +/- 3.6 deg. F MD 1,600 lbf XD 1,500 lbf
 - 3.8.6.2.1.2.2 50 mm/min. @ 23 +/- 2 deg. C MD 7,117.1 N XD 6,672.3 N
 - 3.8.6.2.1.3 Elongation at Maximum Tensile, ASTM D 5147
 - 3.8.6.2.1.3.1 2 in/min. @ 73.4 +/- 3.6 deg. F MD 16.0% XD 16.0%
 - 3.8.6.2.1.3.2 50 mm/min. @ 23 +/- 2 deg. C MD 16.0% XD 16.0%
 - 3.8.6.2.1.4 Low Temperature Flexibility, ASTM D 5147, Passes -40 deg. F (-40 deg. C)
- 3.8.6.3 Surface Coatings:
 - 3.8.6.3.1 Surfacing:
 - 3.8.6.3.1.1 Silver-Shield: ASTM D 2824 aluminum coating fibered aluminum roof coating fibered aluminum roof coating having the following characteristics:
 - 3.8.6.3.1.1.1 Flash Point 100 deg. F (38 deg. C) min.

- 3.8.6.3.1.1.2 Weight/Gallon 8.2 lbs./gal. (1.0 g/cm³)
- 3.8.6.3.1.1.3 Viscosity (75 deg. F) 100 - 125 K.U

END OF SECTION



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Preliminary Pressure Calculations

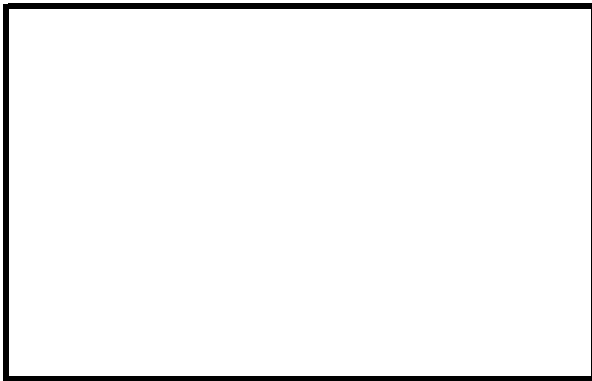
Date	11/18/2022
Sales Rep	Soren Vaerum
City	Orangeville
State	ON

Project Name	Orangeville Operations Centre Expansion
Roof Sections	New Construction

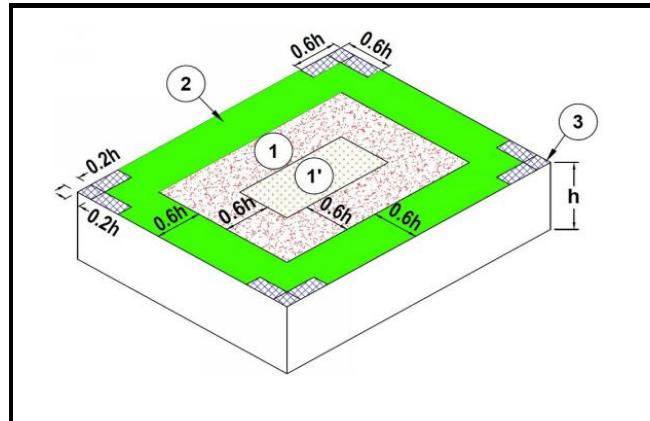
Design Code	FM 1-28	ASD	Base Velocity Pressure	14.0	psf	Gcpi = 0.55
Exposure Category	C		Roof Type	Gable		
Risk Cat. , Importance Factor	III , 1.15		Edge Zones			
Wind Speed	78	mph	Zone 2 width =	13'-3"		
Design Roof Height:	22		Zone 3 width =	4'-5"		
Minimum Building Width	60	ft	Zone 3 length =	13'-3"		
Roof Pitch (X, Y)	0.13	:		=		
Roof Angle	0.62	deg		=		
Parapet ≥ 36" Entire Roof	No			=		

Deck Type: Steel

Notes:



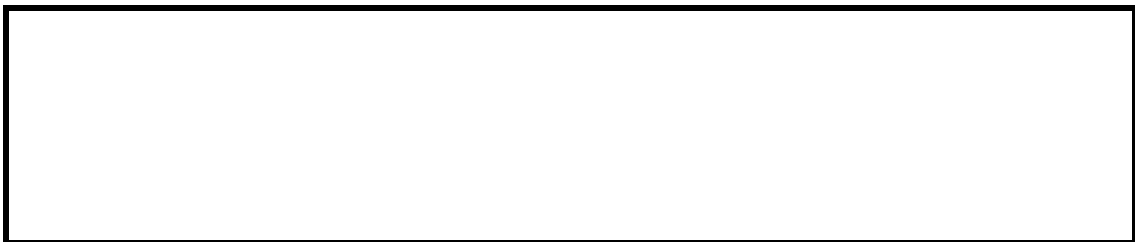
Zone Image



Zone Pressures (psf)

ZONE 1'	ZONE 1	ZONE 2	ZONE 3			Zone 4	Zone 5
20.3	31.5	39.9	52.5			20.8	24.6
FM 1-45	FM 1-75	FM 1-90	FM 1-120				

Notes:





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Coping

Date	11/18/2022
Sales Rep	Soren Vaerum
City	Orangeville
State	ON

Project Name	Orangeville Operations Centre Expansion
Roof Sections	New Construction

ANSI/SPRI ES-1 COPING PRELIMINARY DESIGN

Project Data

Design Wind Speed:	78	mph
Metal Edge Height:	23.67	feet
Exposure Category:	C	
Importance Classification:	III	

Design Wind Pressure **FM 1-28 ASD**

Basic Velocity Pressure:	14.27	psf
Horizontal Design Pressure:	25.04	psf
Vert. Design Pressure:	53.51	psf

ES-1 Tested Coping System

Product Designation: ES-C24-20-60-16

System Description: R-Mer Edge Snap on Coping 16" x 24 Ga w/ 20 GA Anchor Chairs at 60" o.c.

Maximum Tested Front Load:	46.9	psf
Max. Vertical Front Dim.:	6	inches
Maximum Tested Top Load:	100	psf
Max. Vertical Width:	16.00	inches
Maximum Tested Rear Load:	58.7	psf
Max. Vertical Rear Dim.:	4.00	inches



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Fascia

Date	11/18/2022
Sales Rep	Soren Vaerum
City	Orangeville
State	ON

Project Name	Orangeville Operations Centre Expansion
Roof Sections	New Construction

ANSI/SPRI ES-1 FASCIA PRELIMINARY DESIGN

Project Data

Design Wind Speed:	78	mph
Metal Edge Height:	23.67	feet
Exposure Category:	C	
Importance Classification:	III	

Design Wind Pressure **FM 1-28 ASD**

Basic Velocity Pressure:	14.27	psf
Horizontal Design Pressure:	25.04	psf

ES-1 Fascia Load

Vertical Face Dimension:	7.25	inches
Fascia Design Load:	41.82	psf

ES-1 Tested Fascia System

Product Designation: MEA-RMF-Fascia725-Z24

System Description: R-Mer Force Fascia 7.25" x 24 GA w/ RMEBF-700 Base Frame

Maximum Tested Load:	320	psf
Max. Vertical Face Dim.:	7.25	inches

- 1 General
- 1.1 **SECTION INCLUDES**
 - .1 Labour, Products, equipment and services necessary for flashing and sheet metal Work in accordance with the Contract Documents.
- 1.2 **REFERENCES**
 - .1 ASTM A653/A653M, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.
 - .2 ASTM C920, Specification for Elastomeric Joint Sealants.
 - .3 CRCA Roofing Manual, Canadian Roofing Contractors Association.
- 1.3 **SUBMITTALS**
 - .1 Shop drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 indicating:
 - .1 Proposed method of shaping, forming, jointing.
 - .2 Fastening, and application of flashing and sheet metal Work.
 - .2 Samples:
 - .1 Submit following samples in accordance with Section 01 33 00:
 - .1 50 x 50 mm samples of sheet metal material, colour and finish.
 - .2 Representative sample section of prepainted metal flashing illustrating S locking jointing method, minimum 600 mm long..
- 2 Products
- 2.1 **MATERIALS**
 - .1 All materials under Work of this Section, including but not limited to, sealants and paints are to have low VOC content limits.
 - .2 Prepainted sheet steel: ASTM A653/A653M; Classification LFQ, Grade A, Z275 zinc coating designation, 0.60 mm minimum base steel thickness, commercial quality, prefinished with Perspectra Series coating system by U.S. Steel Canada, or WeatherX by Vicwest Steel. Colour as selected by Consultant.
 - .3 Plastic cement: Trowel grade asphalt mastic.
 - .4 Sealant: ASTM C920, Type S, Grade NS, Class 25; High-performance, medium-modulus, one-part, neutral-cure silicone sealant. 'CWS' by Dow Corning or approved alternative.

- .5 Cleats and starter strips: Starter strips to be continuous, of same material as flashing used, 1.2 mm thick.
- .6 Fasteners: Flat head roofing nails of length, type and thickness suitable for metal flashing application.
- .7 Washers: of same material as sheet metal, 1 mm thick with rubber packings.
- .8 Touch-up paint: Same colour and material as prepainted sheet steel, as recommended by prefinished coating manufacturer.

2.2 FABRICATION

- .1 Fabricate copings, flashings, curb counter flashings, starter strips, scuppers and miscellaneous flashings in accordance with CRCA and to details shown.
- .2 Form prepainted sheet material at shop to shapes shown. Make end joints where adjacent lengths of metal flashing meet, in accordance with jointing method specified.
- .3 Form pieces in 2400 mm maximum practical lengths. Make allowance for expansion at joints.
- .4 Hem exposed edges 13 mm minimum on underside for appearance and stiffness. Mitre and seal corners with sealant.
- .5 Reglets and Cap flashing: Form flashings as detailed and in accordance with CRCA. Provide slotted fixing holes and steel/plastic washer fasteners.
- .6 Scuppers:
 - .1 Form scuppers from prefinished steel sheet metal.
 - .2 Sizes and profiles as indicated.
 - .3 Provide necessary fastenings.

3 Execution

3.1 EXAMINATION

- .1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of Work means acceptance of existing conditions.

3.2 **INSTALLATION**

- .1 Install coping flashings, curb counter flashings, starter strips, scuppers and miscellaneous flashings to details shown on the Contract Drawings and in accordance with CRCA.
- .2 Use concealed fasteners where indicated.
- .3 Apply isolation coating to metal surfaces in contact with concrete or mortar.
- .4 Install continuous starter strips to present a true, non-waving, leading edge. Anchor to back-up for a rigid, secure installation.
- .5 Counterflash bituminous flashings at intersections of roof with vertical surfaces and curbs. Flash joints using S-lock forming tight fit over hook strips.
- .6 Make end joints using an S lock joint. Execute by inserting end coping length in 25 mm deep S lock formed in end of adjacent length. Extend concealed portion of S lock 25 mm outwards and nail to substrate. Face nailing of joints will not be permitted.
- .7 Seal where necessary to form weathertight seal between flashing and adjoining surfaces and between flashing and other Work. Sealing Work consists of bedding between members where possible. Tool sealant to concave profile where exposed.
- .8 Insert metal flashing under cap flashing to form weathertight junction.
- .9 Caulk flashing at cap flashing with sealant.

END OF SECTION

- 1 General
- 1.1 **SECTION INCLUDES**
 - .1 Labour, Products, equipment and services necessary for sealant Work in accordance with the Contract Documents.
 - .2 Work of this Section does not include sealants in firestopping and smoke sealed assemblies.
 - .3 Work of this Section does not include sealant work identified in individual specification sections.
- 1.2 **REFERENCES**
 - .1 ASTM C834, Specification for Latex Sealants.
 - .2 ASTM C920, Specification for Elastomeric Joint Sealants.
 - .3 ASTM C1330, Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
- 1.3 **SUBMITTALS**
 - .1 Product data: Submit copies of Product data in accordance with Section 01 33 00 describing type, composition and recommendations or directions for surface preparation, material preparation and material installation.
 - .2 Samples:
 - .1 Submit following samples in accordance with Section 01 33 00.
 - .1 Two samples of sealant/caulking, for colour selection.
 - .2 Two samples of back-up material and primer for physical characteristics.
- 1.4 **QUALITY ASSURANCE**
 - .1 Qualifications: Work of this Section shall be executed by trained applicators approved by sealant manufacturer and having a minimum of 5 years proven experience.
- 1.5 **SITE CONDITIONS**
 - .1 Do not install materials when ambient air temperature is less than 5EC, when recesses are wet or damp.
 - .2 Install materials to manufacturer's recommendations.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Arrange delivery of materials in original, unopened packages with labels intact, including batch number, and ensure that on-site storage is kept to a minimum. Do not store materials on site where there exists any danger of damage from moisture, direct sunlight, freezing and other contaminants.

1.7 EXTENDED WARRANTY

- .1 Submit an extended warranty for Sealant Work in accordance with General Conditions, except that warranty period is extended to 2 years from date of Substantial Performance of the Work.
 - .1 Warrant against leakage, cracking, crumbling, melting, shrinkage, running, loss of adhesion and staining adjacent surfaces.
 - .2 Coverage: Complete replacement including affected adjacent Work.

2 Products

2.1 MATERIALS

- .1 General:
 - .1 All materials under Work of this Section, including but not limited to, primers and sealants are to have low VOC content limits.
 - .2 Use materials as received from manufacturers, without additives or adulterations. Use one manufacturer's Product for each kind of Product specified.
- .2 Sealant **Type A**: ASTM C920, Type S, Grade NS, Class 25; One-part, non-sag type, silicone sealant, in standard colours selected.
 - .1 'DC CWS' by Dow Corning Inc.
 - .2 'Sikasil 305CN' by Sika.
 - .3 'Tremsil 400' by Tremco..
- .3 Sealant **Type B**: ASTM C920, Type S, Grade NS; One-part mildew-resistant silicone, in standard colours selected.
 - .1 '786 Mildew Resistant Silicone Sealant' by Dow Corning Inc.
 - .2 'Sikasil GP Mildew Resistant' by Sika.
 - .3 'Tremsil 200 Silicone Sealant' by Tremco Ltd.
- .4 Sealant **Type C**: ASTM C834; Pure acrylic siliconized sealant; in standard white colour (paintable).
 - .1 'Tremflex 834 Silconized Sealant' by Tremco Ltd.

2.2 ACCESSORIES

- .1 Primers: Type recommended by material manufacturers for various substrates, primers to prevent staining of adjacent surfaces encountered on project.

- .2 Joint backing: ASTM C1330; Round, solid section, closed cell, skinned surface, soft polyethylene foam gasket stock, compatible with primer and sealant materials, 30 to 50% oversized, Shore A hardness of 20, tensile strength 140 to 200 kPa. Bond breaker type surface.
- .3 Bond breaker: Type recommended by material manufacturers.
- .4 Void filler around the window frames to be one part expanding polyurethane foam.
- .5 Cleaning agents: As recommended by material manufacturer, non-staining, harmless to substrates and adjacent finished surfaces.

2.3 **MIXING**

- .1 Follow manufacturers instructions on mixing, shelf and pot life.

3 Execution

3.1 **EXAMINATION**

- .1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of Work means acceptance of existing conditions.

3.2 **PREPARATION**

- .1 Protect adjacent exposed surfaces to prevent smearing, staining or other damage, by masking or other means, prior to performing Work. Make good any damage caused by sealant application. Remove protection upon completion and clean adjacent, exposed surfaces of any compound deposited upon such surfaces.
- .2 Erect scaffolding and rigging required to perform sealant Work in accordance with reviewed Shop Drawings.
- .3 Prepare joints to receive sealants to manufacturer's instructions. Ensure that joints are clean and dry and ferrous surfaces are free from rust and oil.
- .4 Clean recesses to receive sealant, to be free of dirt, dust, loose material, oil, grease, form release agents and other substances detrimental to sealant's performance.
 - .1 Remove lacquer or other protective coatings from metal surfaces, without damaging metal finish, using oil-free solvents. Remove rust, mill scale and coatings from ferrous metals by wire brush, grinding or sand blasting.
 - .2 Ensure recess is dry.
 - .3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings. Remove incompatible coatings as required.

- .5 Ensure that all materials in contact with sealant are compatible. Test substrate for adhesion.
- .6 Depth of recess: Maintain depth to 2 joint width up to a maximum of 13 mm and not less than 6 mm at centre of joint. For greater depth, use joint backing under. Where recess is less than specified depth, cut back surface of recess to specified recess depth.
- .7 Install polyethylene backing rod in joints 6 mm or more in width. Roll backing rod into joint. Do not stretch or bend backing rod. Install bond breaker to back of recess.
- .8 Prime sides of recess, in accordance with sealant manufacturer's instructions.
- .9 Condition products for use in accordance with manufacturer's recommendations.

3.3

INSTALLATION

- .1 Apply sealant immediately after adjoining Work is in condition to receive such Work. Apply sealant in continuous bead using gun with correctly sized nozzle. Use sufficient pressure to evenly fill joint.
- .2 Ensure sealant has full uniform contact with, and adhesion to, side surfaces of recess. Superficial painting with skin bead is not acceptable. Tool sealant to smooth surface, free from ridges, wrinkles, sags, air pockets, embedded impurities, dirt, stains or other defects.
 - .1 At recesses in angular surfaces, finish sealant with flat profile, flush with face of material at each side.
 - .2 At recesses in flush surfaces, finish compound with concave face, flush with face of material at each side.
- .3 Make sealant bead uniform in colour.
- .4 Cure sealants in accordance with sealant manufacturer's instructions. Do not cover up sealants until proper curing has taken place.
- .5 Immediately remove excess compound or droppings which would set up or become difficult to remove from adjacent finished surfaces, using recommended cleaners, as work progresses. Do not use scrapers, chemicals or other tools which could damage finished surfaces. Remove defective sealant.
- .6 Clean recesses and re-apply sealant.
- .7 Remove masking tape immediately after joints have been sealed and tooled.

3.4 **CLEANING**

- .1 Clean surfaces adjacent to joints, remove sealant smears or other soiling resulting from application of sealants. At metal surfaces, remove residue. Do not mar or damage finishes on materials adjacent to joints. Repair or replace marred or damaged materials.

3.5 **SCHEDULE OF LOCATIONS**

- .1 Following sealant location schedule is included for convenience and may not be complete. Examine Contract Drawings and other specification sections and determine entire extent of Work of this Section. Generally seal following locations:
 - .1 Concrete, masonry and wood to metal.
 - .2 Wood to masonry and concrete.
 - .3 Metal to metal.
 - .4 All dissimilar materials.
 - .5 Where 'sealant' or 'caulking' is indicated on drawings.
- .2 Sealant **Type A**:
 - .1 Exterior joints between masonry and steel or aluminum.
 - .2 Exterior joints between masonry and shelf angle.
 - .3 Exterior joints between steel or aluminum and concrete or masonry.
 - .4 Interior and exterior control joints, except in floors.
 - .5 Door frames, louvre frames, interior and exterior side.
 - .6 Protrusions through interior and exterior walls and floors, interior and exterior side, except where fire rated seals are required.
 - .7 Seal thresholds.
- .3 Sealant **Type B**:
 - .1 Control joints in tiled areas.
 - .2 Between vanity and tile.
 - .3 Between vanity and mechanical fixtures/fittings.
 - .4 Between access panels and tile.
 - .5 Between tiles and adjacent materials.
- .4 Sealant **Type C**:
 - .1 Perimeter of kitchen counters.
 - .2 Perimeter of interior windows.
 - .3 Perimeter of firehose cabinets.
 - .4 Junction between drywall and masonry.

END OF SECTION

- 1 General
- 1.1 **SECTION INCLUDES**
 - .1 Labour, Products, equipment and services necessary for the metal doors and frames Work in accordance with the Contract Documents.
- 1.2 **REFERENCES**
 - .1 ASTM A653/A653M, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.
 - .2 ASTM A568/A568M, Specification for General Requirements for Steel, Carbon and High-Strength Low-Alloy, Hot-Rolled Sheet and Cold-Rolled Sheet.
 - .3 CAN4-S104M, Standard Method for Fire Test of Door Assemblies.
 - .4 CAN4-S105M, Standard Specification for Fire Door Frames, Meeting the Performance Required by CAN4-S104M.
 - .5 CAN/CGSB-1.198, Cementitious Primer, (for Galvanized Surfaces).
 - .6 CGSB 41-GP-19Ma, Rigid Vinyl Extrusions for Windows and Doors.
 - .7 CAN/ULC-S702, Thermal Insulation, Mineral Fibre for Buildings.
 - .8 CSA W47.1, Certification of Companies for Fusion Welding of Steel Structures.
 - .9 CSA W59-M, Welded Steel Construction (Metal Arc Welding).
 - .10 NFPA 80, Standard for Fire Doors and Other Opening Protectives.
- 1.3 **DESIGN REQUIREMENTS**
 - .1 Design exterior frame assemblies to accommodate expansion and contraction when subjected to minimum and maximum surface temperature of -35 degrees Celsius to 35 degrees Celsius.
- 1.4 **SUBMITTALS**
 - .1 Product data: Submit manufacturer's Product data in accordance with Section 01 33 00 indicating door and frame construction.
 - .2 Shop drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 for each type of door and frame indicating:
 - .1 Thickness and type of steel.
 - .2 Thickness and type of core.

- .3 Thickness and type of steel stiffeners and location of them within the door.
- .4 Thickness and type of metal facing on edges of door and method of fastening.
- .5 Location of mortises, reinforcement, anchorages, joining, welding, sleeving, exposed fasteners, openings and arrangement for hardware.
- .2 Include schedule identifying each unit with door marks and numbers relating to numbering on Contract Drawings and in door schedule. Indicate doors and frames to be fire rated.

1.5 **QUALITY ASSURANCE**

- .1 Perform Work in accordance with requirements by a member of the Canadian Steel Door and Frame Manufacturers Association.
- .2 Label and list fire rated doors and frames by an organization acceptable to authorities having jurisdiction and accredited by the Standards Council of Canada in conformance with CAN4-S104M and CAN4-S105M for ratings indicated, Labelling shall be in accordance with NFPA 80.

2 Products

2.1 **ACCEPTABLE MANUFACTURERS**

- .1 Baron Metal Industries Inc.
- .2 Daybar Industries Limited
- .3 Fleming Doors Products.
- .4 Vision Hollow Metal Ltd.

2.2 **MATERIALS**

- .1 General: All materials under Work of this Section, including but not limited to, primers are to have low VOC content limits.
- .2 Steel: ASTM A568/A568M, Class 1; Commercial grade steel, hot dip galvanized to ASTM A653/A653M, ZF120 galvanized coating.
- .3 Minimum base steel thickness:
 - .1 Frames 1.6 mm
 - .2 Typical doors 1.2 mm
 - .3 Lock/strike reinforcements 1.6 mm
 - .4 Hinge reinforcements 2.7 mm
 - .5 All other reinforcement 1.6 mm
 - .6 Top and bottom channels 1.2 mm
 - .7 Glazing stops 0.9 mm

- .8 Guard boxes 0.9 mm
- .9 Jamb spreaders 0.9 mm

- .4 Top caps and thermal breaks: CGSB 41-GP-19Ma; Rigid PVC extrusions.

- .5 Primer: CAN/CGSB 1.198.

- .6 Core material:
 - .1 Interior doors: Mineral fibre insulation with a minimum face density of 24 kg/m³.
 - .2 Exterior doors: Rigid poly/isocyanurate, closed cell insulation, 32 kg/m³, thermal value: RSI 1.9.
 - .3 Fire rated doors: Mineral fibre insulation to CAN/ULC S702, Type 1A; 24 kg/m³.

- .7 Screws: Stainless steel screws with countersunk flat head.

- .8 Door silencers: Type 6-180, black neoprene.

- .9 Frame anchors:
 - .1 Frames in masonry: 1.2 mm minimum, adjustable T-strap jamb anchors.
 - .2 Labelled frames: In accordance with ULC requirements.

- .10 Floor anchors: 1.6 mm minimum adjustable floor clip angles with 2 holes for anchorage to floor.

- .11 Labels for fire doors and door frame: Brass plate, riveted to door and door frame.

- .12 Glass and glazing: In accordance with Section 08 80 00.

2.3 FABRICATION

- .1 General
 - .1 Fabricate doors and frames in accordance with reviewed shop drawings.
 - .2 Welding: CSA W59-M to produce a finished unit with no visible seams or joints, square, true and free of distortion.
 - .3 Welding: Continuous unless specified otherwise. Execute welding by a firm fully acceptable to the Canadian Welding Bureau to requirements of CSA W47.1.
 - .4 Form profiles accurately to details shown on Contract Drawings.
 - .5 Ream and remove burrs from drilled and punched holes.
 - .6 Grind welded corners and joints to a flat plane and fill with metallic filler and sand to a uniform smooth finish. Apply one coat of primer.
 - .7 Provide weather strip for exterior doors in accordance with Section 08700 and door manufacturer.

- .2 Frames, windows, and screens:
 - .1 Fabricate frames of welded construction. Cut mitres and joints accurately and weld continuously on inside of frame profile. Exterior frames to be thermally broken.
 - .2 Construct large frame sections with provision for on Site assembly to suit Site conditions.
 - .3 Blank, reinforce, drill and tap frames for mortised, templated hardware. Protect mortised cut-outs with guard boxes.
 - .4 Reinforce frames where required for surface mounted hardware.
 - .5 Reinforce frames over 1200 mm wide with roll formed steel channels or hollow structural sections specified in Section 05 50 00 and as indicated on drawings.
 - .6 Furnish exterior door frames with a continuously welded integral steel weather drip at head of frame.
 - .7 Prepare each door opening for single stud rubber door silencers, 3 for single door openings located in strike jamb, and 2 for double door openings located in head.
 - .8 Install 2 channel or angle spreaders per frame, to ensure correct frame alignment. Install stiffener plates or spreaders between frame trim where required, to prevent bending of trim and to maintain alignment when setting in place.
 - .9 Form channel glazing stops minimum 16 mm height, accurately cut, mitred, fitted and fastened to frame sections with stainless steel counter-sunk, flat head screws spaced at maximum 450 mm throughout and 50 mm from each end.
- .3 Anchorage:
 - .1 Anchor units to floor and wall construction. Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb, minimum number of anchors for each jamb:
 - .1 Frames up to 2285 mm 3 anchors.
 - .2 Frames from 2285 mm to 2440 mm 4 anchors.
 - .2 Where frames are to be set in masonry or concrete, supply adjustable anchors to trade installing frame.
- .4 General Door Requirements:
 - .1 Hollow steel construction, flush swing type, of sizes to conform to details, schedules and reviewed shop drawings with provisions for cut-outs for glass and reinforced to receive hardware fastenings.
 - .2 Blank, reinforce, drill and tap doors for mortised, templated hardware. Where required, reinforce doors for surface mounted hardware and door closers.
 - .3 Reinforce oversized doors with steel channels and plates specified in Section 05 50 00 and as indicated on drawings.
 - .4 Where openings are required, form integral cut-outs with framing, glass stop moldings and division bars.
 - .5 Bevel both stiles of single doors 1 in 16.
 - .6 Reinforce doors with galvanized metal stiffeners at 150 mm o.c.

- .5 Interior Doors:
 - .1 Supply and install inverted, recessed, mechanically interlocked with tack welded channels at top and bottom of doors.
 - .2 Fabricate doors with joints between front and back panels meeting on stile edges. Make joints mechanically interlocked and tack welded for entire height of door. After welding has been completed, grind joints smooth to match metal. Ensure that no filler is used in joints.
 - .3 Fill hollow space within door and vertical stiffeners from top to bottom with mineral fibre batt insulation.

- .6 Exterior Doors:
 - .1 Supply and install inverted, recessed, mechanically interlocked with tack welded channels at top and bottom of doors. Supply and install PVC top caps.
 - .2 Fabricate doors with joints between front and back panels meeting on stile edges. Make joints mechanically interlocked and tack welded for entire height of door. After welding has been completed, grind joints smooth to match metal. Ensure that no filler is used in joints.
 - .3 Fill hollow space within door from top to bottom with rigid polyisocyanurate insulation.

- .7 Fire Rated Doors:
 - .1 Supply and install inverted, recessed, spot welded channels at top and bottom of doors. Supply and install steel flush top caps on exterior doors.
 - .2 Fabricate doors with joints between front and back panels meeting on stile edges. Make joints mechanically interlocked and tack welded for entire height of door. After welding has been completed, grind joints smooth to match metal. Ensure that no filler is used in joints.
 - .3 Fabricate doors to achieve fire rating as indicated on drawings and in accordance with ULC. Provide ULC label plate on door at hinged edge midway between top hinge and head of door.

- 3 Execution
- 3.1 **EXAMINATION**
 - .1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of Work means acceptance of existing conditions.
- 3.2 **HOLLOW METAL DOOR, FRAME, WINDOW AND SCREEN INSTALLATION**
 - .1 Install hollow metal doors, frames, windows, and screens plumb, square, level, secure, and at correct elevation.
 - .2 Install doors clear of floor finishes, and with the correct rebate opening for the door installation. Install door silencers.

- .3 Secure anchorages and connections to adjacent construction. Brace frames rigidly in position while building-in. Remove temporary steel shipping jamb spreaders. Install wood spreaders at third points of frame rebate height to maintain frame width. Supply and install vertical supports as indicated on drawings for openings over 1200 mm in width. Remove wood spreaders after frames have been built-in.
- .4 Allow for structural deflection and prevent structural loads from being transmitted to hollow metal frames.
- .5 Touch-up areas where galvanized coating has been removed or damaged with primer.
- .6 Install fire rated doors and frames in accordance with requirements of NFPA 80.

3.3 **ADJUSTING AND CLEANING**

- .1 Adjust doors for smooth and balanced door movement.
- .2 Clean doors, frames and screens.

END OF SECTION

PART 1. GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Documents and samples to be submitted.
- .2 Section 01 74 21 – Construction and demolition waste management and disposal.
- .3 Section 01 78 00 – Documents and items to submit upon work completion.
- .4 Section 05 50 00 – Metalwork – Springs and rail brackets: Galvanized steel, type and dimensions that meet the installation requirements.
- .5 Section 08 80 50 – Glazing.
- .6 Section 16, with regards to power supply, connections and cables.

1.2 REFERENCES

- .1 The Aluminum Association Inc. (AA).
 - Aluminum Association Designation System for Aluminum Finishes-[DAF 45-03].
- .2 American Society for Testing and Materials International, (ASTM).
 - ASTM A1008/A1008M-[02e1], Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 - ASTM D523-[99(R1999)], Test Method for Specular Gloss.
 - ASTM D822-[01], Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
 - ASTM C518-91, Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - ASTM A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - ASTM E283, Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- .3 Canadian General Standards Board (CGSB).
 - CAN/CGSB-1.105-[M91], Quick Drying Primer.
 - CAN/CGSB-1.213-[95], Etch Primer (Pretreatment Coating) for Steel and Aluminum.
 - CAN/CGSB 1-1.181-[99], Ready-Mixed Organic Zinc-Rich Coating.
 - CAN/CGSB 51-GP-21M, Thermal Insulation, Urethane and Isocyanurate, Unfaced.
 - CAN/CGSB-51.26-M86, Thermal Insulation, Urethane and Isocyanurate, Boards, Faced.
- .4 Canadian Standards Association (CSA)/CSA International.
 - CAN/CSA-G164-M92 (C2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

- .5 Environmental Choice Program
(PCE). · CCD-016-[97], Thermal insulation. · CCD-047a-[98], Coatings, paints. · CCD-048-[95], Recycled water-borne surface coatings.

1.3 DESCRIPTION OF THE WORKS

.1 Design requirements

- Exterior doors and associated rails shall be designed to withstand a wind load of 1 kPa, with a deflection in the horizontal plane that does not exceed 1/240 of the width of the door opening.
They shall be designed to comply with industry standards (DASMA).
- Sectional doors shall have a thermal resistance value (RSI) of 2.81, according to standard ASTM C-518-91.
- The doors and associated rails shall be designed to withstand at least 1 000 operating cycles per year and shall have a global lifetime of 10 years.

1.4 DOCUMENTS/SAMPLES TO SUBMIT

.1 Specification sheets

Submit the products specification sheets and the manufacturer's data and documentation in accordance with Section 01 33 00.

.2 Shop Drawings

Submit the required shop drawings in accordance with Section 01 33 00 – Documents Samples to be submitted.

Shop drawings shall indicate: the door type, dimensions and service specifications; the materials; the type of operating mechanism; the location and details of the glazing; the details of hardware and accessories; and the required clearances and electrical connections.

.3 Submit the installation instructions provided by the manufacturer.

1.5 CLOSE OUT DOCUMENTS

- .1 As Built Shop Drawings & Literature.
- .2 Operation and maintenance manuals for the overhead doors as specified herein.

1.6 QUALITY ASSURANCE

- .1 Test reports: Submit test reports certifying that the products, materials and equipment comply with the physical characteristics and performance criteria laid down in the provisions.
- .2 Qualifications; Installation shall only be by an Authorized Garex Distributor in accordance with the manufactures as Built Shop Drawings and written instructions.

PART 2. PRODUCTS

2.1 SECTIONAL OVERHEAD DOORS (FULL-VIEW ALUMINUM)

.1 "Standard of Acceptance", Model GX-175-FV, as manufactured by Garex Garage Doors. Garex is a Canadian Owned & Operated Company. Contact : Bill Brodie 647.615.2767

.2 Alternates will be considered provided they meet the minimum requirements within, and they are approved & accepted in writing prior to tender closing.

2.2 DOORS

- .1 The doors shall be manufactured with Clear Anodized Tubular aluminum rails c/w double end styles, double top & bottom rail.
- .2 Glazed panels: 3 mm tempered double-glazed sealed (18mm nominal thickness) units mounted on a stainless steel spacer. The glass is inserted into a colour matched PVC frame, eliminating the need for plastic glass retainer stops. The glass is inserted into a preassembled aluminum frame and the window unit is a integral part of the complete door assembly.
- .3 Kicks proof panels; made of two (2) rolled sheet steel by adhesive on plywood core. The kick proof panel is inserted into a colour matched PVC frame. The panel is inserted slide into a preassembled aluminum frame as a complete unit is a integral part of the complete door assembly.

2.3 WEATHERSTRIPPING

- .1 PVC weatherstripping, full width at the top and bottom of each section to ensure thermal break and airtightness according to standard ASTM E-283.
- .2 U-Shaped extruded neoprene weatherstripping (full width), to be installed in bottom extrusion of each door
- .3 Aluminum perimeter weatherseal c/w high quality vinyle to be on to installed on jambs to ensure a weathertight seal against the door face.

2.4 INDUSTRIAL HARDWARE

- .1 75mm (3in) in Track & Hardware, galvanized steel at 2.6mm (12guage) thick. Please reference the Architectural Drawings for hardware configuration.
- .2 Continuous angle, 2.75 mm (12 gauge) thick.
- .3 25mm (1in) Galvanized Solid Shaft c/w 50,000 cycle torsion springs, fitted with brackets in accordance with the manufacturers specifications

- .4 Adjustable top roller brackets : 2.6mm (12 guage) thick, galvanized steel.
- .5 75mm (1in) Rollers: Hardened steel, oil lubricated, free lateral movement, ball bearing,
- .6 Double End Hinges, 2.6mm (12 guage), galvanized steel hinges, galvanized steel, in accordance with the manufacturer's specification.
- .7 Aircraft cable, galvanized steel, in accordance with the manufacturer's specifications.
- .8 Reinforcing Struts : Doors 3708 mm and over shall be provided with horizontal reinforcing struts. In accordance with the manufactures specifications.
- .9 Precision bearing: High-quality ball bearing for doors over 300 kg (600lbs)
- .10 Pusher springs.

2.7 ELECTRIC OPERATOR

- .1 **Manaras Rapido RSI** Operators as shown on the drawings (**Model Rapido RSH**) . Speed Management Feature provides enhanced performance and speed with slow start & slow stop capabilities. The maximum door speed is 19.3 ips (average 12.4 ips) on the open & 12ips (average 9.4 ips) on the close.
- .2 Jackshaft Operator : Manaras Opera industrial duty logic control type operator with on board radio receiver, model Rapido RSH (Model Rapido RSH) to NEMA 1, shall be equipped with an adjustable friction clutch, time delay on reverse, solenoid brake, integral enclosure containing the control, floor level disconnect and emergency manual chain hoist with electrical interlock.
- .3 Provide Separate Control Panel complete step- up Transformer to achever 600 Volt power supply with OPEN/CLOSE/STOP Push Button Station.
- .4 Entrapment Protection : Provide two (2) only Thru- Beam Photoelectric Eyes per operator. Locate the Photoelectric Eyes at different heights to ensure that they will hit Emergency Vehicles.
- .5 Provide one (1) only 3 - Button Transmitter per door. Program each transmitter to operate all (3) doors.
- .6 Reversing Safety Edge : Provide Manaras Sensedge along the bottom edge of door to reverse on contact with an object. **Hose type pneumatic safety edges will not be accepted.** Power to the safety edge shall be supplied through reelite.
- .7 Spreader Bar : between the drive sprocket and shaft to sprocket to ensure that the drive chain stays taught
- .8 Electric motors, control devices, remote control stations with push buttons, relays and other electrical devices: CSA-approved.
- .9 Electrical power supply: 600 Volt, 3 Phase

.10 Power Supply and fused disconnect located within 5'0 of the operator by Division 16. Wiring from the fused disconnect to the operator & low voltage wiring by the door contractor. Co-ordinate the location of the disconnect with the General Contractor & Door Contractor.

PART 3. EXECUTION

3.1 EXAMINATION

.1 Prior to commencement of work, thoroughly examine opening frames and frame extensions to receive the doors and related components for installation. Ensure that the opening frames are square and plumb. Ensure that the floor is level and square to the building lines. So that the door will properly seal against the door and frame

.2 Proceed with installation of the doors when site conditions are satisfactory for the installation.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: Comply with the manufacturer's written requirements, recommendations and specifications, including technical bulletins and installation instructions provided in the product catalogs and on packaging cartons, as well as indications found on specification sheets.

3.3 INSTALLATION

.1 Install doors and related hardware parts according to the manufacturer's instructions.

.2 Secure rails and door openers properly and fix the brackets to the load-bearing framework.

.3 Touch up the areas where the galvanized finish has been damaged during assembly with primer.

.4 Install electrical motors, control devices, control stations with push buttons, relays and other electrical equipment required for the operation of the doors.

.5 Lubricate springs and adjust moving parts to ensure smooth operation of doors.

.6 Adjust weatherstripping to ensure proper weathertightness.

.7 Adjust doors to ensure smooth operation.

3.4 ADJUSTMENT AND CLEANING

.1 Inspection of the doors and provide a complete operating test in the presence of the Owner and the Consultant prior to occupancy. Any defects noted shall be corrected immediately. Once the installation of doors is completed, clean the site to remove all dirt and debris resulting from construction work.

- .2 Remove all traces of paint, caulking, epoxy resin and filler. Clean the doors.
- .3 Clean glazing with a nonabrasive approved cleaning product.
- .4 When installation work is completed, removed from site all surplus materials, waste materials, tools and safety barriers.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Design, labour, Products, tool, equipment and services necessary for Aluminum Work in accordance with the Contract Documents.

1.2 **REFERENCES**

- .1 AAMA 611, Voluntary Standards for Anodized Architectural Aluminum.
- .2 AAMA CW-10, Care and Handling of Architectural Aluminum from Shop to Site.
- .3 AAMA/WDMA/CSA 101/I.S.2/A440, Standard Specification for Windows, Doors, and Unit Skylights.
- .4 ANSI H35.1M, Alloy and Temper Designation Systems for Aluminum (Metric).
- .5 ASTM A167, Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
- .6 ASTM B209M, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- .7 ASTM B221M, Specification for Aluminum-Alloy Extruded Bars, Rods, Wires, Profiles and Tubes.
- .8 ASTM C920, Specification for Elastomeric Joint Sealants.
- .9 ASTM E283, Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- .10 ASTM E330, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- .11 ASTM E331, Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
- .12 ASTM F738M, Specification for Stainless Steel Metric Bolts, Screws, and Studs.
- .13 CAN/CGSB 1.108-M, Bituminous Solvent Type Paint.
- .14 CAN/CGSB-82.1-M, Sliding Doors.
- .15 CAN/ULC S702, Thermal Insulation, Mineral Fibre, for Buildings.
- .16 NFRC 100, Procedure for Determining Fenestration Product U-factors.

- .17 NFRC 200, Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.

1.3 DEFINITION(S)

- .1 Aluminum Work: Shall mean aluminum curtainwall, entrances, vestibules, screens, doors, and framing mentioned in Part 2 of this Specification Section.

1.4 DESIGN REQUIREMENTS

- .1 Design Aluminum Work to meet requirements of AAMA/WDMA/CSA 101/I.S.2/A440, ASTM E283, ASTM E330, ASTM E331, NFRC 100, NFRC 200 and to meet performance and energy requirements specified herein and as required by authorities having jurisdiction.
- .2 Design Aluminum Work in accordance with following Climatic Design Data for the Municipality contained in the Ontario Building Code:
 - .1 Design temperature: January 1%, July 2 1/2%.
 - .2 Hourly wind pressures: 1 in 50 year occurrence.
- .3 Design Aluminum Work to accommodate following without producing detrimental effect:
 - .1 Cyclic 40 degree Celsius daily thermal swing of components.
 - .2 Cyclic, dynamic loading and release of loads such as wind loads.
 - .3 13 mm vertical deflection in supporting structure and movement of supporting structure due to live, dead load, and creep or deflections, seismic load, sway displacement and similar items.
- .4 Design complete aluminum window systems, including glazing, to meet the following performance criteria:
 - .1 Ontario Building Code SB-10 Requirements for Heated Conditioned Space Climate Zone based on project location.
- .5 Design complete aluminum entrance door systems, including glazing, to meet the following performance criteria:
 - .1 Ontario Building Code SB-10 Requirements for Heated Conditioned Space Climate Zone based on project location.
- .6 Design to prevent accumulation of condensate on interior side of Aluminum Work framing under the following service conditions:
 - .1 Interior temperature: 25 degree Celsius.
 - .2 Exterior temperature: -20 degree Celsius.
 - .3 Interior RH: 35%.

- .7 Design windows in accordance to AAMA/WDMA/CSA -101/I.S.2/ A440, to the following performance levels:
 - .1 Performance class: CW.
 - .2 Minimum performance grade (PG): 35.
 - .3 Minimum positive design pressure: 1680 Pa.
 - .4 Minimum negative design pressure: - 1680 Pa.
 - .5 Minimum water penetration test pressure: 290 Pa.
 - .6 Minimum air infiltration/exfiltration: A3.
 - .7 Condensation resistance: I57.

- .8 Restrict air infiltration/exfiltration, through Aluminum Work in accordance with ASTM E283 at pressure differential as indicated:
 - .1 Curtainwalls and entrance assemblies: $0.0003 \text{ m}^3/\text{s m}^2$ at differential of 300 Pa.
 - .2 Doors (per door): $2.78 \text{ m}^3/\text{h m}$ per linear metre of crack at differential of 75 Pa.

- .9 Design and detail controlled drainage path to actively discharge water, which enters into or forms within Aluminum Work, to exterior; prevent accumulation or storage of water within Aluminum Work. Prevent water from entering interior when tested in accordance with ASTM E331.

- .10 Design and detail air barrier, vapour retarder, and rainscreen products and assemblies into continuous and integrated Aluminum Work envelope. Optimize Aluminum Work design to align envelope layers and to minimize thermal bridges.

- .11 Prevent deflection and permanent or progressive glazing displacement. Restrict horizontal and vertical mullion deflection to less than $L/175$ and 19 mm maximum for heights under 4115 mm and $L/240$ and 25 mm maximum for heights over 4115 mm.

- .12 When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span in accordance with ASTM E330.

- .13 Design anchorage inserts for installation as part of other Sections of Work. Design anchorage assemblies to accommodate construction and installation tolerances.

- .14 Provide all reinforcing within aluminum members as required by design and OBC to provide structurally sound assembly. In any case, mullion size shall not be increased due to provision of reinforcing.

- .15 Design Aluminum Work and connections to substrate where the bottom of the Aluminum Work extends to a point below 1070 mm above finished floor level and separates a floor level from an adjacent interconnected space to withstand the required guard and handrail loads in accordance with the OBC and applicable local regulations. When requested by Consultant, provide a letter signed and sealed by a

Professional Engineer certifying that the Aluminum Work conforms to the OBC requirements.

- .16 Design operable windows within reach of occupants with limiting stops conforming to requirements of OBC.

1.5 SUBMITTALS

- .1 Shop drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 indicating:
 - .1 Plans, sections, details, type of extrusions, profiles, finishes, panels, spandrels, operating components, doors, related flashings, closures, fillers, and end caps, and sealants.
 - .2 Products and glazing types.
 - .3 Anchorage inserts, system installation tolerances.
 - .4 Section and hardware reinforcement, anchorage, assembly fixings.
 - .5 Detailing, locations, and allowances for movement, expansion, contraction
 - .6 Path of cavity drainage and air pressure equalization.
 - .2 Samples:
 - .1 Submit two samples of following in accordance with Section 01 33 00.
 - .1 250 mm long samples of each type of extrusion and finish.
 - .2 250 x 200 mm samples of insulating glass unit.
 - .3 One complete corner detail of door frame, glazing, and finish for each door type.
 - .4 Each door hardware item for Consultant's approval.
 - .5 250 x 200 mm sample of aluminum panel.
 - .6 200 x 200 mm sample of insect screen for operable windows for Consultant's approval of fibreglass mesh.
 - .3 Reports:
 - .1 Submit substantiating engineering data, and independent test results of pre-tested, Aluminum Work to substantiate compliance with the design criteria including air leakage and water penetration conforming to ASTM E283 and ASTM E331.
 - .2 Submit documentation to substantiate ten years of experience in Aluminum Work manufacture and installation.
 - .4 Close-out submittals: Submit Aluminum Work data for incorporation into the Operations and Maintenance Manual as part of Section 01 78 23.

1.6 **QUALITY ASSURANCE**

- .1 Retain a Professional Engineer, licensed in Province of Ontario, with experience in Aluminum Work of comparable complexity and scope to perform the following services as part of the Work of this Section:
 - .1 Design of Aluminum Work.
 - .2 Review, stamp, and sign shop drawings.
 - .3 Conduct on-Site inspections and prepare and submit inspection reports.
- .2 Mock-up:
 - .1 Fabricate, deliver, and erect one, full scale mock-up of each type of Aluminum Work, in location acceptable to Consultant.
 - .2 Demonstrate full range of Products, finishes, textures, quality of fabrication, and workmanship.
 - .3 Mock-up may form part of final Work, if acceptable to Consultant. Remove and dispose of mock-ups which do not form part of Work.

1.7 **DELIVERY, STORAGE, AND HANDLING**

- .1 Handle Aluminum Work in accordance with AAMA CW-10.
- .2 Protect aluminum surfaces with strippable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather. Do not remove before final cleaning of building.

1.8 **EXTENDED WARRANTY**

- .1 Submit a extended warranty for Aluminum Work in accordance with General Conditions, except that warranty period is extended to 5 years.
 - .1 Warrant against failure to meet the design criteria and requirements such as interior leakage, insulating glass unit failure, finish degradation, frame condensation.
 - .2 Coverage: Complete replacement including affected adjacent Work.

2 Products

2.1 **ACCEPTABLE MANUFACTURER(S) AND SYSTEM(S)**

- .1 Curtain Wall: 'Therma Wall 2600 Series' by Alumicor Limited, 'HP3252 Series' by CRL / U.S. Aluminum or '5500 HTP Series' by Windspec Inc or approved alternative.
- .2 Operable Windows (Concealed Vent): '5000 Series Phantom Vent' by Alumicor Limited, '7500 Series' by CRL / US Aluminum or approved alternative.

- .3 Aluminum doors:
 - .1 Interior:
 - .1 'Canadiana' by Alumicor Limited.
 - .2 '400 Series' by CRL / U.S. Aluminum.
 - .3 '350 Series' by Windspec Inc.
 - .2 Exterior:
 - .1 'Therma Porte 7700' by Alumicor Limited.
 - .2 '400T Series' by CRL / U.S. Aluminum.
 - .3 'Insul 350' by Windspec Inc.

2.2 MATERIALS

- .1 All materials under Work of this Section, including but not limited to, sealants are to have low VOC content limits.
- .2 Aluminum extrusions and channels: ASTM B221 and ANSI H35.1 AA6063 alloy, T6 temper.
 - .1 Profile and dimensions: Refer to Contract Drawings.
 - .2 Thermal breaks in frame members: Vertically aligned with glazing.
- .3 Aluminum sheet: ASTM B209 and ANSI H35.1 AA1100 aluminum alloy, H14 temper, minimum 1.29 mm for sheets less than 610 mm wide and minimum 2.05 mm for sheets of a greater dimension.
- .4 Reinforcements and anchors: ASTM A167, Type 304 to AISI No. 2B finish. Size as shown.
- .5 Glass and glazing materials: As specified in Section 08 80 00.
- .6 Spandrel panel airseal backpan: ASTM A653/A653M; 0.9 mm thick, Z275 galvanized steel sheet. To be primed as recommended by manufacturer and painted colour as selected by Consultant at a later date.
- .7 Airseal and Aluminum Work sealant: ASTM C920, Type S, Grade NS, Class 100/50; One-part, low-modulus, moisture-curing, silicone. 'Dow Corning 790' by Dow Corning; 'Spectrem 1' by Tremco. Verify compatibility with insulating glass unit manufacturer's secondary sealant. Colour as selected by Consultant. Primer as recommended by manufacturer.
- .8 Frame sealant: Type as recommended by the Aluminum Work manufacturer.
- .9 Joint backing: Closed cell foam polyethylene rod, oversized minimum 30-50% larger than joint width and compatible with joint sealant. Product as recommended by sealant manufacturer.

- .10 Airseal transition membrane: 'Sopraseal Stick 1100' by Soprema Inc., 'Exoair 110' by Tremco or 'Air-Shield' by W.R. Meadows. Membrane to come complete with applicable primer.
- .11 Anchors, clips, and angles: Extruded aluminum or stainless steel.
- .12 Shims and blocking for frame: Rigid plastic, wood is not permitted.
- .13 Flashings, closures and trim: 1.0 mm minimum aluminum sheet, finish to match curtain wall extrusion finish.
- .14 Screws, bolts and other fasteners: ASTM F738M; Stainless Steel Type 304.
- .15 Isolation coating: CAN/CGSB-1.108-M; Bitumastic coating, acid and alkali resistant material.
- .16 Spandrel panel insulation: CAN/ULC S702; Semi-rigid mineral fibre.
 - .1 Type 703 by Owens-Corning.
 - .2 CurtainRock by Roxul Inc.
 - .3 Thickness: As required to fill void.
 - .4 Insulation fasteners: Stik-Clip with retaining washer.
- .17 Spray Foam Insulation: CFC free, polyurethane foam in place, closed cell low expansion, one component, minimum density 15 kg/m³.
 - .1 'ENERFOAM' by Dow Chemical Canada.
 - .2 'IPF All Weather Pro' by Rivenco Industries.
- .18 Door hardware: Manufacturer's standard heavy duty hardware, based on the following:
 - .1 Hinging device: extruded aluminum continuous gear hinge or 1 1/2 pair of heavy duty stainless steel butts complete with back up plates.
 - .2 Closing device: LCN 4040 Series closers with back up plates.
 - .3 Pull handles: Alumicor 1180, 25 mm diameter, anodized aluminum offset pull handles
 - .4 Push bars (for doors without panic hardware): Alumicor 246, 25 mm diameter, anodized aluminum push bar.
 - .5 Locking (basic locking): Adams Rite MS1850 Dead Lock with manufacturers standard cylinder on exterior and thumbturn on interior.
 - .6 Locking (panic hardware): Von Duprin 33/35A rim panic or Von Duprin 3547 vertical rod panic.
 - .7 Hold open devices (where required): Glynn Johnson GJ104S for door stop only applications; Glynn Johnson GJ104H for applications that require both a stop and hold open.
- .19 Insect screen (windows): Extruded aluminum frames containing heavy duty, fine fiberglass mesh in accordance with AAMA/WDMA/CSA 101/I.S.2/A440. Screen to

be retained in place with turn clip type fixings. Provide samples for the Consultant's approval.

- .20 Weatherstripping: Durable, non-absorbing material resistant to deterioration by aging and weathering.

2.3 FABRICATION

- .1 Fabricate sections true to detail, free from defects impairing appearance, strength and durability. Fabricate extrusions with sharp, well defined corners.
- .2 Fabricate Aluminum Work in accordance with reviewed shop drawings and manufacturer's written instructions.
- .3 Fabricate, fit, and secure framing joints and corners accurately, with flush surfaces, and hairline joints. Apply frame sealant at joints for weatherproof seams.
- .4 Conceal anchors, reinforcement and attachments from view. Fabricate reinforcement in accordance with design requirements.
- .5 Do not expose manufacturer's identification labels on aluminum assemblies.
- .6 Fabricate continuous sill flashings with intermediate anchor clips, and joint reinforcing, form to profile shown. Fabricate filler and closure pieces as necessary for a complete and weather tight installation.
- .7 Certify aluminum windows as complying with the AAMA/WDMA/CSA 101/I.S.2/A440 design criteria and requirements using an easily removable label located on the inside face of glazing.
- .8 Position operable windows on main frame to provide direction of opening specified, free and smooth operation, without binding or sticking against main frame members.
- .9 Fabricate doors and frames complete with internal reinforcements, cut-outs, and recesses to accommodate finish hardware. Reinforce cut-outs to assure adequate strength.
- .10 Fabricate Aluminum Work closures and trim from aluminum sheet. Form to profile shown. Make weathertight.
- .11 Double weatherstrip doors. Install weatherstripping in specially extruded ports and secure to prevent shrinkage or movement.
- .12 Fabricate glazing recess with drainage to exterior.

2.4 **ALUMINUM DOORS**

- .1 Fabricate doors of welded construction.
- .2 Glazing stop: Aluminum, square, snap-on type, designed for glazing system.

2.5 **INFILL (SPANDREL) PANELS**

- .1 Fabricate insulated spandrel panel, inner facing of 20 gauge aluminum sheet. Wrap edges with aluminum sheet, enabling installation and minor movement of perimeter seal.
- .2 Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.
- .3 Place insulation within panel, adhered to exterior face of interior panel sheet over entire area of sheet with impale fasteners.
- .4 Provide integral reinforcing and stiffeners as required to reinforce panel against deflection caused by wind and suction loads.
- .5 Provide spacers as necessary to separate dissimilar metals.
- .6 Ventilate and pressure equalize the air space outside the exterior surface of the insulation, to the exterior.
- .7 Arrange fasteners and attachments to ensure concealment from view.
- .8 Glass panels: Consists of 6 mm thick spandrel glass to the exterior with insulated backpan to the inside. Insulation shall be 75 mm thick, retained with stick clips. Seal all joints in shop with high grade butyl sealant, including perimeter seal at backpan. Backpan to be primed and painted same colour as adjacent wall or colour as selected by Architect.
- .9 Metal panels: Consists of an exterior prefinished flush aluminum panel with panel stiffeners as required, to match colour of window framing, with 75 mm thick insulation core and galvanized sheet back-pan. Backpan to be primed and painted same colour as adjacent wall or colour as selected by Architect.

2.6 **FINISH**

- .1 Extrusion finish: Clear anodized to AAMA 611 per Aluminum Association Designation System for Aluminum Finishes AA-M12C22A31.
- .2 Doors: Clear anodized to AAMA 611 per Aluminum Association Designation System for Aluminum Finishes AA-M12C22A31.

.3 Panel and sheet finish: As indicated on drawings to match adjacent extrusion finish.

3 Execution

3.1 **EXAMINATION**

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of Work means acceptance of existing conditions.

3.2 **INSTALLATION**

.1 Install Aluminum Work in accordance with reviewed shop drawings, manufacturer's instructions, AAMA/WDMA/CSA 101/I.S.2/A440 and to meet requirements of authorities having jurisdiction.

.2 Install Aluminum Work in accordance with reviewed shop drawings and manufacturer's written instructions.

.3 Install Work of this Section securely, in correct location, level, square, plumb, at proper elevations, free of warp or twist.

.4 Apply isolation coating at 0.8 mm dry film thickness to prevent corrosive or electrolytic action between dissimilar materials such as aluminum to concrete, masonry, galvanized steel and similar conditions.

.5 Install flashings, closures, and trim pieces.

.6 Fill voids between aluminum framing and adjacent construction with foam insulation.

.7 Install sills in maximum lengths possible. For sills over 1200 mm in length, maintain 3 mm to 6 mm space at each end.

.8 Refer to Contract Drawings for glazing type locations. Install glazing in accordance with Section 08 80 00.

.9 Spandrel panels:

.1 Set spandrel back pans to framing, apply sealant to cover screw heads to maintain air tight seal between back pans and framing.

.2 Adhere stick clips to metal back pans at 300 mm o.c. both ways. Apply insulation adhesive over entire surface of barrier and around clips held with adhesive.

.3 Cut insulation slightly over-size and press insulation boards firmly to barrier impaling them on clips without bending clips. Butt insulation boards tightly. install retainers to clips.

- .10 Automatic door operators to be supplied and installed by Section 08 71 13. Install doors and hardware to manufacturers' written instructions. Clean and adjust hardware for correct performance.
- .11 Install aluminum door manufacturer's standard weatherstripping at door frame perimeter. Install weatherstripping throughout entire length and width of doors at jambs and heads.
- .12 Install doors and hardware to manufacturers' written instructions. Clean and adjust hardware for correct performance.
- .13 Adjust operable parts for correct function.
- .14 Remove damaged or unacceptable Products and assemblies from Site and replace to Consultant's acceptance.
- .15 Install glass presence markers, in two cross stripes extending from diagonal corners. Maintain markers until final clean-up.

3.3 **ERECTION TOLERANCES**

- .1 Tolerances: Non-cumulative.
 - .1 Maximum variation from plumb: 1.5 mm/3 m non-cumulative or 12 mm/30 m, whichever is less.
 - .2 Maximum misalignment of two adjoining members abutting in plane: 0.8 mm.
 - .3 Vertical and horizontal positions: +/- 3 mm.
 - .4 Racking of face: 6 mm, nil in elevation.
 - .5 Operable components: Consistent with smooth operation and weatherproof performance.
 - .6 Maximum perimeter sealant joint between Aluminum Work and adjacent construction: 13 mm.

3.4 **GLAZING PERIMETER AIRSEAL**

- .1 Install glazing perimeter airseal at entire perimeter of each insulating glass unit to achieve an airseal from insulating glass unit to curtain wall frame. Do not obstruct path of cavity drainage and air pressure equalization.
- .2 Perform sealant work in accordance with manufacturer's written requirements.

3.5 **AIRSEAL TRANSITION MEMBRANE**

- .1 Install primer and airseal transition membrane in accordance with manufacturer's instructions. Install airseal transition membrane into extrusion reglet as indicated on drawings. If there is no extrusion reglet, mechanically fasten airseal transition membrane to frame with batten bar fastened at 150 mm o.c.
- .2 Overlap airseal transition membrane 75 mm minimum and lap in direction of waterflow.
- .3 Coordinate airseal transition to adjacent parts of Work.

3.6 **JOINT BACKING AND ALUMINUM WORK SEALANT**

- .1 Prepare substrate surface and mask as recommended by sealant manufacturer.
- .2 Install joint backing and sealant at Aluminum Work and perimeter joints for weather tight installation in accordance with sealant manufacturer's instructions. Tool sealant. Remove excess sealant.

3.7 **FIELD QUALITY CONTROL**

- .1 Test sliding doors in accordance with ASTM E1105 for water penetration.
 - .1 Procedure A: test sliding door at 700 Pa, for uniform static air pressure difference for 15 minutes by applying water at a minimum rate of 3.4 L/m² minute.
 - .2 Procedure B: test sliding door at 700 Pa, for static air pressure difference for 4 cycles of 5 minutes each by applying water at a minimum rate of 3.4 L/m² minute.
 - .3 Failure criteria as per ASTM E1105.

3.8 CLEANING

- .1 Maintain Aluminum Work, inside and outside, in clean condition throughout construction period.
- .2 Remove labels, protective material, and glass presence markers from prefinished surfaces.
- .3 Remove AAMA/WDMA/CSA 101/I.S.2/A440 certification labelling when directed by Consultant, in writing.
- .4 Wash Aluminum Work with solution of mild detergent in warm water, with particular attention to recesses and corners. Wipe surfaces clean and dry.

END OF SECTION

- 1 General
- 1.1 **SECTION INCLUDES**
 - .1 Labour, Products, equipment and services necessary for finish hardware Work in accordance with the Contract Documents.
- 1.2 **REFERENCES**
 - .1 BHMA, Builders Hardware Manufacturing Association.
 - .2 NFPA 80, Standard for Fire Doors and Other Opening Protectives.
- 1.3 **SUBMITTALS**
 - .1 Product data: Submit manufacturer's Product data in accordance with Section 01 33 00 indicating compliance with reference standards, transportation, storage, handling and installation requirements.
 - .2 Shop Drawings:
 - .1 Submit Shop Drawings and 3 complete hardware lists in accordance with Section 01 33 00 indicating:
 - .1 Door locations, sizes, hardware manufacturer's catalogue numbers, finish symbols and quantities required.
 - .2 Locations and mounting heights of each type of hardware.
 - .2 Supply templates and required information to door and frame manufacturer to enable accurate sizes, locations of cut-outs and reinforcement for hardware.
 - .3 Submit templates to required trade to arrange for provisions for accurate setting and fitting of hardware.
 - .3 Samples:
 - .1 Submit 2 samples in accordance with Section 01 33 00 of each item that is different from hardware specified and include manufacturer's parts lists and installation instructions.
 - .2 Submit hardware component samples illustrating style, colour and finish. Tag samples identifying applicable Specification article number, brand name and number, finish, building location, date and catalogue number.
 - .3 Do not order hardware until samples have been accepted. Submit new samples to replace rejected samples. Supply hardware and finishes identical to each accepted sample.
 - .4 Closeout submittals:
 - .1 Submit the following in accordance with Section 01 78 23 for each Product for incorporation into Operation and Maintenance Manual:
 - .1 Maintenance data.
 - .2 Operating instructions and safety precautions.
 - .3 Parts list with name and address of supplier.
 - .4 Lubrication schedule and type of lubricant recommended.
 - .5 Keys, tools and special devices.

- .6 Inspection procedures related to preventive maintenance.

1.4 **QUALITY ASSURANCE**

- .1 General:
 - .1 Manufacturers: Companies specializing in manufacturing door hardware and registered with BHMA.
 - .2 Hardware supplier: Company specializing in supplying commercial door hardware and acceptable to manufacturer.
- .2 Certifications:
 - .1 Employ an Architectural Hardware Consultant to inspect completed installation and certify that hardware has been installed in accordance with manufacturer's printed instructions, Authorities having Jurisdiction and as specified.
 - .2 Submit manufacturer's certificate that finish hardware and fire rated hardware meets specified requirements.

1.5 **DELIVERY, STORAGE, AND HANDLING**

- .1 Be responsible for packaging of hardware, on a set by set basis. As material is received from various manufacturers identify it to correspond to Hardware List symbols.
- .2 Label packages legibly, indicating manufacturer's number, types, sizes, opening number and Hardware List reference number. Wrap hardware and include in package, screws, bolts and fastening necessary for correct installation. If hardware package is not complete, pay additional charges incurred by installer.
- .3 Deliver hardware to Site packaged, labelled and cross-referenced to hardware list for each item and its scheduled installation location.
- .4 Accept Products of this Section on Site and ensure that each item is undamaged.
- .5 Catalogue and store hardware in secure area.

2 Products

2.1 **GENERAL**

- .1 Aluminum door hardware: Supplied and installed under the Work of Section 08 44 00.

- .2 Carefully check and verify Hardware List against Contract Drawings to ensure that hardware listed can be used as specified. Inform Consultant of concerns regarding quality, quantity, operation or function of hardware selected:
 - .1 Verify hand of doors, examine details on Contract Drawings and at Site to ensure hardware supplied can be correctly installed and is correct for Work as constructed.
 - .2 Select hardware in accordance with applicable codes and regulations and to approval of local Fire Marshal.
 - .3 Replace and pay for defective hardware including hardware which was incorrectly selected, and remedial and installation costs.
- .3 Ensure that hardware selected will function correctly, meets Contract requirements and Ontario Building Code and authorities having jurisdiction.
- .4 Ensure that each hardware item is of same type, design and by same manufacturer.
- .5 Manufacturer's names or trademarks are not permitted on exposed surfaces of hardware.
- .6 Include in packing slip a list of parts, name of supplier and door number in which lock is to be installed.
- .7 Hardware for fire rated and labelled door and frame assemblies: ULC listed or as accepted by authorities having jurisdiction.
- .8 Fire rated assemblies:
 - .1 Hardware: Selected and installed in accordance with applicable codes and regulations, NFPA-80 and to approval of Ontario Fire Marshal.
 - .2 Fire rated doors: ULC labelled hardware. Submit written certification of conformance to ULC requirements for each type of hardware prior to delivery.
 - .3 Locksets and latchsets on fire rated doors: 19 mm throw minimum.
- .9 Permanent Cores shall be provided by Royal Security Solutions, per the Municipality's Standards. General Contractor shall provide temporary construction cores for use during construction.

2.2 ACCESSORIES

- .1 Items to be attached to masonry or concrete with expandable shields, lag screws, bolts or other fastening devices as required. Exposed screws: Stainless steel, Phillips or Robertson heads.

2.3 FINISHES

- .1 Metal finishes: Free from defects, clean, unstained and of a uniform colour for each type of finish required. Exposed surfaces and anchors: Specified finish symbol of item.

3 Execution

3.1 **EXAMINATION**

- .1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of Work means acceptance of existing conditions.

3.2 **INSTALLATION**

- .1 Install hardware in accordance with reviewed Shop Drawings, manufacturer's installation instructions, and applicable Codes and regulations.
- .2 Install hardware in accordance with hardware templates.
- .3 Adjust fixed and operable hardware for correct clearances and function.
- .4 Mount hardware measured from finished floor to centre of hardware, unless indicated otherwise or required by Code:
- .1 Top hinge: 250 mm from head of door to top.
 - .2 Bottom hinge: 265 mm from finished floor to bottom of hinge.
 - .3 Intermediate hinge: Equal distance between top and bottom hinge.
 - .4 Locksets, latchsets: 1000 mm.
 - .5 Panic device crossbar: 1000 mm.
 - .6 Push plates: 1100 mm to bottom of plates.
 - .7 Guard bars: 1100 mm.
 - .8 Door pulls: 1100 mm to bottom of pulls.
 - .9 Blank strike: 1450 mm.
 - .10 Blank fronts: 1450 mm.
- .5 Include for supply and installation of wiring for electric strikes from electrical junction box to electric strike hardware.
- .6 Locate door stops to contact doors 75 mm from latch edge.
- .7 Install hardware and trim square and plumb to doors.
- .8 Replace wrappings for hardware provided by manufacturer after installation.
- .9 Safeguard keys to keep them out of unauthorized hands, tag them with door number, and deliver them to person designated by Consultant at building completion.

3.3 **FIELD QUALITY CONTROL**

- .1 Have hardware inspected after installation by hardware supplier's representative, obtain certification in writing that hardware has been supplied and installed in accordance with Specifications and hardware manufacturer's instructions and is functioning correctly.

- .2 Inspect fire rated openings to ensure they are installed in compliance with NFPA 80 requirements and Authorities having Jurisdiction.
- .3 Test access control system and electrified hardware devices for proper operation. Verify electric door release hardware operates properly upon activation of fire alarm system.

3.4 ADJUSTING

- .1 Verify under work of this Section, that installed hardware functions properly.
- .2 Adjust hardware so that latches and locks operate smoothly and without binding, and closers act positively with the least possible resistance in use. Lubricate hardware if required by manufacturer's instructions.
- .3 Adjust doors with self-closing devices or automatic closing devices for proper operation after the HVAC system is balanced and adjusted. Verify spring power of non-sized door closers is properly adjusted.

3.5 CLEANING

- .1 Remove wrappings at completion of the Project and clean hardware in accordance with manufacturer's instructions.

3.6 HARDWARE SCHEDULE

- .1 Hardware groups/schedule: To be prepared with direction from the Client/Municipality and to be paid under the "Cash Allowance".

END OF SECTION

- 1 General
- 1.1 **SECTION INCLUDES**
 - .1 Design, labour, Products, tool, equipment and services necessary for automatic door equipment work in accordance with the Contract Documents.
- 1.2 **REFERENCES**
 - .1 ANSI/BHMA A156.19, Power Assist and Low-Energy Power-Operated Doors.
- 1.3 **DESIGN REQUIREMENTS**
 - .1 Design handicap door system comprising of low energy power operator with touchless infrared sensor system as defined in ANSI/BHMA A156.19.
 - .2 Design system operator to open if touchless infrared sensor system is activated. Actuated door shall open slowly to back check (80°) in 3 to 6 seconds and to full open position in 4 to 7 seconds. Door shall remain open for period set to suit requirements (period of 5 to 30 seconds). After time delay door shall close by spring in door operator from 90° to 10° in 3 to 6 seconds from 10° to fully closed in 1-1/2 to 2 seconds.
- 1.4 **SUBMITTALS**
 - .1 Product data: Submit duplicate copies of manufacturer's Product data in accordance with Section 01 33 00 indicating performance criteria, compliance with appropriate reference standard(s), characteristics, limitations, trouble-shooting protocol, transportation, storage, handling and installation requirements.
 - .2 Shop drawings: Submit shop drawings in accordance with Section 01 33 00 indicating all connections, attachments, reinforcing, anchorage and location of exposed fastenings.
- 1.5 **EXTENDED WARRANTY**
 - .1 Submit an extended warranty for automatic door equipment in accordance with General Conditions, except that warranty period is extended to 2 years.
 - .1 Warrant against failure to meet design criteria and requirements.
 - .2 Coverage: Complete replacement including affected adjacent Work.

2 Products

2.1 **ACCEPTABLE MANUFACTURER(S) AND SYSTEM(S)**

- .1 Heavy Duty Door Operator: Design is based on self-contained, low pressure electro-hydraulic power. Operator to be as manufactured by one of the following:
 - .1 PowerSwing by Besam of Canada.
 - .2 Magic Force by Stanley Canada Inc.
 - .3 Senior/Middle/Astro Swing by Dor-O-Matic.
 - .4 ED700 by Dorma Automatics.
- .2 Door operating equipment shall be complete with electro mechanical motor gear box. Provide 3 position (off-on) switch. System shall operate between -30 deg C and 50 deg C.

2.2 **REQUIREMENTS**

- .1 Functional Requirements:
 - .1 Equipment shall be designed to operate swing doors up to weight of 100 kg.
 - .2 Opening Speed:
 - .1 Door shall be field adjusted to back check as required in Table 1 of ANSI/BHMA A156.19.
 - .2 Opening speed to fully open shall be 4 seconds or longer.
- .2 Hold Open: Door shall be field adjusted to remain fully open for not less than 5 seconds or more than 30 seconds.
- .3 Closing Speed:
 - .1 Doors shall be field adjusted to close 90° to 10° in 3 seconds or longer as required in Table 1 of ANSI/BHMA A156.19.
 - .2 Doors shall close from 10° to fully closed in not less than 1.5 seconds.
 - .3 Force required to prevent door from opening or closing shall not exceed 7 kg applied 25 mm from latch edge of door at any point in opening or closing cycle.
 - .4 During power failure, doors shall open with manual pressure not exceeding 11.3 kg at point 25 mm from latch edge of door.
 - .5 Doors shall be equipped with signs visible from either side, instructing user as to operation and function of door.
- .4 Requirements:
 - .1 Provide header complete with full housing, finish shall match door frame finish.
 - .2 Locations of automatic door operators to conform to requirements of the Ontario Building Code (OBC).
 - .3 Operator shall be activated by touchless infrared sensor as indicated.
 - .4 Switches shall bear universal handicap logo visible to all types of traffic.

3 Execution

3.1 **EXAMINATION**

- .1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of Work means acceptance of existing conditions.

3.2 **INSTALLATION**

- .1 Install automatic door operators, controls and accessories for doors indicated in accordance with reviewed shop drawings and manufacturer written instructions.
- .2 Installation of automatic door operators to be in accordance with requirements of the Ontario Building Code (OBC).
- .3 Doors shall operate manually as though equipped with manual door closers, without damage to automatic door components, in event of power failure or in event of power termination.
- .4 Co-ordinate this work with Section 08 44 00.
- .5 Power supply to each door operator and wiring shall be provided by Division 26 - Electrical. Make connections at operators and at control panel and supply and install each electrical work between operators and activating controls. Comply with requirements of Division 26 - Electrical. All wiring shall be concealed and where exposed shall be run in conduit. Location of exposed wiring shall be subject to Consultant's approval.

3.3 **ADJUSTMENT AND CLEANING**

- .1 Test and adjust operators and controls smooth and proper operation.
- .2 Upon completion of Work of this Section, remove from Site all debris, equipment and excess material resulting from Work of this Section.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Design, labour, Products, equipment, tools, and services necessary for glass and glazing Work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 ASTM C920, Specification for Elastomeric Joint Sealants.

.2 ASTM D2240, Test Method for Rubber Property - Durometer Hardness.

.3 CAN/CGSB-12.1-M, Tempered or Laminated Safety Glass.

.4 CAN/CGSB-12.3-M, Flat, Clear Float Glass.

.5 CAN/CGSB-12.8, Insulating Glass Units.

.6 CAN/CGSB-12.9-M, Glass, Spandrel.

.7 CAN/CGSB-12.11-M, Wired Safety Glass.

.8 CAN/CGSB-12.20-M, Structural Design of Glass for Buildings.

.9 Glass Association of North America (GANA) Glazing Manual.

.10 NFPA 80, Standard for Fire Doors and Other Opening Protectives.

1.3 **DESIGN REQUIREMENTS**

.1 Glass Design:

.1 Design glass using a probability of breakage of 8 lites per 1000 at the first application of design load.

.2 Design glass to CAN/CGSB-12.20-M. Perform stress analysis. Design units to accommodate live, dead, lateral, wind, seismic, handling, transportation, and erection loads.

.3 Perform a thermal stress analysis on each glass unit with Low-E coating and provide heat strengthening and/or tempered units as necessary to prevent thermal breakage.

.4 Perform a thermal stress analysis on each insulating thermal unit and provide heat strengthening and/or tempered units as necessary to prevent thermal breakage.

.5 Where required, design glazing units so as not to allow thermal stress fracture due to heat build-up behind insulating units.

- .2 Structural Glazing:
 - .1 Carry out design of structural silicone joints by rational analysis including all movements specified herein. Maximum stress shall not exceed 138 kPa (20 psi) in tension or shear for short term loading. Maximum stress in shear for long term loading due to the dead load of glass shall not exceed 7 kPa (1 psi) or the limit imposed by sealant manufacturer, whichever is less.
 - .2 The joint shall be essentially rectangular in shape and shall include no internal corners which could precipitate tearing or create high local stresses.
 - .3 Single Source Responsibility for Sealants, Gaskets and Other Glazing Accessories: In order to ensure consistent quality of performance, provide all glazing sealants and seals from a single manufacturer.
 - .4 Preconstruction Compatibility and Adhesion Testing: Submit to sealant manufacturer, samples of each glass, gasket, glazing accessory and glass-framing member that will contact or affect glazing sealants for compatibility and adhesion testing. Schedule submission of test samples to provide sufficient time for testing and analysis of results to prevent delay in the progress of work.
- .3 Limit glass deflection to flexural limit of glass with full recovery of glazing materials.
- .4 Utilize inner light of multiple light sealed units for continuity of air and vapour seal.

1.4 SUBMITTALS

- .1 Shop drawings: Submit shop drawings in accordance with Section 01 33 00 for fabrication and erection of glazing elements indicating materials, thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.
- .2 Samples:
 - .1 Submit following samples in accordance with Section 01 33 00.
 - .2 Submit one sample of each type of glass.
 - .1 300 x 300 mm of each type of insulating glass unit, complete with each different Low-E coating.
 - .2 300 x 300 mm of each colour of spandrel glass.
- .3 Certificates: Submit manufacturer's certification that glass and glazing materials are compatible.
- .3 Submit compatibility and adhesion test reports from sealant manufacturer indicating that glazing materials were tested for compatibility and adhesion with glazing sealants. Include sealant manufacturer's interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed for adhesion.
- .4 Compatibility test report from manufacturer of insulating glass edge sealant, indicating that glass edge sealants were tested for compatibility with other glazing materials including sealants, setting blocks, edge blocks and any other material that contacts or can affect the edge seal.

- .5 IGMA Compliance Audit: Submit in accordance with Section 01 78 23, a written certification of successful completion of a Compliance Audit within the last six months.

1.5 **QUALITY ASSURANCE**

- .1 Insulating glass unit fabricators shall be a certified member of the Insulating Glass Manufacturer's Alliance (IGMA). IGMA members must participate in the certification program and shall have successfully passed a Compliance Audit within the last six months.
- .2 Installers qualifications: Perform Work of this Section by a company that has a minimum of five years proven experience in the installation of glazing units of a similar size and nature.

1.6 **SITE CONDITIONS**

- .1 Glaze with compounds, sealants, or tapes only when glazing surfaces are at temperatures over 4 degrees Celsius, and when positive that no moisture is accumulating on them from rain, mist, or condensation.
- .2 When temperature of glazing surfaces is below 4 degrees Celsius, obtain from Consultant approval of glazing methods and protective measures which will be used during glazing operations.

1.7 **EXTENDED WARRANTY**

- .1 In accordance with Section 08 44 00.

2 **Products**

2.1 **ACCEPTABLE MANUFACTURERS**

- .1 Glass manufacturers:
 - .1 AGC Flat Glass.
 - .2 Cardinal Glass Industries.
 - .3 Guardian Industries.
 - .4 PPG Industries Ltd.
 - .5 Viracon Inc.
 - .6 Guardian Glass

2.2 **MATERIALS**

- .1 All materials under Work of this Section, including but not limited to, primers, coatings, sealers, sealants, adhesives and cleaners are to have low VOC content limits.
- .2 Float glass (**FGL**): CAN/CGSB-12.3-M; clear, glazing quality, minimum 6 mm thick. Clear or tinted as indicated. Heat strengthened as required.

- .3 Tempered glass (**TGL**): CAN/CGSB-12.1-M, Type 2, Class B, Category II, clear or colour as indicated in Low-E coating or opaque, minimum 6 mm thick or 4mm (Solar Blue) / 3mm (clear) thick for apparatus bay door lites.
- .4 Fire-lite glass (**FIGL**): ULC Standard CAN4-S104, S106, NFPA 80, 257, FireLite® as manufactured by Nippon Electric Glass Company, Ltd., 5 mm thick or as otherwise noted on Door Schedule, clear polished glass. 1 Hour Fire Resistance Rating Required
- .5 Spandrel glass (**SGL**): CAN/CGSB-12.9-M, 6 mm thick unless otherwise indicated, with water-based silicone emulsion coating applied to backside, 'Opaci-Coat 300' by ICD High Performance Coatings or approved alternative.
Colour: #3 – 820 Harmony Grey
- .5 Tempered Low Iron Glass (**TLIGL**): Clear, glazing quality, minimum thicknesses as indicated, low iron content, colourless: 'Starphire Ultra Clear Glass' by PPG, AGC, or Guardian Industries.
- .5 Low Iron Glass (**LIGL**): Clear, glazing quality, minimum thicknesses as indicated, low iron content, colourless: 'Starphire Ultra Clear Glass' by PPG, AGC, or Guardian Industries.
- .6 Insulating glass units: To CAN/CGSB-12.8-M and IGMA requirements utilizing approved metallic stainless steel edge spacer. Dual seal with a PIB primary seal and silicone secondary seal.
- .7 Argon gas: 100% pure. Argon gas to be used to fill air space at all insulated glass units.
- .8 Low-E coating (Soft coat): High performance sputtered low-E coating. Provide insulating glass units with low-E coating edge deletion and low-E coating. Apply low-E coating to second surface unless otherwise indicated. 'Solarban 67' by PPG on Solar Blue substrate. 4mm th. Where used in apparatus bay overhead doors.
- .9 Glazing types:
- .1 **Type 1:** (Double glazing): **TLIGL** outside, air space, **LGIL** inside. Standard throughout unless noted otherwise. 25 mm overall thickness. With Low-E Coating
- .2 **Type 2:** (Double glazing): **TGL** outside, air space, **TGL** inside. At exterior doors, thickness to suit alum. door manufacturer glazing width. With Low-E Coating
- .3 **Type 3:** (Double glazing): **TGL** outside, air space, **TGL** inside. 4mm th. Panes. At exterior O/H doors. Thickness to suit O/H doors. With Low-E Coating
- .3 **Type 4:** **FIGL** used at interior glass lites in fire-rated doors.
- .4 **Type 5:** **SGL** where indicated.
- .5 **Type 6:** **TGL** opaque 6mm thick (privacy glass) in Office Room(s) side-lites, or as noted on architectural drawings.

- .10 Glazing and rebate primers, sealants, sealers, and cleaners: Compatible with each other. Type as recommended by glass manufacturer.
- .11 Glazing sealant: Silicone sealant as recommended by glazing manufacturer. Verify compatibility with insulating glass unit secondary sealant.
- .12 Glazing Sealant (Structural Glazing):
 - .1 Silicone, One Part in accordance with ASTM C920, Type S or M, Grade NS, Class 25.
 - .2 Structural glazing tensile bead: 'Spectrem 2 Sealant' by Tremco or 'Dow 795' by Dow Corning.
 - .3 Structural glazing weather bead: 'Spectrem 2 Sealant' by Tremco or 'Dow 795' by Dow Corning.
 - .4 Structural glazing (factory glazed): Two-part, neutral cure silicone sealant, 'Proglaze II' by Tremco or 'Dow 983' by Dow Corning.
 - .5 Colour to be selected later by Consultant.
- .13 Heel & toe bead: Silicone sealant as recommended by glazing manufacturer.
- .14 Glazing gasket: 'Visionstrip' by Tremco Ltd., extruded composite glazing seal, size as recommended by manufacturer.
- .15 Glazing tape: 'Polyshim II' glazing tape EPDM shim.
- .16 Glazing splines: EPDM or neoprene, extruded shape to suit glazing channel retaining slot, colour as selected.
- .17 Setting blocks (regular): EPDM, 80 - 90 Shore A durometer hardness to ASTM D2240, sized to suit glazing method, glass unit weight and area.
- .18 Setting Block (Structural Glazing): Silicone setting blocks with Shore, Type A durometer hardness of 85, plus or minus 5 to ASTM D2240, sized to suit glazing method, glass unit weight and area.
- .19 Edge blocks: EPDM, 60-70 Shore A Durometer hardness, sized with 3 mm clearance from glass edge and spanning glass thickness(es). Capable of withstanding weight of glass unit, self-adhesive on face.
- .20 Glass presence markers: Easily removable, non-residue depositing.
- .21 Screws, bolts and fasteners: Type 304 stainless steel.

2.3 FABRICATION

- .1 Verify glazing dimensions on Site.
- .2 Clearly label each glass lite with maker's name and glass type. Ensure labels are easily removable, non-residue depositing type. Do not remove labels until after Work is accepted by Consultant.

- .3 Fabricate glazing not less than 3 mm smaller than rebate size in either dimension; allow for edge spacers, shims, and setting blocks as necessary.
- .4 Work shall have smooth finished surfaces free from distortion and defects detrimental to appearance and performance.
- .5 Carefully make and fit details. Take special care with exposed finished Work to produce a neat and correct appearance to the Consultant's acceptance.
- .6 Fabricate argon filled thermal units with air space filled minimum 90% with argon gas.

3 Execution

3.1 **EXAMINATION**

- .1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of Work means acceptance of existing conditions.
- .2 Verify that openings for glazing are correctly sized and within tolerance.
- .3 Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.

3.2 **PREPARATION**

- .1 Clean contact surfaces with solvent and wipe dry.
- .2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- .3 Prime surfaces scheduled to receive sealant.

3.3 **INSTALLATION**

- .1 Provide glazing in accordance with IGMA recommendations. Provide continuous contact between glazing tapes and gasket to the glazing.
- .2 Install glazing to the Work of Sections 08 11 13 and 08 44 00.
- .3 Provide neat, straight sight lines. Trim excess glazing material flush with top of stops and fixed leg of frames.
- .4 Remove protective coatings, glazing stops, clean rebate and glass contact surfaces with solvent, wipe dry.

- .5 Apply primer/sealer to contact surfaces, prior to glazing.
- .6 Apply glazing tape as per manufacturer's instructions including recommended corner sealant.
- .7 Use setting blocks at 1/4 points and spacers to centre glass unit in frame.
- .8 Install glazing in accordance with reviewed shop drawings and manufacturer's written instructions. Install glazing with full contact and adhesion at perimeter. Maintain edge clearance recommended by glass manufacturer.
- .9 Apply a continuous heel bead of sealant around perimeter of inboard lite of the sealed unit and the metal framing.
- .10 Re-install glazing stops ensuring continuous contact and rattle-free installation. Do not distort glass. Trim tape protruding more than 2 mm above stop.
- .11 Install glazing gasket in accordance with manufacturer's recommendations.
- .12 Do not cut or abrade tempered, heat treated, or coated glass.
- .13 Install glass presence markers in two cross stripes extending from diagonal corners. Maintain markers until final clean-up.
- .14 Remove, dispose of, and replace broken, cut, abraded glass, and defective glass including but not limited to production dimples, 'tiger-stripping', chips, cracks, etc.
- .15 Exterior glass: Glaze units with gasket on exterior side and glazing tape on interior side. Seal gap between glazing and stop with sealant to depth equal to bite of frame. Apply cap head of sealant along void between stop and glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.
- .16 Exterior glass (Structural Glazing): Glaze units in accordance with reviewed shop drawings and in accordance with manufacturer's written instructions.
- .17 Interior glass: Glaze interior glass using glazing gasket glazing tape.
- .18 Wire glass: Install wired glass in fire rated metal doors with 5 mm gap between glazing stops, in accordance with ULC and NFPA 80 requirements. Strike and point exposed joints between metal and glass.

3.4 **CLEANING**

- .1 Immediately remove sealant and compound droppings from finished surfaces.
- .2 Remove labels, protective material, and glass presence markers from prefinished surfaces.
- .3 Clean glass surfaces with cleaning agents and methods in accordance with Manufacturer's written instructions.

END OF SECTION

- 1 General
- 1.1 **SECTION INCLUDES**
 - .1 Labour, Products, equipment and services necessary for painting Work in accordance with the Contract Documents.
- 1.2 **REFERENCES**
 - .1 CAN/CGSB 85.10, Protective Coatings for Metals.
 - .2 CAN/CGSB-85.100, Painting.
 - .3 Master Painters Institute (MPI), Painting Specification Manual.
 - .4 SSPC Steel Structures Painting Council, Standards.
- 1.3 **SUBMITTALS**
 - .1 Product data:
 - .1 Submit copies of manufacturer's Product data in accordance with Section 01 33 00 indicating:
 - .1 Performance criteria, compliance with appropriate reference standard, characteristics, limitations.
 - .2 Product transportation, storage, handling and installation requirements.
 - .2 Submit listing of manufacturer's Product types, Product codes, and Product names, number of coats, and dry film thicknesses, corresponding to each Painting Schedule code; submit listing minimum of 8 weeks before materials are required.
 - .2 Samples:
 - .1 Submit following samples in accordance with Section 01 33 00.
 - .1 Three 300 x 150 mm drawdowns of each colour minimum 4 weeks before paints are required.
 - .2 Identify each sample with Contract number and title, colour reference, sheen, date, and name of applicator.
 - .3 Certificates:
 - .1 Submit certification from paint manufacturer, on company letterhead, indicating each product proposed for use is Manufacture's premium grade, first line Product.
 - .2 Submit certified documentation to confirm each airless spray painter has minimum of 5 years' experience on applications of similar complexity and scope.
 - .3 Submit certified documentation to confirm each worker has Provincial Tradesman Qualification certificate of proficiency.

- .4 Reports:
 - .1 Submit written field inspection and test report results after each inspection.
 - .2 Submit Field Quality Control test result reports for alkali content, substrate moisture, and dry film thickness.
 - .3 Submit electronic moisture meter manufacturer's specifications including tolerances. Submit record of latest meter calibration to meet manufacturer's recommendations.

1.4 **QUALITY ASSURANCE**

- .1 Finishing Work: Perform work to MPI requirements for premium grade.
- .2 Supervision: Have Work supervised by a full-time qualified foreperson who has 10 years minimum experience on Contracts of similar complexity and scope.
- .3 Mock-up:
 - .1 Construct three 4 m² mock-ups of different Paint Schedule code systems, selected by Consultant, in locations acceptable to Consultant to demonstrate installation workmanship, colour, and hiding power of Products.
 - .2 Obtain Consultant's acceptance in writing before proceeding with the Work of this Section.
 - .3 Mock-ups may remain as part of the Work if acceptable to Consultant and will serve as a standard for similar code systems.
 - .4 Repaint over mock-ups which do not form part of the Work.

1.5 **DELIVERY, STORAGE, AND HANDLING**

- .1 Install correct, safe temporary storage for paint, thinner, solvents, and other volatile, corrosive, hazardous, and explosive materials in accordance with requirements of authorities having jurisdiction.
- .2 Post hazard warning signage in areas of storage and mixing. Install and maintain sufficient CO₂ fire extinguishers of minimum 9 kg capacity, accessible in each storage mixing and storage areas.
- .3 Maintain storage enclosures at minimum 10°C ambient temperature and to manufacturer's instructions.

1.6 **SITE CONDITIONS**

- .1 Apply coatings under the following conditions:
 - .1 Exterior coatings (except Latex): 5° C minimum.
 - .2 Exterior latex coatings: 10°C minimum.
 - .3 24 hours minimum after rain, frost, condensation, or dew.
 - .4 When no condensation is possible (unless specifically formulated against condensation).
 - .5 Interior coatings: 7°C minimum.

- .6 Relative humidity: 85% maximum.
- .7 Not in direct exposure to sun light.
- .2 Maintain temperature conditions indicated above for 24 hours before, during and 24 hours after painting.
- .3 Install clean plywood sheets to protect floors and walls in storage and mixing areas, from paint drips, spatters, and spills.
- .4 Apply sufficient masking, clean drop cloths, and protective coverings for full protection of Work not being painted including, but not limited to, the following:
 - .1 Light fixtures, fire and smoke detectors.
 - .2 Sprinkler heads.
 - .3 Prepainted diffusers and registers.
 - .4 Prepainted equipment.
 - .5 Fire rating labels and equipment specification plates.
 - .6 Finished surfaces.

1.7 ENVIRONMENTAL PERFORMANCE REQUIREMENTS

- .1 Provide paint products meeting MPI "Green Performance Standard GPS-1-05".

1.8 MAINTENANCE

- .1 Deliver to Owner's place of storage on completion of work, sealed containers of each finish painting material applied, and in each colour. Label each container as for original, including mixing formula. Provide the following:
 - .1 1 L of extra materials when less than 50 L are used for Project;
 - .2 3.78 L of extra stock when 50 to 200 L are used;
 - .3 7.57 L of extra stock when over 200 L are used.

2 Products

2.1 MATERIALS

- .1 Paint:
 - .1 All materials under Work of this Section, including but not limited to, primers, stains, and paints are to have low VOC content limits.
 - .2 Products in accordance with the MPI Painting Specification Manual, Exterior and Interior Systems;
 - .1 For each MPI paint code, manufacture's premium grade, first line Products is to be use.
 - .2 Uniform dispersion of pigment in a homogeneous mixture.
 - .3 Ready-mixed and tinted whenever possible.
 - .3 Products within each MPI paint system code: From single manufacturer.
 - .4 Acceptable manufacturers:
 - .1 Benjamin Moore.

- .2 Dulux Paints/PPG.
- .3 Para Painting & Coatings.
- .4 Sherwin Williams.

.2 Epoxy floor coating: In accordance with Section 09 67 23.

.3 Epoxy wall coating: In accordance with Section 09 96 56.

2.2 COLOUR SCHEDULE

.1 Consultant will select choice of colours and gloss when compiling a Colour Schedule after award of Contract; allow for colour selection beyond paint manufacturer's standard colour range.

.2 Refer to Colour Schedule for selected colour references.

.3 Conform to gloss reflectance definitions listed in MPI Specification Manual.

2.3 PAINTING AND FINISHING SCHEDULE

.1 Refer to Table 1, MPI Painting and Finishing Schedule coded systems, comply with MPI Painting Specification Manual.

Table 1: Painting and Finishing Schedule				
EXTERIOR SUBSTRATES	Typical substrates (Including but not limited to)	MPI Manual Ref.	MPI Finish System Code	Topcoat
Structural steel and metal fabrications		EXT 5.1	EXT 5.1D	Alkyd
Galvanized steel	HM doors & frames	EXT 5.3	EXT 5.3B	Alkyd
INTERIOR SUBSTRATES	Typical substrates (Including but not limited to)	MPI Manual Ref.	MPI Finish System Code	Topcoat
Concrete floors		INT 3.2	INT 3.2C	Epoxy
Concrete block masonry		INT 4.2	INT 4.2A	Latex

Table 1: Painting and Finishing Schedule				
Structural steel (Factory primed)		INT 5.1	INT 5.1R	High performance latex
Steel (High heat)	Boilers, pipes, flues, heat exchangers	INT 5.2	INT 5.2A	Heat resistant enamel
Galvanized steel	Ducts, pipes, metal deck	INT 5.3	INT 5.3A	Latex
Galvanized metal	HM doors & door frames	INT 5.3	INT 5.3B	WB light industrial coating
Dressed lumber	Doors and frames requiring paint finish	INT 6.3	INT 6.3A	High performance latex
Wood paneling & casework	Millwork	INT 6.4	INT 6.4C	Semi-transparent stain
Wood paneling & casework	Millwork	INT 6.4	INT 6.4E	Polyurethane
Gypsum board,	Drywall, walls, ceilings	INT 9.2	INT 9.2A	Latex
Gypsum board,	Wet areas	INT 9.2	INT 9.2F	Epoxy-modified latex

3 Execution

3.1 **EXAMINATION**

- .1 Verify condition of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of Work means acceptance of existing conditions.

3.2 PREPARATION

- .1 General:
 - .1 Clean substrate surfaces free from, dust, grease, soiling, or extraneous matter, which are detrimental to finish.
 - .2 Patch, repair, and smoothen minor substrate defects and deficiencies e.g. machine, tool and sand paper marks, shallow gouges, marks, and nibs.
 - .3 Clean, sweep, and vacuum floors and surfaces to be painted, debris and dust-free prior to painting.
 - .4 Refer to MPI Painting Specification Manual for surface preparation requirements of substrates not listed here.
- .2 Where finish hardware has been installed remove, store, re-install finish hardware, to accommodate painting. Do not clean hardware with solvent that will remove permanent lacquer finishes.
- .3 Alkali Content tests and neutralization:
 - .1 Test for ph level using litmus paper on dampened substrate.
 - .2 Neutralize surfaces over 8.5 ph with 4% solution of Zinc Sulphate for solvent based systems and tetrapotassium pyrophosphate for latex based systems, to below 8.0 ph, and allow to dry.
 - .3 Brush-off any residual Zinc Sulphate crystals.
 - .4 Coordinate paint system primer / sealer to be alkali-resistant.
- .4 Substrate moisture tests:
 - .1 Test for moisture content over entire surface to be painted, minimum one test/ 2 m² in field areas and one test/600 mm along inside corners including at ceiling to wall juncture.
 - .2 If any test registers above 10% allow entire substrate surfaces, within the plane, to dry further before paint system application. Install temporary drying fans if necessary.
 - .3 Re-test employing same criteria.
- .5 Mildew removal: Scrub with solution of trisodium phosphate and sodium hypochlorite (Javex) bleach, rinse with water, and allow to dry completely.
- .6 Cementitious and masonry (Concrete, block):
 - .1 Allow 28 days cure before painting.
 - .2 Coordinate repair of protrusion-chipping and grinding, and honeycomb filling with responsible trades.
 - .3 Remove dirt, loose mortar, scale, powder, efflorescence, and other foreign matter.
 - .4 Remove form oil and grease with trisodium phosphate, rinse, and allow to dry thoroughly.
 - .5 Prepare surfaces in accordance with CAN/CGSB-85.100.
 - .6 Remove rust stains with solution of sodium metasilicate after thorough wetting; allow to dry thoroughly.

- .7 Concrete floors:
 - .1 Allow 28 days cure before painting.
 - .2 Remove contamination, acid etch, rinse with water, and allow to dry completely. Test and adjust for neutral ph.
 - .3 Prepare surfaces in accordance with CAN/CGSB-85.100 acid etch.

- .8 Galvanized steel sheet:
 - .1 Z275 (Satin & Spangled Sheet): SSPC SP7 brush blast.
 - .2 ZF075 (Wiped Coat): Remove contamination, wash with Xylene solvent.
 - .3 Touch-up damaged galvanized areas with organic zinc rich primer.

- .9 Galvanized iron and steel: Prepare galvanized and ungalvanized metal surfaces according to CAN/CGSB-85.10.
 - .1 Unpassivated, unweathered and weathered: Remove contamination, wash with Xylene or Toluol solvent, allow to dry thoroughly. Make paint system primer/sealer an etching type primer.
 - .2 Manufacturer pre-treated (including passivated): SSPC SP7.
 - .3 Touch-up damaged galvanized areas with organic zinc rich primer.

- .10 Structural steel and miscellaneous metal fabrications:
 - .1 Coordinate the following with the responsible trades:
 - .1 Rust, mars, mill scale, and weld-burn touch-ups.
 - .2 Oil, grease, weld flux and other residue removal.
 - .2 Prime paint items, not otherwise indicated to be primed as part of another Section.
 - .3 Touch-up damaged galvanized areas with organic zinc rich primer.

- .11 Wood and Millwork:
 - .1 Wood surfaces to be clean and dry with a moisture content of less than 15%.
 - .2 Remove foreign matter prior to prime coat; spot coat knots, pitch streaks and sappy sections with sealer.
 - .3 Fill nail holes and fine cracks after primer has dried.
 - .4 Backprime interior and exterior woodwork.

- .12 Factory primed surfaces:
 - .1 Touch up damaged areas.
 - .2 Clean as required for top coat.

- .13 Gypsum board:
 - .1 Apply primer/sealer paint to reveal defects and deficiencies and to equalize absorption areas.
 - .2 Coordinate repairs and touch-ups with the responsible trade.
 - .3 Re-prime repairs.

- .14 Coordinate with other trades to prevent:
 - .1 Damage, and inadvertent activation of fire and smoke detectors.

.2 Odour and dust distribution by permanent HVAC systems including fouling of ducts and filters.

.15 Field-mix Products in accordance with manufacturer's written instructions.

3.3 APPLICATION

.1 Apply painting systems in accordance with the MPI Painting Specification Manual. Apply each Product to manufacturer's recommended dry film thickness.

.2 Painting systems listed are required minima, apply additional coats if necessary to obtain substrate hiding acceptable to the Consultant.

.3 Tint intermediate coats lighter than final top coats for identification of each succeeding coat and to facilitate inspections. Include only manufacturer's recommended reducing and tinting accessories. Do not add adulterants.

.4 Primer to be specialized primer coating system as required by manufacturer for selected colour. Standard primer being tinted shall be tinted to a maximum of 1.5% by volume.

.5 Sand lightly between coats to achieve a tooth or anchor for subsequent coats.

.6 Apply paint uniformly in thickness, colour, texture, and gloss, as determined by the Consultant under adequate illumination and viewed at a distance of 1500 mm. Apply finishes free of defects in materials and application which, in the opinion of the Consultant, affect appearance and performance. Defects include, but are not limited to:

.1 Improper cleaning and preparation of surfaces.

.2 Entrapped dust, dirt, rust.

.3 Alligatoring, blisters, peeling.

.4 Scratches, blemishes.

.5 Uneven coverage, misses, drips, runs, and poor cutting in.

.7 Do not apply coatings on substrates which are not sufficiently dry. Unless indicated otherwise, allow each painting system coat to cure dry and hard before following coats are applied.

.8 Repaint entire areas of damaged or incompletely covered surfaces, to the nearest inside or outside corner; patching will not be permitted.

.9 Miscellaneous painting requirements:

.1 Paint projecting ledges, and tops, bottoms and sides of doors both above and below sight lines to match adjacent surfaces.

.2 Paint door frames, access doors and frames, door grilles, prime coated butts, and prime coated door closers to match surface in which they occur.

.3 Finish closets and alcoves as specified for adjoining rooms.

- .4 Paint light covers white whether a light lense is installed or not, unless otherwise indicated.
- .5 Paint interior columns to match walls of room.
- .6 Allow for:
 - .1 2 wall colours per room, one ceiling colour per room.
 - .2 Different door colours in each functionally different area.
 - .3 Different colours on both sides of same door.
- .10 Mechanical, electrical, and other painting coordination:
 - .1 Paint mechanical services in accordance with Mechanical Identification Division 21, 22 and 23.
 - .2 Coordinate painting of pipes, ducts, and coverings with the Work of Division 21, 22 and 23 to precede pipe colour banding, flow arrows, and other pipe identification labeling installation.
 - .3 Paint exposed conduit, pipes, hangers, ductwork, grilles, gratings, louvres, access panels, fire hose cabinets, registers, convector and radiator covers, enclosures, and other mechanical and electrical equipment including services concealed inside cupboard and cabinet Work; apply colour and sheen to match adjacent surfaces, except as noted otherwise.
 - .4 Paint portions of surfaces such as duct interiors, piping, ductwork, hangers, insulation, walls, and similar items, visible through grilles, louvres, convector covers etc., matte black in colour.
 - .5 Remove the following to accommodate painting, carefully store, clean, then re-install on completion of each area and when dry:
 - .1 Switch and receptacle plates, fittings and fastenings, grilles, gratings, louvres, access panels, convector covers, and enclosures.

3.4 FIELD QUALITY CONTROL

- .1 Dry film thickness tests:
 - .1 Test for film thickness over entire surface to be painted, minimum one test/2 m² in field areas and one test/600 mm along inside corners including at ceiling to wall juncture.
 - .2 If any test registers below specified thickness, re-apply paint to entire surface to nearest inside and outside corners.
 - .3 If test registers more than 50% above specified thickness, consult with paint manufacturer, determine if problem exists, offer solutions to Consultant, and repair as directed.
 - .4 Re-test employing same criteria after repair.

3.5 CLEANING

- .1 Remove spilled, splashed, and spattered paint promptly as Work proceeds and on completion of Work. Clean surfaces soiled by paint spillage and paint spatters. Repair or replace damaged Work, as directed by Consultant.

3.6 **PROTECTION**

- .1 Post Wet Paint signs during drying and restrict or prevent traffic where necessary.
- .2 Post sign, after Consultant's inspection and acceptance of each room, reading:
PAINTING COMPLETE - NO ADMITTANCE WITHOUT CONTRACTOR'S
PERMISSION.

END OF SECTION

- 1 General
- 1.1 **SECTION INCLUDES**
 - .1 Labour, Products, equipment and services necessary for earthwork Work in accordance with the Contract Documents.
- 1.2 **REFERENCES**
 - .1 ASTM D698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort.
 - .2 ASTM D4253, Test Method for Maximum Index Density and Unit Weight of Soil Using a Vibratory Table.
 - .3 OPSS, Ontario Provincial Standard Specification.
- 1.3 **SUBMITTALS**
 - .1 Shop drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 indicating:
 - .1 Adjacent construction, elevations, sections and details, dimensions, and relationship to adjacent construction.
 - .2 Include design calculations, design concept, construction method, sequence and means by which existing structures, utilities and equipment will be protected; Location of in-use, maintained, re-routed and abandoned underground lines.
 - .2 Reports:
 - .1 Submit written laboratory test reports.
 - .2 Submit written field inspection and test report results after each inspection.
 - .3 Submit dewatering methods 30 days in advance for review by Consultant. If well point system is required, Engineer shall design system and supervise installation.
 - .4 Submit to Consultant details of locations where surplus soils and other materials are to be disposed of or reused. Include each disposal/reuse Site and type of surplus soil or other material, location of the disposal/reuse Site, operator's name and business address, type of license under which Site operates, and criteria used by Site to access suitability of surplus material for disposal.
 - .5 Submit to Consultant, within 48 hours of a load of surplus soil or other material leaving the Site, a daily register recording the time and place of disposal/reuse of each load signed by a representative of the disposal site. Such documentation must be submitted before payment for excavation will be made.

1.4 **QUALITY ASSURANCE**

- .1 Have shop drawings signed and sealed by a Professional Engineer licensed in Province of Ontario and having experience in design and inspection of shoring, bracing, underpinning and dewatering (if required) required to complete Work.

1.5 **SITE CONDITIONS**

- .1 Geotechnical conditions: For information on subsurface conditions refer to document appended to this Specification. See 02 32 00
- .2 Cultural heritage resources: If Cultural Heritage Resources (such as archaeological sites, artifacts, building and structural remains, and/or human burials) are encountered during performance of Work, contact Consultant immediately and suspend Work in immediate area until assessment has been completed by Ministry of Culture, Tourism and Recreation. Perform required measures to mitigate negative impacts on found resources to acceptance of Consultant.

1.6 **PROTECTION**

- .1 Existing buried utilities and structures:
 - .1 Size, depth and location of known existing utilities and structures are indicated for guidance only. Completeness and accuracy is not guaranteed.
 - .2 Prior to commencing any excavation Work, have authorities stake out utility locations to prevent disturbance during Work.
 - .3 Confirm locations of buried utilities by careful test excavations. Hand dig test excavations as necessary.
 - .4 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered. Obtain permission of Consultant before moving or otherwise disturbing utilities or structures.
- .2 Existing surface features:
 - .1 Conduct with Consultant, a condition survey of existing trees and other plants, lawns, fencing, service poles, wires, rail tracks and paving, survey benchmarks and monuments which may be affected by Work.
 - .2 Protect existing surface features which may be affected by Work from damage while Work is in progress and repair damage resulting from Work.
 - .3 Where excavation necessitates root or branch cutting, perform Work in accordance with Authorities having Jurisdiction.
 - .4 Confirm with Consultant, condition Survey of buildings and structures undertaken by Consultant.
- .3 Temporarily cover local existing catch basins and maintenance holes to prevent entry of earth or debris. Ensure adequate surface drainage in affected area is maintained.
- .4 Protect Work or work of other Contracts in progress or completed and protect existing properties, stored Products, services, utilities, trees, landscaping and natural features from damage.

- .5 Protect excavations against flooding and damage and install and maintain appropriate warning devices during construction and during time when Work is closed down for any cause.
- .6 Protect bottom of excavations that will support foundations, slabs, pavements etc. from frost or freezing.
- .7 Keep access roads clear of debris and dirt resulting from Work of this Section to acceptance of Authorities having jurisdiction.
- .8 Shoring, bracing and underpinning: Comply with local regulations, authorities having jurisdictions and requirements specified.

2 Products

2.1 **MATERIALS**

- .1 Select fill: Subject to approval of Consultant consisting of reusable fill excavated from Site or imported fill that is free of organic matter, rubble and material other than soil. Maximum particle size of half thickness of lift specified, moisture content at time of placing 2% maximum over its optimum moisture content and is either non-plastic or has a plasticity index of 25% maximum.
- .2 Granular A fill: Imported Granular A fill, free of organic matter and, in accordance with OPSS 1010.
- .3 Granular B Fill: Imported Granular B fill free of organic matter and in accordance with OPSS 1010.
- .4 Granular D fill: In accordance with OPSS-1004, containing 100% crushed aggregates, free of organic matter.
- .5 Clear Stone fill: 19 mm clear stone in accordance with OPSS 1004, free of organic material.
- .6 Unshrinkable fill: 0.7 MPa cement stabilized backfill conforming to requirements of CAN/CSA A23.1/A23.2-M.

3 Execution

3.1 **EXAMINATION**

- .1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of Work means acceptance of existing conditions.

3.2 LINES AND ELEVATIONS

- .1 Establish lines and elevations from Control Points shown on Contract Drawings.
- .2 Have lines and elevations established by Registered Ontario Land Surveyor or qualified Civil Engineer registered in Province of Ontario.
- .3 Protect and maintain Control Points and Bench Marks as long as they are required.

3.3 STRIPPING

- .1 Do not handle topsoil while in wet or frozen condition or in manner in which soil composition is adversely affected.
- .2 Strip topsoil from working area in locations shown.
- .3 Strip topsoil to depths indicated. Avoid mixing topsoil with subsoil.
- .4 Stockpile topsoil in locations directed by Consultant. Stockpile to height not exceeding 2 m. Remove excess topsoil from Site.

3.4 REMOVAL OF WATER

- .1 Obtain letter of conditional approval from Municipality to dispose of ground water into sewer drainage system. Apply for and pay for water disposal permit, if applicable.
- .2 Keep excavations and trenches free of water throughout construction period.
- .3 Groundwater removal:
 - .1 Lower groundwater level and maintain at depth below lowest point of excavation to ensure a dry stable surface.
 - .2 Dewater to prevent loss of soil and maintain stability of sides and bottom of excavation and of adjacent structures.
 - .3 Dispose of water in conformance with applicable by-laws and in a manner not detrimental to public and private property, or portion of Work completed or under construction.
 - .4 Supply and install flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to sewers, water courses or drainage areas in accordance with authorities having jurisdiction. Perform testing on settlement tank discharge to confirm that effluent meets sewer bylaw requirements. Locate tanks to acceptable area determined by Consultant.
 - .5 Should method of dewatering fail to achieve conditions specified above, Consultant reserves right to revise methods and procedures at no cost to Owner.

- .4 Surface water removal:
 - .1 Remove surface run-off in a manner that will prevent loss of soil and maintain stability of sides and bottom of excavation. Obtain Consultant's approval of dewatering method to be used.
 - .2 Discharge surface water into existing storm drainage system to acceptance of Consultant and local authorities.
- .5 Do not obstruct flow of surface drainage or natural water courses.

3.5 EXCAVATION

- .1 Remove concrete, masonry, paving, demolished foundations and rubble and other obstructions encountered during excavation Work.
- .2 Do not disturb soil within drip line of trees or shrubs that are to remain. If excavating through roots, excavate by hand and cut roots with sharp axe or saw in a manner acceptable to authorities having jurisdiction.
- .3 Excavate to required lines and grades shown on Contract Drawings with allowance for subsequent Work including shoring, bracing and formwork. Make excavation clean and clear of loose material and true to size.
- .4 Protect stockpiles of fill against contamination and moisture absorption.
- .5 Do not undermine adjacent structures. Where it is necessary to have footings at different levels, found upper footing below imaginary 10-horizontal-to-7 vertical line, or as otherwise indicated, drawn up from base of lower footing. Protect adjacent foundations from frost.
- .6 Have excavations in excess of 1200 mm in depth conform to requirements of Occupational Health and Safety Act, and Regulations for Construction Projects.
- .7 Do not expose shale at subgrade elevation to drying cycles and in any case, following inspection, cover with minimum 50 mm of lean concrete within 4 hours after exposure.
- .8 Fill excavations for foundations which are, through error, carried below elevation shown or approved depth, with 15 MPa concrete, or as directed by Consultant.
- .9 Trim, and remove loose material, debris and organic material from excavations. Where material at bottom of excavation is disturbed, remove disturbed material and re-compact to density equal to or better than undisturbed soil or backfill with lean concrete as directed by Consultant.
- .10 When excavations are complete, prior to commencement of subsequent Work, request Consultant for inspection of excavation Work.

3.6 TRENCHING

- .1 Excavate trenches to lines and grades indicated and to a depth of 75 mm minimum below invert elevation and slope established for pipe, and backfill to invert elevation of pipe with specified granular material.
- .2 Unless otherwise authorized by Consultant, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation. Remove unsuitable material from trench bottom to extent and depth as directed by Consultant.
- .3 Backfill Over-excavation with granular material and compact.
- .4 If unstable soil conditions are encountered, excavate trenches to depth directed by Consultant and backfill to correct elevation with backfill material.
- .5 Remove loose material from bottom of trenches to ensure granular material is placed against undisturbed soil.
- .6 Compact bedding and grade as required for even and uniform support on each length of pipe.
- .7 Where excavating is required adjacent to and parallel with and below any footing, submit excavation and backfill procedures to Consultant for review prior to start of excavating.
- .8 Keep width of trenches to a minimum to ensure minimum span for pipe to be supported.
- .9 Make excavations for fire hydrants of sufficient size and depth to accommodate a minimum 0.75 m³ of crushed stone. Hand place stone and tamp around and below hydrant elbow to ensure proper drainage of hydrant.

3.7 EXCAVATED MATERIAL DISPOSAL

- .1 Except for material to be used as select fill, immediately remove and dispose of excavated material from Site.
- .2 Remove and dispose of construction rubble, abandoned gas, water and sewer pipes, valves, valve boxes and fittings, maintenance holes, frames and covers and other material which may be encountered during excavation but not indicated on Contract Drawings.

3.8 BACKFILLING

- .1 Do not proceed with backfilling operations until walls, slabs, waterproofing and below grade Work has been inspected and accepted by Consultant.
- .2 Backfill areas which are free from debris, snow, ice, water and frozen ground.

- .3 Do not use backfill material which is frozen or contains ice, snow or debris.
- .4 Do not backfill on or against any membrane or protection board covered waterproofing with jagged rock or other sharp objects which might damage waterproofing.
- .5 Limit vertical drop of backfill material to 2000 mm.
- .6 Use only rubber-tired vehicles over roof of structure during backfilling, maximum tire pressure 70 kPa. Metal-tracked vehicles will not be allowed on roofs for compaction purposes.
- .7 To avoid pockets and voids, remove sheathing and shoring materials that require removal, as backfilling progresses.
- .8 Prior to backfilling or placing concrete on exposed soil subgrade, proof roll subgrade to identify soft or loose areas. Proceed with placing backfill or concrete only after inconsistencies identified by above procedure have been reworked and compacted or excavated, backfilled and compacted as required to eliminate such conditions to acceptance of Consultant.
- .9 Place backfill material, grade and compact to levels shown on Contract Drawings.
- .10 Place backfill materials in uniform layers 200 mm maximum loose thickness unless specified otherwise.
- .11 Ensure each layer is compacted, and accepted by Consultant, before placing succeeding layers.
- .12 Unless otherwise indicated, use specified granular material from bottom of trench to 300 mm above top of pipe or 150 mm above top of electrical conduits. Hand place in 150 mm layers and compact carefully to ensure proper backfilling and compaction around bottom quadrants and sides of pipe.
- .13 For backfill from 300 mm above top of pipe or 150 mm above electrical conduits to sub-grade level, use select fill unless otherwise noted. Compact either by hand or by machine.
- .14 Do not backfill trenches until piping, conduits and cables therein have been inspected, tested, and approved by inspection authorities having jurisdiction and Consultant.
- .15 Prior to backfilling of trenches, remove wood block or wedges used to prevent movement of piping during tests.

- .16 Where there is a common boundary between select fill and granular fill or unshrinkable fill, place select fill after granular fill has been compacted. Place and compact fill around free-standing structures evenly on all sides of structure simultaneously in layers sloping away from structure.
- .17 During backfilling, take care to avoid displacing or damaging Utilities Work and Services.
- .18 Notify Consultant prior to commencement of backfilling and compacting operations.

3.9 **COMPACTION**

- .1 Compaction densities for select fill, granular fill, and sand fill materials will be determined by ASTM D698. Compaction densities for clear stone will be determined by ASTM D4253.
- .2 Add water if necessary to obtain required densities. Correct irregularities or depressions that may develop during compaction by removing or adding material to form a smooth and uniform surface.
- .3 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
- .4 If material is excessively moist, aerate by scarifying with suitable equipment until moisture content is corrected.
- .5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers acceptable to Consultant.
- .6 Compact backfill materials in accordance with Geotechnical Report providing the following as a minimum:
 - .1 Imported fill: 98% standard Proctor maximum dry density (SPMDD).
 - .2 Under slabs, walks and pavements: 100% (SPMDD).
 - .3 All other areas: 95% (SPMDD).

3.10 **GRADING**

- .1 Prior to placing fill over existing ground, scarify surface to depth of 150 mm. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.
- .2 Place material only on clean unfrozen surface, properly shaped and compacted and free from snow and ice. Ensure no frozen material is used in placing.
- .3 Grade as necessary to bring Work areas to required elevations. Supply additional material required to obtain new grade levels. Place and compact as specified.
- .4 Grade drainage ditches to elevations indicated on Contract Drawings.
- .5 Maintain positive drainage.

- .6 Grade materials using methods which do not lead to segregation or degradation of aggregate.
- .7 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
- .8 Remove and replace that portion of layer in which material becomes segregated during spreading.
- .9 Slope grade away from buildings 1:50 minimum.
- .10 Make graded areas smooth to profile, free of debris, with local excavations and depressions filled and compacted.
- .11 Do not disturb soil within branch spread of trees and shrubs remaining.
- .12 Cultivate entire area which is to receive topsoil to a depth of 100 mm. Repeat cultivation in those areas where equipment used for hauling and spreading has compacted soil.
- .13 Remove surface debris, roots, vegetation, branches and stones in excess of 50 mm in diameter.

3.11 **FINISH GRADING**

- .1 Fine grade and loosen topsoil. Eliminate rough spots and low areas to ensure positive drainage. Prepare loose friable bed by means of cultivation and subsequent raking.
- .2 Roll to consolidate topsoil for areas to be seeded or sodded leaving surface smooth, uniform, firm against deep foot printing, and with fine loose texture to approval of Consultant.

3.12 **UNSHRINKABLE FILL**

- .1 Place unshrinkable fill in locations indicated on Contract Drawings or where Work area is too limited to permit proper placing and compaction. Obtain Consultants approval prior to placing unshrinkable fill. Place in accordance with supplier's written instructions.
- .2 If embedded items occur in area being backfilled, coordinate with appropriate trades to ensure that disturbance of embedded items during backfilling is prevented.

END OF SECTION

- 1 General
- 1.1 **SECTION INCLUDES**
 - .1 Labour, Products, equipment, tools, and services necessary for asphaltic concrete paving Work in accordance with the Contract Documents.
- 1.2 **REFERENCES**
 - .1 ASTM D 698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort.
 - .2 ASTM D1559, Test Method for Resistance to Plastic flow of Bituminous Mixtures Using Marshall Apparatus.
 - .3 CAN/CGSB 1.74, Alkyd Traffic Paint.
 - .4 OPSS, Ontario Provincial Standard Specification.
- 1.3 **SUBMITTALS**
 - .1 Shop drawings: Submit shop drawings in accordance with Section 01 33 00 indicating sections, materials, dimensions, and relation to adjacent construction.
 - .2 Reports:
 - .1 Submit written mix designs for each type of asphalt concrete for acceptance.
 - .2 8 weeks prior to commencing Work test materials for conformance with requirements of Specifications. Submit written test report verifying compliance 4 weeks minimum prior to commencing Work.
 - .3 Submit written field inspection and test reports.
 - .4 Submit certification that testing laboratory is accredited for asphalt mix design through the Canadian Council of Independent Laboratories (CCIL).
- 1.4 **QUALITY ASSURANCE**
 - .1 Pre-installation meetings: Arrange with Contractor, asphalt Subcontractor, and Consultant to inspect substrates, and to review installation procedures 48 hours in advance of installation.
- 1.5 **SITE CONDITIONS**
 - .1 Do not install Work of this Section outside of following environmental ranges without Consultant's and Product manufacturer's written acceptance:
 - .1 Air and surface temperature: OPSS 310.
 - .2 Precipitation: None within 24 hours prior to placement.

1.6 **EXTENDED WARRANTY**

- .1 Submit a extended warranty for Work of this Section in accordance with General Conditions, except that warranty period is extended to two years.

2 Products

2.1 **MATERIALS**

- .1 Granular base and sub-base material: Granular "A" OPSS 1010, crushed or screened stone or gravel.
- .2 Asphalt materials:
 - .1 Hot mixed, hot laid asphalt meeting OPSS 1150, designation H.L. 8 for binder course and H.L. 3 for surface course.
 - .2 Tack and primer coat: OPSS 1103 Grade SS-1.
- .3 Traffic paint: CAN/CGSB 1.74, new pavement markings, white or yellow as selected by Consultant.

2.2 **MIXES**

- .1 Mix asphalt materials in accordance with OPSS 1003 for H.L. 8 and H.L. 3.
- .2 Do not change mix without prior approval of Consultant.

2.3 **SOURCE QUALITY CONTROL**

- .1 Source approval:
 - .1 Inform Consultant of proposed source of Products and afford access for sampling and testing of quality of Products at least 4 weeks prior to commencing production.
 - .2 Ensure that source of Products to be incorporated into Work or stockpiled is acceptable to Consultant.
 - .3 Submit laboratory test results for samples of specified Products to be supplied by this Section. Include in laboratory test results those tests required to demonstrate that Product meets requirements of this Section.
 - .4 If Products from proposed source do not meet, or cannot reasonably be processed to meet specified requirements, locate an alternative source or demonstrate that Products source in questions can be processed to meet specified requirements.
 - .5 Should a change of Products source be proposed during Work, advise Consultant 14 days in advance of proposed change to allow sampling and testing.

- .6 Acceptance of Product at source does not preclude future rejection if it is subsequently found to lack uniformity, or if it fails to conform to requirements specified, or if its field performance is found to be unacceptable. Remove and dispose rejected material.
- .2 Production sampling:
 - .1 Products may be subject to continual sampling by Consultant during production.
 - .2 Afford Consultant ready access to source and processed Products for sampling and testing.
 - .3 If Products fail to meet Specifications, bear cost of additional sampling and testing of aggregates and fill.
 - .4 Supply necessary personnel and equipment to permit adequate investigation and sampling. Advise Consultant at least 14 days in advance of use of Products, to allow sufficient time for sampling and testing.
- 3 Execution
- 3.1 **EXAMINATION**
 - .1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of Work means acceptance of existing conditions.
- 3.2 **PREPARATION**
 - .1 Verify grades of items set in paving area for conformity with elevations and sections before placing granular base and subbase material.
 - .2 Obtain approval of subgrade by Consultant before placing granular subbase and base.
 - .3 Coordinate elevations of maintenance holes and other appurtenances and make flush with top of finish asphalt concrete paving.
- 3.3 **SUBBASE AND BASE**
 - .1 Comply with OPSS 314.
 - .2 Prior to placing subbase and base proof roll subgrade to identify soft spots. Excavate soft spots and backfill with granular material to 100% standard Proctor maximum dry density in accordance with ASTM D698.
 - .3 Place granular base and subbase material on clean unfrozen surface, free from snow and ice.
 - .4 Place granular base and subbase to compacted thicknesses as indicated. Do not place frozen material.

- .5 Place in layers not exceeding 150 mm compacted thickness. Compact to density not less than 100 % standard Proctor maximum dry density in accordance with ASTM D698.
- .6 Finished base surface to be within 5 mm of specified grade, but not uniformly high or low.

3.4 **ASPHALT PRIMER**

- .1 Apply primer coat in accordance with OPSS 302.
- .2 Do not apply primer when air temperature is less than 5 degrees Celsius or when rain is forecast within 2 hours.
- .3 If asphalt primer fails to cure within 24 hours, spread sand blotter material in amounts required to absorb excess material. Sweep and remove excess blotter material.

3.5 **EQUIPMENT**

- .1 Pavers: mechanical grade-controlled self-powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown indicated.
- .2 Rollers: sufficient number of rollers of type and weight to obtain specified density of compacted mix.
- .3 Vibratory rollers:
 - .1 Minimum drum diameter: 750 mm.
 - .2 Maximum amplitude of vibration (machine setting): 0.5 mm for lifts less than 40 mm thick.
- .4 Haul trucks: of sufficient number and of adequate size, speed, and condition to ensure orderly and continuous operation and as follows.
- .5 Suitable hand tools.

3.6 **ASPHALT PAVING**

- .1 Comply with requirements of OPSS 310.
- .2 Obtain approval of tack coat base and primer from Consultant before placing asphalt mix.
- .3 Place asphalt mix only when base or previous course is dry and air temperature is above 5 degrees Celsius.
- .4 Place asphalt concrete in compacted layers not exceeding 50 mm per lift.
- .5 Minimum 135-degree Celsius mix temperature required when spreading.

- .6 Maximum 160-degree Celsius mix temperature permitted at any time.
- .7 Compact each course with roller as soon as it can support roller weight without undue cracking or displacement.
- .8 Compact paving to density not less than 97% of density obtained with Marshall specimens prepared in accordance with ASTM D1559. Roll until roller marks are eliminated.
- .9 Keep roller speed slow enough to avoid mix displacement and do not stop roller on fresh pavement.
- .10 Moisten roller wheels with water to prevent pick up of material.
- .11 Compact mix with hot tampers or other equipment approved by Consultant, in areas inaccessible to roller.
- .12 Finish surface to be within 5 mm of design elevation and with no irregularities greater than 10 mm in 4.5 m.
- .13 Repair areas showing checking, rippling or segregation as directed by Consultant.

3.7 JOINTS

- .1 Remove surplus material from surface of previously laid strip. Do not deposit on surface of freshly laid strip.
- .2 Paint contact surfaces of existing structures such as catch basins, manholes, curbs or gutters with tack coat prior to placing adjacent pavement.
- .3 For cold joints, cut back to full depth vertical face and tack face with hot asphalt.
- .4 For longitudinal joints, overlap previously laid strip with spreader by 25 to 50 mm.

3.8 PAVEMENT MARKINGS

- .1 Spray paint parking zone lines and other pavement markings indicated, included, but not limited to, hash marks for no parking areas, direction arrows and handicap parking symbols.
- .2 Use suitable compressor type striping machine. Use templates for symbols, arrows, lettering.
- .3 Unless otherwise indicated, paint lines 125 mm wide.
- .4 Paint lines straight, or uniformly curved, with well-defined edges and full paint coverage in all locations.

3.9 **FIELD QUALITY CONTROL**

- .1 Conduct following field tests, submit report to Consultant:
 - .1 Granular materials for composition and gradation.
 - .2 Granular material and asphalt concrete compaction.

3.10 **PROTECTION**

- .1 Keep vehicular traffic off newly paved areas until paving surface temperature has cooled below 38 degrees Celsius. Do not permit stationary loads on pavement until 24 hours after placement.

3.11 **SCHEDULE**

- .1 Refer to Geotechnical Report for compacted thicknesses of pavement structures for asphaltic concrete paving, unless otherwise indicated.
- .2 Paving on public property, meet requirements of municipality.

END OF SECTION